

# **SOltmC & RTU 2017 Conference**

## Let Us Conquer the Growth Limits of Capitalism through New Combination between Technology, and Market or Society

June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

#### Society of Open Innovation: Technology, Market, and Complexity (SOItmC) with RTU

#### Keynote Speakers



Philip Cooke (UK) Professor, Bergen University College, Norway • étior of European Planning Studies(SCI) • Presentation Theme: "A Ground-up "Quaternary" Innovation Strategy for South Korea Using Entrepreneutia Ecosystem Platforms"

Anil K. Gupta (India) Professor, India Institute of Management, India Founder of Honey Bee Network Presentation Theme: "Connecting corporations and communities: Towards a theory of social inclusive open innovation"

Journal of Open Innovation: Technology, Market, and Complexity • All Keynote Speakers' Presenting Papers will be invited to the journal as Special Issue (All publications will be supported and funded by DGIST & Special SOItmC)

 Giovanni Schiurna (Italy)
 Professor at University of Basilicata and Vice Mayor of Matera City, Italy
 Professor at University of Basilicata and Vice Mayor of Matera City, Italy
 The Founder and Fist Director of the Involution Knowledge Management Research and Practice\*
 and as Co-Editor in Chief of the Journal "Measuring Business Excellence"
 Presentation Theme "The Business Model Fism Managing and Involting Basiness Model of at a Quitral Organization" Ulrich Witt (Germany) Professor at Griffin Business School, Griffith University/Australia) Direter of the Evaluationary Economics Group at the Max Planck Issibute of Economic + Koncarny Member of Layam Association for Evolutionary Economics 2006 Presentation Theme: "Capitaliam as a Complex, Adaptive System"

Natalja Lace (Latvia) • Protessor, Riga Technical University, Latvia • Presentation Theme: "Total Factor Productivity and the Features of Economic Growth: the Case of Lithuania and Latvia"

SOltmC & Riga Technical University 2017 Conference • Poster download, click [Here] • Registration Invoice download, click [Here]

**Special Sessions** 



Uwe Cantner (Germany) • Professor, University of Jana, Germany • Editor of Journal of Evolutionary Economics • Presentation Theme: "Cluster Policy: Insights from the German Leading Edge Cluster Competition"

Special Session 21. Social Network and Technology Commercialization • Chair: Kiseok Kwon(Hanbat National University, Korea)

Special Session 23. Open Innovation and Business Model Competition Session • Chairs: ChoongJae Im(Keimyung University, Korea)

Special Session 25. Innovation in Supply Chain Management • Chair: Anna Svirina(Kazan National Research Technical University, Russia)

Special Session 27. Climate Change and Environmental Resilience • Chairs: Sang-Don Lee(Ewha Womans University, Korea),

Special Session 28. Innovation & Technology Entrepreneurship -Educational and Nascent Entrepreneurs' Perspective • Chair: Chang-Soo Sung(Dongguk University, Korea)

Special Session 29. Innovation Ecosystem: Strategy and Policy • Chairs: Lei Ma (Nanjing University of Science and Technology, China), Zheng Liu (Nanjing University of Science and Technology, China)

Special Session 30. Technology and Innovation Driven Industrial Development and Business Economics • Chair: Min-Ren Yan(Chinese Culture University, Taiwan)

Special Session 26. Towards Circular Economy: Innovations, Clusters and Entrepreneurship • Chair: Manuela Tvaronaviciene(Vilnius Gediminas Technical University, Lithuania)

Special Session 22. Open Innovation of Service Sectors • Chair: DaeCheol Kim(Hanyang University, Korea)

Special Session 24. Uncertainty and Innovation Policy Making • Chair: SamYoul Lee(Yonsei University, Korea)





Tan Yigitcanlar (Australia) • Associate Professor, Queensland University of Technology, Australia • Editor-in-Chief of International Journal of Knowledge-Based Development • Presentation Theme: "Sustainable Development of Smart Cities: A Systematic Review of the Literature'

Inviting Professor of Open Innovation Academy & Donator of Building Open Innovation Off-line Campus • For more inviting requirements, click [Here]

Special Session 2. Emerging Design Practices in Knon Creative Destruction of Design • Chair: Craig Anz(Southern illinois University, USA) vledae-Oriented Economies – The

Special Session 3. Evolutionary Economics, Economic Geography, Open Innovation and Business Networks Chair: Tommi A. Inkinen(University of Turku, Finland)

Special Session 4. Japan's Role of Business Innovation in Emerging Economies • Chair: Yuri Sadoi(Meijo University, Japan)

Special Session 5. Open Innovation Focused on Renewing Aging • Chair: Pedro D. Almaguer Prado(Isinapsys, Mexico)

Special Session 6. Social Innovation for Sustainable Development • Chair: Karine Oganisjana(Riga Technical University, Latvia)

Special Session 7. Management of Innovation and Technology Transfer • Chair: Mikus Dubickis(Riga Technical University, Latvia)

Special Session 8. Innovation Diversity for Emerging Economies • Chair: Natalia Lace/Riga Technical University. Latvia)

Special Session 9. Women in Management, Work and Organization • Chair: Paola Paoloni(University Niccolo Cusano, Italy)

Special Session 10. Open Innovation for Industrial Ecosystems • Chair: Jinxi Wu, Lei Shi(Tsinghua University, China)

Special Issue Journals

Special Session 11. Knowledge, Value, Ethics, and Business Ecosystem • Chairs: John C. Yi(Saint Joseph's University, USA), Jeong SukJae(KwangWoon University, Korea)

Special Session 12. Entrepreneurship, and Knowledge and Action Straing Among Industries, Higher Educations & Research Institutions, and Science and Technology Parks • Chairs: Jachoon Rher(Peungman University, Korea)

pecial Session 13, Creativity, Public Service Motivation, and Innovation Diffusion at Comparative Perspective Chairs: Kwanyfo Jung/Seou/National University, Korea, Seung-Hee Lee(Southern Illinois University, USA)

Special Session 14. Technology Commercialization & Management • Chair: Eui-Seop Jeong(Korea Institute of Science and Technology Information, Korea)

Special Session 15. Open Innovation, New Combination, and Schumpeter • Chair: JinHyo Joseph Yun(Daegu Gyeongbuk Institute of Science & Technology, Korea

Special Session 16. Open Innovation for Roadmapping Future Technology & Society • Chair: Jeonahwan Jeon(Gveonasana National University, Korea)

Special Session 17. Dynamics of Open Innovation, Business and Society • Chairs: KyungBae Park(Sangji University, Korea), SangOh Shim(HanBat National University, Korea)

Special Session 18. The Ecosystem of Open Innovation and Organizational Innovation • Chairs: Chih-cheng Lo(National Changhua University of Education, Taiwan) Ying-Che Hsieh(National Tsing Hua University, Taiwan)

Special Session 19. Complex Innovation Strategies for Intelligence Society • Chair: Boong Kee Choi(Korea Institute of Science and Technology Information, Korea)

General Sessions(Refer to SOltmC Homepage)

#### more informatio

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• Prof. Natalja Lace (Hosting Chair of SOItmC & Riga Technical University 2017, Riga Technical University) Contact: natalja.lace@rtu.lv, (mobile)+37-12-954-3819

 Dr. XIAOFEI ZHAO(SOItmC Secretariat) Contact: openinnovationtmc@dgist.ac.kr +82-53-785-4414, 4415, (mobile) +82-10-4072-8595 Address: 333 Techno Jungang-daero, Hyeonpung-myeon, Dalseong-gun, Daegu, 42988, Korea

Journal of Open Innovation: Technology, Market, and Complexity • Editor-in-Chief: JinHyo Joseph Yun(jhyun@dgist.ac.kr) • Keynote Speakers' Papers & Best Award Papers will be invited to the journal. Knowledge Management Research & Practice(SSCI) Editor-in-Chief: Giovanni Schiuma(g.schiuma@arts.ac.uk) • About 8 papers will be invited to the journal.

Science, Technology and Society(SSCI) • Editor-in-Chief: Venni V. Krishna(krishna@mail.jnu.ac.in) • Non-Confirmed, we can apply after succeeding in 2016 Special Issue.

Sustainability(SSCI and SCIE) • Editorin-Chief: Marc A. Rosen(marc.rosen@uoit.ca) • Guest Editor: JinHyo Joseph Yun(Managing, jhyun@dgist.ac.kr),Tan Yigitcanlar (tan.yigitcanlar@qut.edu.au), KwangHo Jung(kwjung77@snu.ac.kr)

Technological Forecasting and Social Change(SSCI)(SOItmC 2016 - SOItmC 2017) • Editor-in-Chief: Fred Phillips(fphillips@saturn.yzu.edu.tw) • Guest Editor: JinHyo Joseph Yur(Managing, jhyun@dgist.ac.kr), Jane E. Workman (jworkman@siu.edu), Kuen Lee(Kenneth@su.uz.kr), Tan Yigitarahar(tan.yigitarahar@qut.edu.au)

#### Designated General Issue Journals (Designated Reviewer: JinHyo Joseph Yun(jhyun@dgist.ac.kr)

- Journal of Security and Sustainability Issues(Scopus)
   \* Editor-in-Chief: Manuela Tvaronaviciene(manuela007756@gmail.com)
- Entrepreneurship and Sustainability Issues(ESCI)
   \* Editor-in-Chief: Manuela Tvaronaviciene(manuela007756@gmail.com)
- International Journal of Knowledge-Based Development(Scopus)
   \* Editor-in-Chief: Tan Yigitcanlar(tan yigitcanlar@qut.edu.au) European Planning Studies(SSCI)
   \* Editor-in-Chief: Philip Cooke(CookePN@cardiff.ac.uk)
- Journal of Evolutionary Economics(SSCI)
   \* Editor: Uwe Cantner(uwe.cantner@uni-jena.de)

The full version of proceeding can be downloaded in SOltmC homepage, order 'openinnovationtmc@gmail.com' if you want

- Organized by Society of Open Innovation: Technology, Market, and Complexity
- Hosted by Riga Technical University
- Sponsored by



15. June – 18. June, 2017 Riga Technical University, Riga, Latvia





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> Society of Open Innovation: Technology, Market, and Complexity (SOItmC) with RTU





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## Welcoming Speech by the President of SOItmC Prof. Dr. JinHyo Joseph Yun

Welcome Honor Professors, Researchers, Students, and Entrepreneurs who are at this Riga technological University in world best beautiful city, Riga<sup>1)</sup> of Latvia, right now.

Thanks a lot to the hosting chair, Professor Natalja Lace, and all Riga colleagues for preparing this great conference.

The theme of SOItmC 2017 conference is "Let us conquer the Growth Limits of Capitalism through New Combination between Technology, and Market or Society". Growth limits means no existence of development. Development is spontaneous and discontinuous change in the channels of the flow, disturbance of equilibrium, which forever alters and displaces the equilibrium state previously existing(J. A. Schumpeter, 1934, p. 64). Even though 4<sup>th</sup> industrial revolutions motivates new economy growth, high unemployment, the increase of poverty population ratio, and appearing of new poor classes from youth and old together from worldwide are not disappearing.

Stopping by woods on a snowy evening, I thinks the road not taken which had be discontinuous change and development<sup>2</sup>.

I propose 3 approach of new combinations between technology, and market, or society as ways of conquering the growth limits of capitalism from Schumpeterian perspective before a lot of creative proposals are discussed in SOItmC 2017 at Liga Technologycal University on June 16<sup>th</sup>-18<sup>th</sup>.

First, let us approach at the economic development not by way of individual agents, or targets but by the economy as a whole including social economy, individual entrepreneur, and big business together(Becker, Knudsen, & Swedberg, 2011, pp. 155-158).

Second, Let us respond to the right now world economy situations such as the vanishing of investment opportunity, the obsolescence of the Entrepreneurial functions, and the growing hostility

<sup>1) &#</sup>x27;If the hemp and flax of **Riga** are purchased with the tobacco of Virginia, which had been purchased with British manufactures, the merchant must wait for the returns of two distinct foreign trades, before he can employ the same capital in repurchasing a like quantity of British manufactures.' In Adam Smith (1789). *The Wealth of Nations*. p. 213

<sup>2)</sup> This sentence receives motives from "Stopping by woods on a snowy evening", and "The Road Not Taken" which were written by Robert Lee Forest(1874-1963).

by motivating social open Innovation including sharing economy, social economy, and common economy(J. Schumpeter, 1942, pp. 111, 131, 143).

Third, Let us motivate business cycle through creative destructions by not just individual entrepreneur, or organizational entrepreneur, but also entrepreneurial state with huge development bank with high entrepreneurship(Mazzucato, 2015; J. A. Schumpeter, 1939).

Dear professors, researchers, students, and entrepreneurs

"The timeless in you is aware of life's timelessness,

And knows that yesterday is but today's memory

And tomorrow is today's dream."<sup>3)</sup>

Let us enjoy SOItmC 2017 conference together from right now.

<Reference>

Becker, M., Knudsen, T., & Swedberg, R. (2011). *The Entrepreneur-Classic texts by Joseph A. Schumpeter*: Stanford University Press.

- Mazzucato, M. (2015). *The entrepreneurial state: Debunking public vs. private sector myths:* PublicAffairs.
- Schumpeter, J. (1942). Capitalism, socialism, and democracy: New York: Harper & Row.
- Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle* (Vol. 55): Transaction publishers.

Schumpeter, J. A. (1939). Business cycles (Vol. 1): McGraw-Hill New York.

June 16, 2017

#### JinHyo Joseph Yun Ph. D.

President of Society of Open Innovation; Technology, Market, and Complexity jhyun@dgist.ac.kr; +821066978355

<sup>3)</sup> In Kahlil Gibran The Prophet " On time"

### Welcoming Speech by the RTU Hosting Chair Prof. Natalja Lace

Dear participants of the international conference SOItmC & RTU' 2017,

On behalf of the organizing committee I welcome you in the Faculty of Engineering Economics and Management of Riga Technical University!

Innovation based development is a hot topic in all economies of the world. Openness of mind, openness of businesses and openness of innovation are the key characteristics and success factors of the global world today. Development strategies are becoming smarter transforming economy towards creation of higher added-value products, services and more effective use of resources. Such a high-priority aim is to be achieved implementing smart specialization strategy to boost all regions and create future capabilities and comparative advantage for providing a platform for sustainable growth and development. Universities play a significant role in this process. The Latvian National Research Programme "Economic Transformation, Smart Growth, Governance and Legal Framework for the State and Society for Sustainable Development – a New Approach to the Creation of a Sustainable Learning Community (EKOSOC-LV)" is researching the mechanisms of the achievement of this crucial aim. Riga Technical University, in collaboration with leading state universities of Latvia, realizes three research projects within the National Research Programme EKOSOC-LV on the development of innovation and entrepreneurship in Latvia, involvement of the society in social innovation processes and strengthening of competitiveness of the Latvian companies on external markets.

We are extremely honoured to receive you in the Faculty of Engineering Economics and Management of Riga Technical University!

We hope the conference will be a fruitful exchange and discussion of scientific findings and ideas for further collaboration!

Enjoy your staying in beautiful Riga - in the heart of Latvia!

**Prof. Dr.oec. Natalja Lace** Hosting Chair of SOItmC&RTU 2017 Faculty of Engineering Economics and Management Riga Technical University

## Welcoming Speech by the Vice Rector of RTU Prof. Tālis Juhna

Dear, participants!

On behalf of Riga Technical University, I welcome you to the SOItmC&RTU'2017 conference. We are privileged to host this event this time in Riga which is one of the main commercial centre in the Baltic states. In the post-crises period Latvia was able to stabilise budget and now working actively on finding new ways how to transform economy to more knowledge-based and innovation-driven one that will increase productivity and create new jobs. There is no panacea how to do it, but clearly, in the long run, open flow of novel ideas between businesses will increase probability of creation of new products and services to rise quality of live for people. So, how to encourage companies to build the trust in sharing expertise and ideas for the mutual benefit? How to educate future entrepreneurs in open innovation settings? How to engage universities and research institutes in this process more actively? These are only a few of many questions need be to addressed now. Hence, I am pleased to see so many distinguished academics from all around the world at the conference speaking about the open innovation and sharing their knowledge how this economical strategy could be materialised in the real life, hopefully also in Latvia.

RTU is one of the leading universities in the region in terms of high quality engineering education and impact of research. Moreover, the third cornerstone of our strategy is valorisation of knowledge to facilitate economic growth in the country. We believe that universities play an important role not only by creating future human resources but be also by providing a platform for knowledge transfer from science to business and from business to business. I am sure this conference will bring new insights which will be useful both for international academia and for modern universities strategies.

I wish you fruitful meeting and enjoyable time in Riga.

**Prof. Talis Juhna** *RTU Vice-Rector for Science* 

## Welcome speech by the Charge d'Affaires of Korea in the Latvia-Mr. Kyong-Ho Min Head of Mission, Embassy of the Republic of Korea in Riga

Distinguished guests, ladies and gentlemen,

It is my pleasure to be among so many eminent scholars and businessmen, who have gathered at this conference, dedicated to innovations and new technologies as a driving force for future growth.

We all have seen the fall of many big companies, which could not adapt themselves to the changing environment. Similarly, we have seen new, ambitious companies emerging and effectively entering world markets with products or approaches which some perceived unattainable a while ago, but which have become the new reality. Innovation, new technologies and knowledge-driven economies are the keywords describing successful businesses, and countries as well.

I have come from a land, which fortunately understood that significant investments in research and development must be made to ensure sustainable growth. These days we can see Korea being among the world's most innovative countries and for many people around the globe Korea is an epitome of hi-tech and smart growth.

I am happy that this event is taking place in Latvia - a country which in just 25 years succeeded in rebuilding its economy and, by undergoing bold reform process, successfully integrated into major international organizations such as the EU, WTO and most recently - OECD. I take this opportunity to once again extend my congratulations on Latvia becoming its 35th member state!

Dear participants, hereinafter I would like to briefly outline the bilateral relations between Korea and Latvia, hoping that you will find it as a useful input for your future discussions here at the conference and beyond.

Firstly, I would like to emphasize that this conference is another excellent example of cooperation between the Asian and Baltic Tiger, as some like to call our countries. Friendly and cooperative relationship which began 25 years ago has seen a major leap forward. Strong willingness to see people interacting has led us to tangible outcomes. Five years ago a Korean language module was introduced within the Asian Studies program at the University of Latvia. And last year, in response to growing need for people with proficient knowledge of Korean language and culture, as well as growing interest from general public, the Korean Studies Centre and the Riga King Sejong Institute were opened.

Moreover, students seeking opportunities to learn more about each other's country have facilitated significant growth of student exchanges between Korea and Latvia. It is my personal

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belief that greater interaction leads to valuable exchanges of innovative ideas and enhances mutual understanding and reciprocal development of our societies.

Ladies and gentlemen, Latvia has a proven track record of achievements in ICT, pharmacy, chemistry, wood and food processing industries. High quality plywood from Latvia is used for shipbuilding in Korea, innovative anti-reflective glass helps visitors better appreciate Korean history and culture at the National Museum of Korea, and a Latvian company will be involved in building the Olympic snowboarding facilities in PyeongChang. Likewise, Korean companies, such as Samsung and LG Electronics, have acknowledged the advantages of Latvia's geographical location as the gateway to the Baltic region and beyond. These are just few examples of successful interactions, but I see many other prospective areas of cooperation, particularly in the fields of transport and logistics, tourism, as well as science and education. And I have a reason to believe there is a great potential of turning this into reality.

In conclusion, I would like to take this opportunity to thank the Society of Open Innovation, Technology, Market and Complexity and the Riga Technical University for making this conference possible. I am confident you will find this conference truly inspiring and I hope you will have many fruitful discussions. Enjoy your stay in Riga!

Thank you!

June 16, 2017

**Kyong-Ho Min** Ambassador of the Republic of Korea in the Latvia



## Congratulatory Speech by the Mayor of Daegu Mr. Kwon Young-jin

I am delighted to send my warmest greetings to the scholars, professors, businessmen, and the organizing committees connected with the SOItmC & RTU 2017 Conference, which takes place in Latvia.

As you may know, the limitations of capitalism-in terms of economic grow-th

have been reported frequently. Indeed, in Korea alone, we have been seeing a conglomerateoriented growth for a long time. Such growth appears to have been created by the conglomerates themselves. However, it would not have been possible without the efforts and hard work of many small and medium-sized businesses. Thus, the time has come when we need to overcome such crisis with creative business models and through being open to innovation.

Open innovation will stimulate corporate innovation locally, which will in turn play a positive role in the supply chain from business to business. Then, the supply chain will evolve into a strong basis for open innovation once again. Such a positive cycle is what the City of Daegu is hoping for. Daegu's implementation of a Smart City Plan reflects these ideas. I'm so grateful that SOItmC Conference keeps the academic networks collaborating with one another.

In particular1 the City of Daegu is promoting policies to support these developments, in the hope that small and medium-sized companies in the city will grow into global companies through creative innovation. In fact, the SOItmC and CSCOM 2016 Conference, hosted by the Daegu Gyeongbuk Free Economic Zone Authority, is one of the city's key supporting policies. I hope that the SOItmC Conference will become a major event in the near future.

Nowadays, focusing on the keywords of Artificial intelligence, loT, Cloud, Big Data, and Mobile, etc., the predicted 4th industrial revolution which is on the horizon is expected to bring us both challenges and opportunities. I am very glad to see that a session of focusing on discussing the 4th industrial revolution has been included by SOltmC•& RTU 2017. I hope that the SOItmC Conference will create more guidelines and solutions for the forthcoming 4th industrial revolution.

In that sense, I hope that the conference will be successful and pave the way for small and medium-sized companies not only in Daegu but also in other local places around the world to develop their innovation capabilities. I hope the conference will be able to contribute more responses to the 4th industrial revolution. Moreover, I also hope that everyone researchers and businessmen alike--will be inspired by this event to generate great ideas that will contribute to the global economy.

Thank you.

June 16, 2017

Kwon Young-jin Worth Mayor, Daegu Metropolitan City Government



## Congratulatory Speech by the President of DGIST Dr. Sang Hyuk Son

On behalf of Daegu Gyeongbuk Institute of Science & Technology (DGIST), I would like to extend my heartfelt congratulations on the successful hosting of the SOltmC & RTU 2017 Conference in Latvia. As the president of DGIST, I welcome all participants and guests of this conference from Korea and all over the world. I believe that this conference is very meaningful as a forum where many experts and entrepreneurs in the field of open innovation and creative business models freely exchange their ideas and opinions on innovation.

At the age of the Fourth Industrial Revolution, we will soon witness accelerating progress of science and technology and a rapid change in society. To be adaptable to such a huge change, it is critical to broaden the scope of our interests and understanding, and focus on convergence of diverse technologies. I hope that the SOltmC & RTU 2017 Conference will plays a key role in deriving innovative solutions towards various confronting challenges.

The importance of open and collaborative innovation is even more highlighted all over the world to bring in the new era of hyper-connected and intelligence-based society. Considering such a rapid change, the roles of universities and research institutions need to be redefined. In that regard, DGIST has been leading innovation in the field of science and engineering through its solid convergence education, interdisciplinary research, and technology commercialization. Under the convergence-focused curriculum, DGIST fosters students with the spirit of 4Cs - Creativity, Challenge, Collaboration, and Care — to become future leaders for the knowledge creation and innovation. Our goals include facilitating scientific advancement and nurturing talented individuals through innovative strategy. Hence it is meaningful for us to support the SOltmC, which shares the same vision: open innovation for the advancement.

I am confident that you will enjoy high quality presentations and lively discussions with leading researchers at the conference. I hope that what you have discussed and presented here continues to bring sustainable advancement and innovative changes at the corporate, national, and global levels.

June 16, 2017

Sang Hyuk Son, Ambassador of the Republic of Korea in the Latvia

Ir.) Programs	*Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street Industry Visiting (Getlini EKO) Emcee: Xiaofei Zhao(DGIST, Korea)	<image/> <image/>	<ol> <li>(RTU → Getlini EKO) The bus departure</li> <li>09:30 at main gate of Rzwell Elefant Hotel</li> <li>09:50 at main gate of RTU dormitory(Azenes street 6, Kipsala, Riga)</li> </ol>	2. (Getlini EKO → RTU) • 12:30~13:30 (the arrival at RTU Canteen) 3.1 unch Time: 13:30-44:30	• Lunch will be booked.     3. How to apply: through email(openinnovationtmc@dgist.ac.kr)     • First 50 applicants can only participate in the tour:	
6. 15(Thur.)	<b>Time</b> 10:00~18:30					

6. 15(Thur.) Time 14:30~16:00 14:30~17:00 16:00~17:00 17:30~18:30 18:30~20:30
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6. 16(Fri.)			Programs		
Time	#301	#303	#309	#321	Lobby
06:60-00:80	<ul> <li>Session-16.#301-1(SS8 &amp; SS22)" Innovation diversity for emerging economies</li> <li>Chair: Natalja Lace(RTU, Latvia)</li> <li>Paper 1: "Internet of Things as a framework for company digitalization" by Deniss Sceulovs, Vladimir Shatrevich &amp; Iveta Ozolina-Ozola</li> <li>Paper 2: "Managing Competence Based Synergy in Acquisition Processes: Empirical Evidences from Information and Communication Technologies Industry" by Andrejs Črijevskis</li> <li>Paper 3: "Relevance analysis of factors enhancing coaching in organizations" by Angelina Rosha &amp; Natalja Lace</li> <li>Paper 4: "Efficiency Analysis of Retail Chain Stores in Korea" by Kyungwan Ko, Meehyang Chang), Eun-Song Bae &amp; Daecheol Kim</li> <li>Paper 5: "The Efficiency Analysis and Service Quality for Chinese Commercial Banks Using DEA" by Meehyang Chang &amp; Hanbyeol Jang</li> </ul>	<ul> <li>Session 16.#303-1(SS7 &amp; SS15)</li> <li>Open Innovation, New Combination, and Schumpeter</li> <li>Chair: JinHyo Joseph Yun(DGIST, Korea)</li> <li>Honor discusser: Philip Cooke</li> <li>Paper 1: "Effect of Distance on Open Innovation: Differences among Institutions according to Patent Citation and Reference" JinHyo Joseph Yun, EuiSeob Jeong, ChangHwan Lee, JinSeu Park) &amp; Xiaofei Zhao</li> <li>Paper 2: "Harnessing the value of open innovation: ChangHwan Lee, JinSeu Park) &amp; Xiaofei Zhao</li> <li>Paper 2: "Harnessing the value of open innovation: Change in the moderating role of absorptive capability in the South Korean Manufacturing Sector" by JinHyo Joseph Yun, Xiaofei Zhao</li> <li>Paper 3: "Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal" by JinHyo Joseph Yun, KyungBae Park, Jeonghwan Jeon &amp; XiaoFei Zhao</li> <li>Paper 4: "Innovation of the Management Systems in Medium-Sized Enterprises - Problems and Solutions" by Maris Miller &amp; Elina Gaile-Sarkane</li> <li>Paper 5: "Assessment of sustainability at higher education institutions" by Jana Erina &amp; Ingars Erins</li> </ul>	<ul> <li>Session 16.#309-1(SS6 &amp; SS14)</li> <li>Social innovation for sustainable development</li> <li>Chair: Karine Oganisjana(RTU, Latvia)</li> <li>Paper 1: "The model of involvement of the society in social innovation processes in Latvia" by Karine Oganisjana, Svetlana Surikova, Konstantins Kozlovskis, Nicolás Monge-Iriarte &amp; Anna Svirina</li> <li>Paper 2: "Grassroots social innovation development: the main trends" by Anna Svirina, Alfia Zabbarova &amp; Karine Oganisjana</li> <li>Paper 2: "The social entrepreneurship concept as a subject of social innovation" by Lasma Dobele &amp; Gunta Grinberga-Zalite</li> <li>Paper 4: "A food industry trend analysis of Gangwon-province in Korea based on Patent Information" by Taehoon Kwon, LeiSeob Jeong, Eui Soo Kim, Joon Woo Lee &amp; Hyang Ho Son</li> <li>Paper 5: "Statup tend analysis of global listed companies - Focusing on growthen gline industry in Korea" by Lee-Nam Kwon, Jun-Hwan Park, Yeong-Ho Moon &amp; Bang-Rae Lee</li> </ul>	<ul> <li>Session 16.#321-1(SS3 &amp; SS12)</li> <li>Entrepreneurship, and Knowledge and action sharing among industries, higher educations &amp; research institutions, and science and technology parks</li> <li>Chairs: Janchon Rhee/Yeungmam University, Korea), Junghyun Yoon(Dongguk University, Korea), Junghyun Yoon(Dongguk University, Korea), Junghyun Yoon(Dongguk University, Korea), Junghyun Yoon(Dongguk University, Korea), Junghyun Yoon, Daekon Rhee &amp; Sanghyun Sung</li> <li>Paper 1: "Entrepreneurial Behaviors, Technology Transfer, and Performance: Focused on Network among Industries-Higher education &amp; Research Institutions, and Technopark" by Junghyun Yoon, Jaehoon Rhee &amp; Sanghyun Sung</li> <li>Paper 1: "The Effects of Entrepreneurial Business Process on New Firm Creation:" by Sanghyun Sung, Seunghoon Lee &amp; Junghyun Yoon</li> <li>Paper 4: "Socio-spatial dynamics of e-services and e-commerce potential" by Maria Merisalo &amp; Tomm Inkinen</li> <li>Paper 5: "Cost aggregation in export logistics chain" by Eas Hämäläinen &amp; Elen Twrdy</li> </ul>	
09:30~09:40	Coffee Break <b>Coffee and dessert will be provided.</b>	be provided.			
9:40~11:20	Welcoming Speech by the President of SOltmC (09:40~09:50)	* Venue: #321	Emcee:SamYoul Lee(Yonsei University, Korea)		
	Welcoming Speech by the RTU Hosting Cha	Welcoming Speech by the RTU Hosting Chair/ Dean of Faculty of Engineering Economics and Management of RTU (09:50~10:00)	:s and Management of RTU ( $09:50{\sim}10:00$ )		
	Welcoming Speech by the Vice Rector of RTU $(10{:}00{\sim}10{:}10)$	<b>U</b> (10:00~10:10)			
	Welcoming Speech by the Charge d'Affaires of the	of the Republic of Korea in the Latvia (10:10~10:20)	0~10:20)		
	Congratulatory Speech by the Mayor of Daegu (10:20~10:30)	<b>ju</b> (10:20~10:30)			
	Congratulatory Speech by the President of DGIST $(10:30{\sim}10:40)$	<b>)GIST</b> (10:30~10:40)			
	Keynote Speech 3 (10:40~11:10) Philip C Entrepreneurial Ecosystem Platforms	ooke(Bergen University College, Norway	Keynote Speech 3 (10:40~11:10) Philip Cooke(Bergen University College, Norway) •Theme: A Ground-up "Quaternary" Innovation Strategy for South Korea Using Entrepreneurial Ecosystem Platforms	ovation Strategy for South Korea Using	
_	Keynote Speech 4 (11:10~11:40) JinHyo Jos	<pre>sph Yun(DGIST, Korea) •Theme: Benefits and Costs</pre>	Keynote Speech 4 (11:10~11:40) JinHyo Joseph Yun(DGIST, Korea) •Theme: Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal	s Galaxy Note 7 Explosion and Withdrawal Scandal	
11:40~13:00	Lunch Break * We recommend the Facu	tty Canteen for lunch(Faculty of Engineering	* We recommend the Faculty Canteen for lunch(Faculty of Engineering Economics and Management, 6 Kalnciema Street)	treet)	
Note. **(SS8 &	Note. **(SS8 & SS22): SS8=Special Session 8, SS22= Special Session 22; GS=General Session; The special session number can be confirmed in the cover.	Session 22; GS=General Session; The special s	session number can be confirmed in the cover.		

(SS8 & SS22): SS8=Special Session 8, SS22= Special Session 22; GS=General Session; The special session number can be confirmed in the special session of the special session set of the special session and the special session set of the special set of the specia

**SOltmC & RTU 2017** 







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6. 16(Fri.)			Programs		
Time	#301	#303	#309	#321	Lobby
13:00~14:30	<ul> <li>Session 16.#301-2(SS8 &amp; SS22)</li> <li>Open Innovation of Service Sectors Chair: DaeCheol Kim(Hanyang University, Korea)</li> <li>Paper 1: "Consumer Acceptance Analysis on Home Energy Management Systems" by Eurg-Suk Park, Byung-Yong Hwang, Kyung-Wan Ko &amp; Dae-Cheol, Kim</li> <li>Paper 2: "A Case Study on the Improvement of Institution of 'High-risk high-return R&amp;D' in Korea" by Byung Yong HWANG, Hee Ju Jun &amp; Dae Cheol Kim</li> <li>Paper 2: "The Effects of Hallyu on Tourism in Korea" by Euro-Song Bae, Meehyang Chang, Euro-Song Bae, Meehyang Chan</li></ul>	<ul> <li>Session 16.#303-2(SS7 &amp; SS15)</li> <li>Session 16.#303-2(SS7 &amp; SS14)</li> <li>Management of Innovation and Technology Commercialization &amp; Transfer</li> <li>Transfer</li> <li>Chair: Mikus Dubickis (RTU, Latvia)</li> <li>Paper 1: "Identification of Innovativeness Level in New Product and Technology Technology Commercialization &amp; Management</li> <li>Paper 1: "Identification of Innovativeness Level in New Product and Technology Using Fast-Fourier-Transformation Development Projects: Case of Latvia" by Mikus Dubickis &amp; Jana Erina</li> <li>Paper 2: "Internal Evaluation of Intellectual Capital Management at Universities" by Laura Vitola &amp; Jana Erina</li> <li>Paper 2: "Internal Evaluation of Intellectual Capital Management at Universities" by Laura Vitola &amp; Jana Erina</li> <li>Paper 3: "Employee retention in knowledge Intellectual Capital Management at Universities" by Jointyo Joseph Yun, Abiodun A.</li> <li>Paper 3: "Internal Calle-Sarkane</li> <li>Paper 3: "Analysis of the Effect of Technology and Market Dynamism Intensive companies" by Veta Ozolina - Paper 3: "Analysis of the Effect of Technology and Market Dynamism Denses Performances by SME S succeed? Learning from Buro Battery, and Grass roots innovation Festival of India"</li> <li>Paper 4: "Comparative analysis of Chilean and Latvian contexts for policy on social innovation" by Nic. Dongky un Social innovation" by Nic. Dongky un Social innovation" by Nic. Dongky Un, Dongky Un, Dongky Un, Dongky Un, Dongky Un, Euiseob Jeong, KungBae Park, Devender Technology and Market Dynamism Dondel India"</li> <li>Paper 5: "Dismantling of the Inverted U</li> <li>Paper 5: "Isimantling of the Inverted U</li> <li>Paper 5: "Dismantling of the Inverted U</li> <li>Paper 5: "Isimating of the Invert</li></ul>	a) c method by hot Market n Patent Kwon Nean Kwon No no the erprises) upporting g Yoo, the Lanka" IIa Kapu	<ul> <li>Session 16.#321-2(SS3 &amp; SS12)</li> <li>Evoluationary Economics, Economic Geography, Open Innovation and Business Networks</li> <li>Chair: Tommi A. Inkinen(University of Turku, Finland)</li> <li>Paper 1: "E-Capital and Economic Evolution in European Metopolitan Areas" by Juho Kiuru &amp; Tommi Inkinen</li> <li>Paper 2: "Developing a classification framework for assessing ports" environmental effectiveness: by Olli-Pekka Environmental effectiveness: by Olli-Pekka Brunia, Vappu Kunnaala-Hyrkki &amp; Tommi Inkinen</li> <li>Paper 2: "The Role of Entrepreneurial Business Process on Improving Innovation: Based on Early-stage Companies" by Sanghyun Sung, Injun Choi &amp; Junghyun Yoon</li> <li>Paper 4: "Impacts of Meta-cognition on Innovative Behaviors: Focused on the Mediating Effects of Entrepreneurship" by Deasu Kim &amp; Junghyun Yoon</li> <li>Paper 4: "Impacts of Meta-cognition on Innovative Behaviors: Focused on the Mediating Effects of Entrepreneurship" by Deasu Kim &amp; Junghyun Yoon</li> <li>Paper 4: "Impacts of Meta-cognition on Innovative Behaviors: Focused on the Mediating Effects of Entrepreneurship" by Deasu Kim &amp; Junghyun Yoon</li> <li>Paper 4: "Impacts of Meta-cognition on Innovative Behaviors: Focused on the Mediating Effects of Entrepreneurship" by Doose Kim &amp; Junghyun Yoon</li> </ul>	
14:30~14:50	Break				

6. 16(Fri.)			Programs		
Time	#301	#303	#309	#321	Lobby
14:50~16:20	Session 16#301-3(SS16 & SS25) Session Open innovation for roadmapping future Japan technology & society emergi Chair. Jeonghwan Jeon(Gyeongsang National Chair: ) University, Korea) Honorl	Session 16#303-3(SS4 & SS17) Japan's role of business innovation in emerging economies Chair: Yuri Sadoi(Meijo University, Japan) Honor Discusser: JinHyo Joseph Yun	Session 16#309-3(SS18 & SS20 & SS29) Open Innovation by Design Thinking Chair: Sunah Kim(Kumoh National Institute of Technology, Korea) Honor Discusser. Natalja Lace	Session 16#321-3(SS23) (Open Innovation and Business Model Competition Session) Chair: ChoongJae Im(Keimyung University, Korea)	
	<ul> <li>Paper 1: "Open roadmap for open innovation at the national level: A case of Roman period" by Jeonghwan Jeon &amp; Yongyoon Suh</li> <li>Paper 2: "Roadmapping for export of space segment based on portfolio analysis: A case of Korea" by Jeonghwan Jeon &amp; Jieun Kim</li> <li>Paper 3: "How to improve future mobile app service quality: Exploring the rule of satisfaction from user reviews" by Jieun Kim</li> <li>Paper 4: "Exploring open innovation network in safety systems for future society: A patent analysis" by YongYoon Suh &amp; Joonghwan Jeon</li> <li>Paper 4: "Exploring open innovation network in safety systems for future society: A patent analysis" by YongYoon Suh &amp; Joonghwan Jeon</li> <li>Paper 5: "Revisiting LPI index in regionally polarized economies: comparative study for Russia and Kazakhstan" by Anna Svirina, Marina Munina, Prause G, Lukashevich N., Garanin D., Bozhko L, Zarubina V.</li> </ul>	<ul> <li>Paper 1: "Human Resource Development through Re-manufacturing Business in Myanmar" by Yuri Sadoi</li> <li>Paper 2: "The Role of Higher Education in Industrial Development in Myanmar" by Ye Tun Min</li> <li>Paper 3: "Outlook of the implementation "Routeman" system on the Russian market (the case of DyDo DRINCO Inc)" by Sandugash Aimanova, Maria Vasilyeva &amp; Vera Gurova</li> <li>Paper 4: "The role of a business model in market growth: The difference between the converted industry and the emerging industry" by JinHyo Joseph Yun, DongKyu Won, KyungBae Park, EuiSeob Jeong &amp; Xiaofei Zhao</li> <li>Paper 5: "Comparing Validity of Risk Measures in Newsvendor Models" by SungYong Choi, KyungBae Park &amp; Sang- Oh Shim</li> </ul>	• • • • •	<ul> <li>Paper 1: "Participatory Public Service</li> <li>Paper 1: "Participatory Public Service</li> <li>Design "by Suhyun Baek &amp; Sunah Kim</li> <li>Paper 2: "Collaborative Workshops for</li> <li>Design Development" by Hye-Jeong Choi,</li> <li>Young-ok Jeon, Jiyoung Christine Koo &amp;</li> <li>Paper 3: "Improved wheelchair for the physical study on Taiwan</li> <li>Paper 3: "Modified Walker with Adjustable their adde value" by Lo Chih-Cheng,</li> <li>Dason Kao &amp; Peng, Hsiao-Yun</li> <li>Paper 4: "Modified Walker with Adjustable Legs" by Shalini Kumari</li> <li>Paper 4: "An intellectual property service</li> <li>Paper 4: "An intellectual property service</li> <li>Paper 4: "An intellectual property service</li> <li>Paper 5: "Design Awards Business Model" by Do-Young Kim Hyo-Jin Kim &amp; Ken Nah</li> <li>Paper 5: "An Empirical Analysis for The Paper 5: "Design Awards Business Model" by Do-Young Kim Hyo-Jin Kim &amp; Ken Nah</li> <li>Paper 5: "An Empirical Analysis for The Paper 8: "Open innovation &amp; Business Model" by KyungYang Park(Non-Confirmed)</li> <li>Paper 5: "An Empirical Analysis for The Daper 8: "Open innovation &amp; Business Model" by KungYang Park(Non-Confirmed)</li> <li>Li, Lei MA &amp; Yue ZHU</li> <li>Paper 9: " Business model and open innovation of DISEC" by Oh JungPyo(Non-Confirmed)</li> </ul>	
16:20~16:40	Break time Coffee and dessert will be provided	ovided			

SoltmC & RTU 2017 June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

6. 16(Fri.)			Programs		
Time	#301	#303	602#	#321	Lobby
16:40~18:10	<ul> <li>Session 16.#301.4 (SS16 &amp; SS24 &amp; SS25) Innovation in Supply Chain Management Chair: Anna Svirina(Kazan National Research Technical University, Russia)</li> <li>Paper 1: "Expert assessment of Kazakhstan economic model: the aspect of global supply chains" by Bozhko L, Zarubina V. &amp; Anna Svirina</li> <li>Paper 2: "The innovative approach towards high-speed roads efficiency estimation" by Viktor Dubolazov &amp; Temirgaleev Egor</li> <li>Paper 3: "Data-driven scenario planning in open innovation: Integrating keyword network and morphological analysis" by Jieun Kim &amp; Jeonghwan Jeon</li> <li>Paper 5: "Transforming Government: A Platform Approach" by Sanghoon Lee &amp; Jeonghwan Jeon</li> <li>Paper 5: "Transforming Government: A Platform Approach" by Sam Youl Lee &amp; Yoon Sang Ha</li> </ul>		<ul> <li>Session 16.#309-4(SS18 &amp; SS29)</li> <li>Innovation Ecosystem: Strategy and Policy</li> <li>Chairs: Lei Ma &amp; Zheng Liu(Nanjing University of Science and Technology, China)</li> <li>Honor Discusser: Tan Yigitcanlar</li> <li>Paper 1: "The Impact of Local Government Policy on Innovation Ecosystem: Case Study of Changzhou, China" by Lei MA &amp; Zheng LU</li> <li>Paper 2: "A framework of Fostering Regional Innovation Ecosystem: A case study of Jiangsu province in China" by Shaowen Low, Menghang Zhang &amp; Lei Ma</li> <li>Paper 2: "Construction of Health Assessment Innovation Ecosystem" by Shaowen Consystem" by Guo-peng Xiang</li> <li>Paper 4: "The influence of institutional voids on servitization of manufacturing-comparative study on the role of intermediaries between Taiwan and Korea's ICT industies" by China and Korea's ICT industies" by China and Korea's ICT industing X on the role of Innovation: The Moderating Role of External Knowledge Search strategy" by Chunhsien Wang</li> </ul>	<ul> <li>Session 16.#321.4</li> <li>Chairs: Ustyuzhantseva Olga(Tomsk, Russia) &amp; Cho, Deokho(Daegu University, Korea)</li> <li>Paper 1: "Discovering innovative potential of people in Russia" by Ustyuzhantseva Olga</li> <li>Paper 1: "Discovering innovatives potential of Life Satisfaction of Potential Elderly and Elderly People" by Cho, Deokho</li> <li>Paper 4: "Blockchain Government" by MyungSan Jun</li> <li>Paper 5: "Long-term colla boration network based on ClinicalTrials.gov DB in pharmaceutical industry" by Heyoung Yang</li> </ul>	
18:10~18:20	Break time				







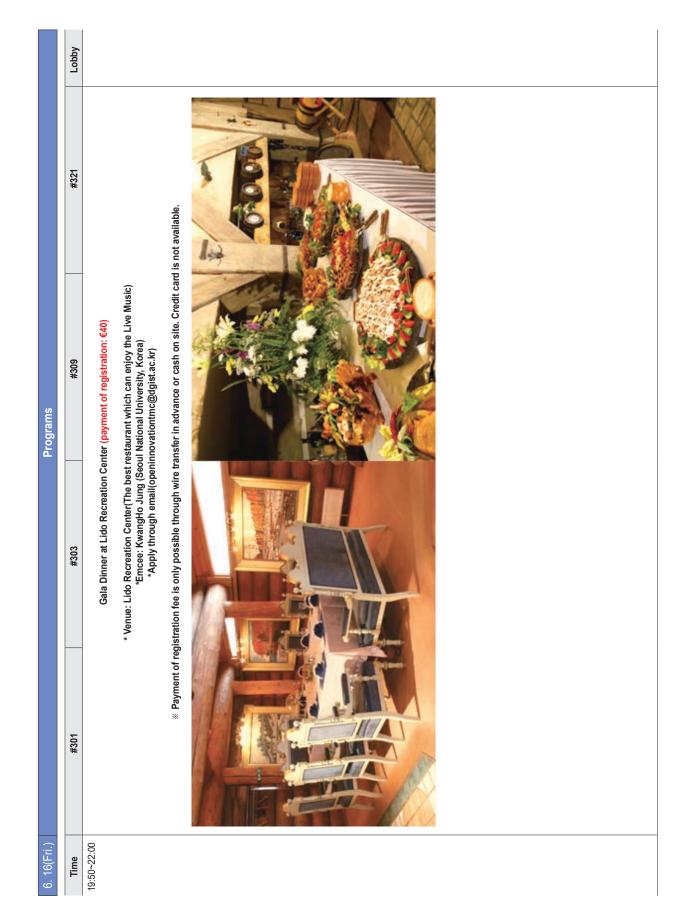


6. 16(Fri.)			Programs		
Time	#301	#303	602#	#321	Lobby
18:20~19:50	<ul> <li>Session 16.#301-5(SS24 &amp; SS25) Uncertainty and innovation policy making Chair: SamYoul Lee(Yonsei University, Korea)</li> <li>Paper 1: "Why uncertainty is unequal without government's precaution action?: the case of toxic humidifier disinfectant" by Young Jun CHOI &amp; Mi Sun JEON</li> <li>Paper 2: "Effect of Art Enjoyment on the Perception of Inequality" by Yoon Kyung Lee &amp; Sam Youl Lee</li> <li>Paper 3: "A Study of Civic Hacking for Improving the Performance of Government 3:0 in Korea" by B. Shine Cho &amp; Sam Youl Lee</li> <li>Paper 4: "Muttilevel prognosis of logistics chains in case of uncertainty: information and statistical technologies implementation" by Dmitry Garanin, Nikita Lukashevich, Anna Svirina &amp; Aleksandr Klavdiev</li> <li>Paper 5: "Global Value Chains: Green Economy and Sustainable Development Challenges" by Adam Albekov, Taras Medvedkin, Yevgeniya Medvedkina, Oleg Bodiagin &amp; Inga Mezinova</li> </ul>	<ul> <li>Session 16.#303-5(GS1 &amp; GS3 &amp; GS5)</li> <li>Technology, and Business Model in Second IT revolution(so to speak 4th industrial revolution) era</li> <li>Chairs: HangSik Park(Eujli University, Korea)</li> <li>&amp; David Parks(Newcastle Youth Offending Team, UK)</li> <li>Honor Discusser: Anil K Gupta</li> <li>Paper 1: "Technology convergence, open innovation and dynamic economy" by HangSik Park</li> <li>Paper 1: "Technology convergence, open innovation and dynamic economy" by HangSik Park</li> <li>Paper 2: "IT-related business model innovation cases in Korea towards 4th industrial revolution" by Heyoung Yang &amp; Su Youn Kim</li> <li>Paper 2: "An international perspective on the expression of the 4th Industrial Revolution by Data mining Approach" by Jeonghwan Jeon &amp; Yongyoon Suh</li> <li>Paper 4: "An international perspective on the social value equilibrium: a case study" by Kartr-Liis Reimann &amp; David Parks</li> <li>Paper 5: "Grassrots to Global: A multi-actor evolution and transfer of the Builet Santi from India to Kenya" by Christopher Kanali, Peter Nyariki, Paul Apondi, Livingstone Mulamu, Mansukh Jagani, Upendra Rathod, Shailesh Dodiya &amp; Anil K Gupta</li> </ul>	<ul> <li>Session 16.#309-5(SS18 &amp; SS20 &amp; SS29)</li> <li>The Ecosystem of Open Innovation and organizational innovation</li> <li>Chairs: Chih-cheng Lo (National Changhua University of Education, Taiwan), Ying-Che Hsieh (National Tsing Hua University, Taiwan)</li> <li>Paper 1: "How innovation contributes to the sustainable business ecosystem: A lesson from the Taiwanese local comic industry" by Ying-che HSIEH &amp; Li-Hsiang Yi</li> <li>Paper 2: "The design innovation of E-textile and wearable computer-a historical" by Wei Her Hsieh &amp; Shih Yun Lu</li> <li>Paper 2: "Flesearch on China's Technology Industrialization based on the Measure of Paper 3: "Fasearch on China's Technology Industry" by Soyoung Kim &amp; Hyojin Kim</li> <li>Paper 5: "Finding Opportunities to Innovate 119 Emergency Medical Service by Design Thinking" by Taesun Kim</li> </ul>	<ul> <li>Session 16.#321-5(GS2 &amp; SS19)</li> <li>Innovation in tourism industry: new challenges and perspectives</li> <li>Chairs: Valentina Della Corte &amp; Giovanna Del Gaudio(University of Naples Federico II, Italy)</li> <li>Paper 1: "Innovation and tradition-based firms: the case of "La Torrente" by Valentina Della Corte, Giovanna Del Gaudio &amp; Fabiana Sepe</li> <li>Paper 2: "Innovating and Inventing for Sustainable Cities: a Tale of Three Incongruities" by Craig A. Stephens, Matthias O. Miller, Alan K. Graham &amp; Andreas J. Habig</li> <li>Paper 3: "A Study on Establishing Economic Activation Strategy Based upon Inter-Industry Network Analysis: The Case of Korea" by Hyoung Sun Yoo, Ji-Hui Kim, Dong Kyu Won &amp; Young-II Kwon</li> <li>Paper 5: "A Study on New Approach for the S&amp;T Intelligence Service" by Yong-II Kwon</li> </ul>	









6. 17(Sat.)	Programs *Venue	ue: Faculty of Engineering Economics and Management, 6 Kalnciema Street	ent, 6 Kalnciema Street	
Time	#301	#303	#321 Tr	Lobby
06:60-00:80	<ul> <li>Session 17#301-1(SS11 &amp; SS13)</li> <li>Creativity, Public Service Motivation, and Innovation Diffusion at Comparative Perspective</li> <li>Chairs: KwangHo Jung (Seoul National University, USA)</li> <li>Honr Discusser: Deborah Dougherty</li> <li>Paper 1: "Public Service Motivation and Creativity" by Jane Workman, Kwangho Jung &amp; Seung-Hee Lee</li> <li>Paper 2: "Bhavioral Model of Innovation Adoption: Comparing Chinese and U.S. College Students" by Seung-Hee Lee, Jane Workman &amp; Kwangho Jung</li> <li>Paper 3: "The Civil Servant Pension Reform in South Korea as Social Innovation: Using Advocation Framework (ACF)" by Keunyoung Lee &amp; Kwangho Jung</li> <li>Paper 4: "Sustainable predictive-analytics driven knowledge management in university teaching to improve students' learning experience and performance" by John Yi</li> </ul>	<ul> <li>Session 17.#303-1(SS10 &amp; SS27)</li> <li>Open innovation for industrial ecosystems Chairs. Jinxi Wu, Lei Shi(Tsinghua University, China) Honor Discusser: Uwe Cantner Honor Discusser: Uwe Cantner and the Canton of CNG vehicle: a case from Sichuan Province in China" by DING Ling, WU Jin-xi &amp; DUAN Ming-ving Paper 1: "Impacts of Potential Climate Change and Human Paper 2: "Impacts of Potential Climate Change and Human Paper 2: "Impacts of Potential Climate Change and Human Paper 2: "Impacts of Potential Climate Change and Human Paper 2: "Impacts of Potential Climate Change and Human Paper 2: "Impacts of Potential Climate Change and Human Paper 2: "Impacts of Potential Climate Change and Human Paper 3: "A study of wintering habitat use pattern of red- crowned cranes in Demiliarized Zone in Korea" by Sangdon Paper 3: "The Construction of technology innovation Paper 5: "The Construction of technology innovation ecosystem of Chinese manufacturing enterprises: A case study of the Nanjing panda LCD Technology Co. Ltd" by Lei MA &amp; Jingxian GAN</li> </ul>	<ul> <li>Session 17.#321-1(SS21 &amp; SS30)</li> <li>Technology and Innovation Driven Industrial Development and Business Economics</li> <li>Chair: Min-Ren Yan(Chinese Culture University, Taiwan)</li> <li>Honor Discusser: Giovanni Schiuma</li> <li>Paper 1: "Simulation-based System Dynamics Decision Support System for Innovation-driven Business Development and System for Innovation Supply Chain Collaborations in Multinational Evaluations" by Min-Ren Yan &amp; Ling-Wei Jen Multinational Enterprises" by Min-Ren Yan &amp; Ling-Wei Jen Multinational Enterprises" by Min-Ren Yan &amp; Ling-Wei Jen Wultinations for Technological Innovations and Industrial Economics. A Case Study of Science Parks" by Min-Ren Yan, Kuo-Ming Chien &amp; Wen-Lin Cho</li> <li>Paper 3: "Nation-wide Eco-System of Academia-Industrial Economics. A Case Study of Science Parks" by Min-Ren Yan, Kuo-Ming Chien &amp; Wen-Lin Cho</li> <li>Paper 4: "A study on the factors influencing academics' knowledge-transfer activities: The case of South Korea" by Ki-Seok Kwon</li> </ul>	
09:30~09:40	Coffee Break <b>+ Coffee and dessert will be provided</b>			
09:40~11:10	Keynote Speech 5 (09:40~10:10) Deborah Dougherty(Rutgers, USA) •Them *Venue: #321 Emcee: Kiseok Kwon(Hanbat National University, Korea)	Keynote Speech 5 (09:40~10:10) Deborah Dougherty(Rutgers, USA) •Theme: Taking Advantage of Emergence for Complex Innovations *Venue: #321 Emcee: Kiseok Kwon(Hanbat National University, Korea)	Complex Innovations	
	Keynote Speech 6 (10:10~10:40) Uwe Cantner(Universit	Keynote Speech 6 (10:10~10:40) Uwe Cantner(University of Jena, Germany) •Theme: Cluster Policy: Insights from the German Leading Edge Cluster Competition	erman Leading Edge Cluster Competition	
	Keynote Speech 7 (10:40~11:10) Giovanni Schiuma(Univ	ersity of Basilicata, Italy ) •Theme: The Business Model Prism: Managi	Keynote Speech 7 (10:40~11:10) Giovanni Schiuma(University of Basilicata, Italy) • Theme: The Business Model Prism: Managing and Innovating Business Models of arts and Cultural Organisations	
11:10~11:20	Break			
11:20-13:00	<ul> <li>Session 17#301-2(SS11 &amp; SS13)</li> <li>Knowledge, Value, Ethics, and Business Ecosystem Chairs: John C. Y((Saint Joseph's University, USA), Chairs: John C. Y((Saint Joseph's University, USA), Paper 1: "Ecosystems are co-created: Fostering value- driven relationships between business; yovenment, and people with technology" by Brent Smith.</li> <li>Paper 3: "Creative Attitude, Cultural Literacy, and Cultural Receptivity in an Era of Sustainable Development" by Kwangho Jung, Seung-Hee Lee &amp; Jane. E. Workman</li> <li>Paper 4: "The rise and fall of RFID-using food waste meter rate system: A case of Gangnam district in South Korea" by Kwangho Jung, Sabine Lee Development focustion Promotion for knowledge- based Innovation: focusing on Brain Korea 21 Programin Korea" by Kwangho Jung, Dung, Dongguk Kim</li> </ul>	<ul> <li>Session 17.#303.2(SS10 &amp; SS27)</li> <li>Climate change and environmental resilience &amp; Chair: Sang-Don Lee(Ewha Womans University, Korea)</li> <li>Honor Discusser: Ulrich Witt</li> <li>Paper 1: "Trends of phenological responses to climate change and urbanization in South Korea" by Se Young Park &amp; Sang Don Lee</li> <li>Paper 1: "Den innovation of industrial ecosystems – some Chinese cases" by Lei Shi</li> <li>Paper 2: "Open innovation of industrial ecosystems – some Economy" by Junghee Han &amp; Almas Heshmati</li> <li>Paper 4: "Analysis on determinant affecting open innovation of Korean Network Service Industry" by by Euo Do Kim &amp; Junghee Han</li> </ul>	<ul> <li>Session 17.#321-2(SS21 &amp; SS30 &amp; GS4)</li> <li>Social Network and Technology Commercialization Chair: Kiseok Kwon(Hanbat National University, Korea)</li> <li>Paper 1: "Agro-economic situation in the world and domestic markets of agricultural and food products in the CIS countries: Russia. Ukraine, Kazakhstan and Belarus" by Lee Sang-duk &amp; Lee Soon-joo</li> <li>Paper 2: "Multiform Context Dynamic Cooperation Strategies of Enterprise Organization Knowledge Share" by L Nun</li> <li>Paper 2: "Integrating Business Model Development and Open Service Innovations in Textiles and Clothing Industries: A Case- based Approach" by Min-Ren Yan, Po-Hong Lin &amp; Chia-Chi Hsu</li> <li>Paper 4: "A comparative study between the heritage of the three states in Korea and the divine comedy in Italy-Hidden Rules in Happiness Equations-" by Sang C. Lee, Kwon Dong Kim &amp; Jong Han Chae</li> </ul>	
13:00~14:00	Lunch Break *We recommend the Faculty Canteen	"We recommend the Faculty Canteen for lunch(Faculty of Engineering Economics and Management, 6 Kalnciema Street)	snt, 6 Kalnciema Street)	

Time	#301	#303	#321	Lobby
14:00~15:30	<ul> <li>Session 17 #301-3(SS1 &amp; SS19)</li> <li>Schumpeterian Dynamics</li> <li>Chair: Andreas Pyka(University of Hohenheim, Germany)</li> <li>Paper 1: "Schumpeterian dynamics of products as agents" by Euy-Young Jung &amp; Andreas Pyka</li> <li>Paper 2: "The Communicative Dynamic Model of Collective Intelligence in Risk Society" by DongKyu Won, Woon-Dong Yeo &amp; Analysis on the relation between business keyword's trends and company's financial performance in Korea" by BangRae Lee, Jun-Hwan Park, Leenam Kwon, Young-Ho Moon &amp; Han-joon Kim</li> </ul>	<ul> <li>Session 17.#303-3(SS26 &amp; SS28)</li> <li>Towards Circular Economy: Innovations, Clusters and Entrepreneurship</li> <li>Chair: Manuela Tvaronaviciene(Vilnius Gediminas Technical University, Lithuania)</li> <li>Paper 1: "Do Social Media Influence on Entrepreneurial Opportunity? an examination of a moderating role of social media use" by Joo Y Park &amp; Chang Soo Sung</li> <li>Paper 2: "Investigating the factors effect on corporate entrepreneurship in platform business" by Kyunghee Kyung</li> <li>Paper 3: "The Effect of the Accelerator Program on EO and Performance" by Chul Hyun UHM, Chang Soo Sung &amp; Joo Y Park</li> <li>Paper 4: "Americanization in Lithuania as a driving force for globalization" by Agné Šimelytė, Renata Korsakiené &amp; Deniss Ščeulovs</li> </ul>	<ul> <li>Session 17.#321-3(GS1 &amp; GS4 &amp; S3 30)</li> <li>Reciprocal and Accountable Open Innovation System: Connecting corporations and communities</li> <li>Chairs: Anil K. Gupta, Anamika R. Dey(Indian Institute of Management, India) &amp; Sang C. Lee(DGIST, Korea)</li> <li>Paper 1: "The open, frugal and reciprocal innovations for climate resilience: incentives for partnership between formal and informal sector" by Anamika Dey, Gurdeep Singh &amp; Anil Gupta</li> <li>Paper 2: "Analytic Framework of Critical Bargaining Power for Open Services Innovation in Printer, Publisher and Paper Merchant Alliance" by Min.Ren Yan &amp; Jan.Ming Weng</li> <li>Paper 2: "Technology and Society-Perspective of strong artificial intelligence-" by Sool In Lee, Kwon Dong Kim &amp; Sang C. Lee</li> <li>Paper 4: "Detention and Liberation, the Constant Slip Related to Naming and its Consciousness" by Kwon Dong Kim, Doo Hyun Jang &amp; Sang C. Lee</li> <li>Paper 4: "Detention and Liberation, the Constant Slip Related to Naming and its Consciousness" by Kwon Dong Kim, Doo Hyun Jang &amp; Sang C. Lee</li> <li>Paper 6: "A Study on the Energy Performance Evaluation and Energy Performance Evaluation and Economic Analysis of Insulation materials" by Boeun</li> </ul>	
15:30~15:40	Coffee Break ★Coffee and dessert will be provided			
15:40~17:10	Session 17.#301.4(SS1 & SS19) Complex Innovation strategies for intelligence society Chair: Boong Kee Choi(KISTI, Korea)	Session 17#303-4(SS26 & SS28) Innovation & Technology Entrepreneurship-educational and nascent entrepreneurs' perspective Chair: Chang-Soo Sung(Dongguk University, Korea)	Session 17.#321.4 On-Line Presentation(SS10 & GS2) Chair: Jeonghwan Jeon(Gyeongsang National University, Korea)	
	<ul> <li>Paper 1: "ANT (Actor Network Theory) Simulation Model for Making R&amp;D Policy" by Boong Kee Choi, Woon-Dong Yeo &amp; DongKyu Won</li> <li>Paper 2: "Analysis of industry trends using financial information of company from ORBIS database" by Jun-Hwan Park, Bangrae Lee, Yeong-Ho Moon &amp; Lee-Nam Kwon</li> <li>Paper 3: "Evolution of clinical trial collaboration network of Novartis for 29 years" by Hyuck Jai Lee &amp; Heyoung Yang</li> <li>Paper 4: "Transformations of Economic Systems: The Bioeconomy Case" by Andreas Pyka</li> </ul>	<ul> <li>Paper 1: "CLUSTERS, SMART GROWTH AND ENERGY SECURITY: IF CONSITENT PATTERNS COULD BE TRACED" by Manuela Tvaronavičiené</li> <li>TRACED" by Manuela Tvaronavičiené</li> <li>TRACED" by Chang Soo Sung, Joo Y. Park &amp; Market Orientation" by Chang Soo Sung, Joo Y. Park &amp; DaeEop Kim</li> <li>Paper 3: "Entrepreneurship Education and Innovation performance: The moderating effect of Team_Based Learning on the Innovative personality in relation to Team Innovative Behavior and New Venture Idea" by Jiyoung Kim, Dae Soo Choi, Joo Y. Park &amp; Chang Soo Sung</li> <li>Paper 4: "Case Study on the course of 'Google YouTube multimedia creation and business' from the aspect of entrepreneurship education" by Tae Hyun Lee, Chang Soo Sung &amp; Joo Yeon Park</li> </ul>	<ul> <li>Paper 1: "The Influence of Perceive Quality on Word of Mouth as Mediated by Perceived Value (Social, Emotional and Functional) Study of Zara's Customers in Surabaya, Indonesia" by Januar Heryanto &amp; Bezaleel Hadinata</li> <li>Paper 2: "HOW INNOVATION CONDITIONS THE SEARCH FOR EXTERNAL KNOWLEDGE: A STUDY OF NIGERIAN FIRMS" by Abiodun Egbetokun</li> <li>Paper 3: "ICT-Enabled Platform-based Business Ecosystem for WEEE Recycling: structure and characteristic" by Chang Wang, Qiao Sun, Lihong Zhang, Ivshui Zuo &amp; Hai-lin YaO</li> <li>Paper 4: "A Value Co-creation Mechanism Research in a Platform Empowerment-based Entrepreneurial Ecosystem-A case study of Taobao.com" by Wenhui Zhou &amp; Yifang Zhou</li> </ul>	
17:10~17:20	Break Time			





RIGA TECHNICAL UNIVERSITY

Time	#301	#303	#321	Lobby
8:00 ~09:00	08:00 ~09:00 Session 18.#301-1 On-line Presentation(SS9) Chair: Xiaofei Zhao(DGIST, Korea)	Session 18.#303-1 On-line Presentation(SS9) Chair: KyungBae Park(Sangji University, Korea)	Session 18-#321-1 On-line Presentation(GS1) Chair: Junghyun Yoon(Dongguk University, Korea)	
	<ul> <li>Paper 1: "A Time Series Analysis of Fertility Intentions and Innovative Environments" by Talamo Giuseppina &amp; Drago Carlo</li> <li>Paper 2: "Introducing Women's Professional Football through a Sectorial Analysis" by Raffaele Trequattrini, Rosa Lombardi, Benedetta Cuozzo, Matteo Palmaccio &amp; Martina Fusco</li> <li>Paper 3: "The Right to Education Resource Center: Furthering Education, Deepening Community Partnerships" by Ankur Sarin &amp; Ashish Ranjan</li> <li>Paper 4: "SauMill: The Journey of Cost &amp; Value Innovation at Taba Communications Limited" by Sanjay Verma &amp; Shubhi Thakuria</li> </ul>	• • • • •	<ul> <li>Paper 1: "Female entrepreneur and social media: a literature review" by Paola Paoloni, Paola Demartini &amp; Francesca Maria Cesaroni</li> <li>Paper 2: "Measuring and Evaluating the Changing Interest Cuban biopharmaceutical industry as example" by Ricardo on Management and Gender Topics: A Time Series</li> <li>Paper 2: "Measuring and Evaluating the Changing Interest Cuban biopharmaceutical industry as example" by Ricardo on Management and Gender Topics: A Time Series</li> <li>Paper 2: "Manager Characteristics, Entrepreneurship and Paoloni &amp; Drago Carlo, Ljubomir Drakotonia: a Multidimensional Analysis" by Viewandan Custering Approach" by Gabriele Serafini</li> <li>Paper 4: "Is there in economic literature a (lack of) definition of female entrepreneurship?" by Gabriele Serafini</li> <li>Paper 5: "Relations and sustainability in Italian women</li> <li>Lam from Grassroots Innovators "by Liyan Zhang</li> </ul>	







Lobby					
ent, 6 Kalncierna Street #321	Emcee: Xiaofei Zhao(DGIST, Korea)	ure a, Riga)	of Latvia) Airport) whenever you would like to.		c.kt)
e: Faculty of Engineering Economics and Management, 6 Kalnciema Street #303	Cultural Tour "House of the Blackheads"	<ul> <li>(RTU → House of the Blackheads) The bus departure</li> <li>09:00 at main gate of Rixwell Elefant Hotel</li> <li>09:15 at main gate of RTU dormitory(Azenes street 6, Kipsala, Riga)</li> </ul>	<ul> <li>2. (House of the Blackheads → Ethnographic Open-air Museum of Latvia)</li> <li>14:00~ Participants may act for themselves,</li> <li>The Baggage can be loaded in the bus and participants can go to another place (ex. Airport) whenever you would like to.</li> </ul>	3. (Ethnographic Open-air Museum of Latvia $\rightarrow$ RTU) $\bullet$ 15:00~16:00 (the arrival at RTU dormitory)	<ul> <li>4. How to apply: through email(openinnovationtmc@dgist.ac.kr)</li> <li>• First 50 applicants can only participate in the tour.</li> <li>※ Lunch will be booked.</li> </ul>
ograms *Venue: #301			• The Baggage can		
6. 18(Sun.) Programs	09:00~16:00				







#### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# Keynote Speech

## June 15(Thursday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 16:00~17:00)

- Tan Yigitcanlar(Queensland University of Technology, Australia) Theme: Sustainable Development of Smart Cities: A Systematic Review of the Literature
- Natalja Lace(RTU, Latvia)
   \*JOltmC 2017 Special issue shooting waiting Theme: Total Factor Productivity and the Features of Economic Growth: the Case of Lithuania and Latvia

### June 16(Friday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 09:40~11:20)

- Philip Cooke(Bergen University College, Norway)
   Theme: A Ground-up "Quaternary" Innovation Strategy for South Korea
   Using Entrepreneurial Ecosystem Platforms
- JinHyo Joseph Yun(DGIST, Korea) Theme: Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal







#### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 17(Saturday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 09:40~11:10)

- Deborah Dougherty(Rutgers, USA) Theme: Taking Advantage of Emergence for Complex Innovations
- Uwe Cantner(University of Jena, Germany)
   Theme: Cluster Policy: Insights from the German Leading Edge Cluster Competition
- Giovanni Schiuma(University of Basilicata, Italy)
   Theme: The Business Model Prism: Managing and Innovating Business
   Models of arts and Cultural Organisation

#### June 17(Saturday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 17:20~18:20)

- Anil K. Gupta(Indian Institute of Management, India) Theme: Connecting corporations and communities: Towards a theory of social inclusive open innovation
- Ulrich Witt(Griffith University, Australia)
   \*JOltmC 2017 Special issue shooting waiting
   Theme: Capitalism as a Complex, Adaptive System

## Sustainable Development of Smart Cities: A Systematic Review of the Literature

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#### **Competing interests**

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#### Authors' contributions

This paper represents a result of collegial teamwork. The authors designed the research jointly. The first two authors conducted the literature review and prepared the first draft of the manuscript. The last author finalised the manuscript. All authors read and approved the final manuscript.

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## Sustainable Development of Smart Cities: A Systematic Review of the Literature

#### Abstract

This paper aims to analyse scientific studies focusing on both environmental sustainability and smart city concepts to understand the relationship between these two. In order to do so the study identifies information about researchers, models, frameworks and tools focused on the chosen themes. This research uses a qualitative methodology, through a systematic review of the literature, which examines the terms, 'smart city' and 'sustainability', aimed at sustainable development of smart cities. For this, three databases were used: Scopus, Science Direct, and Emerald Insight. This paper provides detailed information on the most recent scientific articles focusing on smart cities and sustainability issues. The paper can serve as a basis for researchers seeking background information for further investigations. The findings provide invaluable insights for scholars researching on the subject, and public managers considering applying those into practice in their cities.

Keywords: Smart City, Smart Community, Sustainable City; Environmental Sustainability, Sustainable Urban Development

#### Introduction

Since the mid-20th century, numerous environmental, social and economic crises on a global scale have significantly affected our societies (Yigitcanlar and Lee 2014). Especially during the last two decades, metropolitan areas around the world have been engaged in initiatives to improve urban infrastructure and services, aiming at a better environment, social and economic conditions, improving the attractiveness and competitiveness of cities (Jong et al. 2015). These efforts brought up the concept of intelligent cities (Komninos 2002) that is the predecessor of smart cities (Yigitcanlar 2015). According to Deakin and Al Waer (2012) and Townsend (2013), smart cities arise due to the intelligent use of digital information, for example in the areas such as human health, mobility, energy use, education, knowledge transfer and urban governance.

Sustainability and sustainable urban development concepts generates awareness of the production and use of resources required for residential, industrial, transportation, commercial or recreational processes (Peetrosemolli and Monroy 2013; Goonetilleke et al. 2014; Yigitcanlar and Kamruzzaman 2014, 2015). Sustainable urban development corroborates, aiming at environmental awareness in the use of natural resources in smart cities (Dizdaroglu and Yigitcanlar 2014; Yigitcanlar and Teriman 2015; Komninos 2016). Yigitcanlar and Dizdaroglu (2015) focus on the concept of ecological cities in their research. This concept has been developed and promoted since 1970 as part of the sustainable development agenda.

This paper provides a systematic review of the literature selected from three databases: Emerald Insight, Science Direct, and Scopus. The keywords used for the selection include: 'smart city' and





'sustainability' terms. The paper seeks to address the following overall research questions: What is the relationship between the concepts of sustainable urban development and smart cities? In order to explore this issue we also looked into the following secondary research questions: (a) Which articles do involve both the terms smart city and environmental sustainability? (b) What information are provided in these articles? (c) What kind of models, frameworks or tools do these articles present?

DGÁST

#### Sustainable Urban Development and Smart City

The concept of smart city is relatively new and can be seen as a successor of information city, digital city and smart city; however it has been used frequently, especially after 2013, when it exceeded a frequency of citations of other terms including sustainable city (Jong et al. 2015; Yigitcanlar 2016). Despite the discussion about its concept in recent years, there is a lack of consensus on what a smart city is (Angelidou 2015; Hortz 2016). Although a number of authors have the difficulty of conceptualisation, these definitions are not contradictory but partially overlapping (Scheel and Rivera2013; Cocchia 2014). In general, however, it is understood that smart cities make use of information and communication technology (ICT) extensively to help cities to build their competitive advantages (Caragliu et al. 2011), or that it is a conceptual model where urban development is achieved through the use of human, collective and technological capital (Angelidou 2014). The term smart city is, therefore, an umbrella concept that contains a number of sub-themes such as smart urbanism, smart economy, sustainable and smart environment, smart technology, smart energy, smart mobility, and so on (Cocchia 2014; Lara et al. 2016).

In their literature review, Caragliu et al. (2011) conceptualise smart city with the following main characteristics: (a) An enhanced administrative and economic efficiency that enables the development of culture and society by utilising networked infrastructures; (b) An underlying emphasis on business oriented urban development; (c) A strong focus on the goal of realising the social inclusion of different kinds of urban residents in public services; (d) An emphasis on the significant role of high-tech and creative industries in long-term growth; (e) A perspective to pay close attention to the function of social and relational capital in city development, and; (f) A vision to take social and environmental sustainability as an important aspect of smart city development. Some authors also point to the necessary ingredients for the composition of a smart city, such as: smart economy, smart mobility, smart environment, smart people, smart living and smart governance (Lazaroiu and Roscia 2012; Lee et al. 2014; Jong et al. 2015). Additionally, the concept of smart city goes beyond the definitions of information cities, digital cities, and intelligent cities, because it contextualises technology to be used in favour of systems and services for people (Jong et al. 2015).

The evaluation of a smart city, as discussed by Marsal-Llacuna et al. (2015) should consider past experiences of environmentally friendly and liveable cities, encompassing sustainability and quality of life, in addition, of course, the composition of technological factors. Lazaroiu and Roscia (2012) state that it should represent a technological community, interconnected, sustainable, comfortable, attractive, and secure. In order to understand how it works in practice, smart cities make use of city data for traffic management, energy consumption statistics, security, and optimising the operation of municipal services (Harrison et al. 2010). This new reality is encouraging the increase of new suppliers to the smart city market niche, using technological resources for the management of urban services (Carvalho and Campos 2013; Angelidou 2015).

Schaffers et al. (2011), later on emphasised by Kramers et al. (2014), point out that to have a smart city is necessary: (a) Create a rich environment of broadband networks that support digital applications, and; (b) Initiate large-scale participatory innovation processes for the creation of applications. Some cities that have appropriated the concept of smart cities have applied themselves to enjoy their benefits so that the needs of the city are met. Barcelona defines smart city as a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create sustainable greener city, competitive and innovative commerce and an increased life quality, while the city of Amsterdam addresses the issue as an innovative technology and is willing to change people's energy-related behaviour to tackle climate challenges (Lee et al. 2014). In the case of Doha, smart city practice is more of an interaction of urban technologies and knowledge economy activities (Conventz at al. 2015); whereas in the case of Brisbane, the practice is to integrate smart technologies into good urban and space design practices (Pancholi et al. 2015).

Nam and Pardo (2011) divide smart city into three dimensions: (a) Technology (hardware and software infrastructures); (b) Population (creativity, diversity and education) and; (c) Institutions (governance and policy). In view of this, investments in technology, population and institutions aiming at the concept of smart city generate sustainable development and quality of life, promoting responsible management of natural resources and allowing institutions to contribute with innovation and better services for citizens, strengthening the debates and political participation (Caragliu et al. 2011).

When studying cities, to better understand the term sustainability, one must take into account the meaning of sustainable urban development (Dizdaroglu and Yigitcanlar 2016). This, in turn, can be seen as a process of change in which resource exploitation, investment direction, technological development and institutional change are consistent with present and future needs (WCED 1987). The term sustainable city as a concept became popular in the 1990s (Roy 2009) denoting the relationship between economic, social and environmental sustainability aspects from a combination of indicators of each of these components (Ahvenniemi et al. 2017). Although the current vision is to address these three issues to talk about sustainable cities, certain authors focus on one of only three. This is the case of Meadows (1999), who propose the inclusion of indicators such as pollution, waste generation and consumption of water and energy, unlike Rode and Burdett (2011), who direct efforts towards an interpretation More socioeconomic, such as social equity and a greener environment (Jong et al. 2015).

Considering all these aspects, Hiremath et al. (2013) define sustainable urban development as achieving a balance between the development of the urban areas and protection of the environment with an eye to equity in income, employment, shelter, basic services, social infrastructure and transportation in the urban areas. The spread of interest in smart cities and adjacent concepts is linked to a number of factors, including: most of the world's population living in cities, climate change, scarcity of natural resources, globalisation, and increased competition. With this, cities need to offer improved and customisable services for people (Angelidou 2015). According to Dhingra and Chattopadhyay (2016), a smart and sustainable city has goals to be achieved in an adaptable, reliable, scalable, accessible and resilient way, such as:

- Improve quality of life of its citizens;
- Ensure economic growth with better employment opportunities;





- Improve well-being of its citizens by ensuring access to social and community services;
- Establish an environmentally responsible and sustainable approach to development;
- Ensure efficient service delivery of basic services and infrastructure such as public transportation, water supply and drainage, telecommunication and other utilities;
- Ability to address climate change and environmental issues, and;
- Provide an effective regulatory and local governance mechanism ensuring equitable policies.

It is observed that, when it comes to the environmental issues of smart cities, the discussion is more political in nature, considering international resolutions and innovative solutions to combat complex urban challenges. According to the same author, there are four attributes of the smart and sustainable cities: (a) Sustainability; (b) Quality of life; (c) Urban aspects, and; (d) Intelligence. These are analysed under four main themes: (a) Society; (b) Economy; (c) Environment, and; (d) Governance (Carrillo et al. 2014; Kondepudi 2015). These themes are also presented by Yigitcanlar and Lönnqvist (2013) on their work on knowledge-based urban development, which is another concept that relates to the development of smart cities. A similar concept, smart-eco city, proposes that the city should be ecologically healthy, using advanced technologies and having economically productive and environmentally efficient industries, have a responsible and harmonious systematic culture, a physically aesthetic and functionally living landscape (Yigitcanlar and Lee 2014).

#### Methodology

The literature review is the basis for scientific writing. It is in the review that the researcher becomes familiar with the texts, identifies the eminent authors who have been writing on the topic (Ferenhof and Fernandes 2016). We have adopted a systematic analysis approach (Jesson et al. 2011) for the literature review. The systematic review searched for articles in three major databases: Emerald Insight, Science Direct, and Scopus. The search terms used were 'smart city' and 'sustainability'. EndNote software was used to assist in data compilation. As a result of the search, we obtain:

- 19 documents from the Scopus database;
- 49 documents from the Emerald database, and;
- 629 documents from the Science Direct database.

After verifying documents in duplicate, we got 630 articles. Of these, 353 were fully available on electronic format. Next, we evaluated the titles and key words to choose which documents dealt with the two terms 'smart city' and 'sustainability', and we selected 97 documents to be read. After reading the abstracts, we have 47 documents to read in full. After the reading these articles, considering which of them provided information about frameworks, models or tools adopted in smart cities in line with green sustainability, 25 documents were selected for the final analysis.

#### Results

This section discusses the results of selected 25 journal articles. The discussion includes similarities in the research, differences and bibliometric information of the research, such as main authors, keywords, journals in which the researches are published in, time scale, models, frameworks or tools. Table 1 lists the reviewed articles selected and their aims.

#### Table 1: Reviewed literature

Cleaner Production, 109, 152-165.

No	Literature	Aim	
1	Yigitcanlar, T., & Lee, S. H. (2014). Korean ubiquitous-eco-city: A smart-sustainable urban form or a branding hoax?. Technological Forecasting and Social Change, 89, 100-114.	The paper aims to put the premise of u-eco-city into a test and address whether u-eco-city is a dazzling smart and sustainable urban form that constitutes an ideal 21st century city model or just a branding hoax.	
2	Kramers, A., Höjer, M., Lövehagen, N., & Wangel, J. (2014). Smart sustainable cities– Exploring ICT solutions for reduced energy use in cities. Environmental Modelling & Software, 56, 52-62.	This paper explores the opportunities of using ICT as an enabling technology to reduce energy use in our cities.	
3	Götz, G., & Schäffler, A. (2015). Conundrums in implementing a green economy in the Gauteng City-Region. Current Opinion in Environmental Sustainability, 13, 79-87.	This paper analyses how these green economy strategies have faced conundrums that narrow the thinking on future growth paths, in turn threatening to reproduce a profoundly unsustainable regional economy.	
4	Lazaroiu, G. C., & Roscia, M. (2012). Definition methodology for the smart cities model. Energy, 47(1), 326-332.	This paper proposes a model for computing the smart city indices. However, the chosen indicators are not homogeneous, and contain high amount of information.	
5	Lee, J. H., Hancock, M. G., & Hu, M. C. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. Technological Forecasting and Social Change, 89, 80-99.	This paper develops a conceptual framework to examine an analyse two leading cases from the US and Asia. Through the lens of this new framework the paper identifies heterogeneous and heterogeneous characteristics in the process of planning and developing a smart city.	
6	Marsal-Llacuna, M. L., Colomer-Llinàs, J., & Meléndez-Frigola, J. (2015). Lessons in urban monitoring taken from sustainable and livable cities to better address the Smart Cities initiative. Technological Forecasting and Social Change, 90, 611-622.	This paper puts forward new ideas for monitoring the smart cities initiative in a better way.	
7	Joss, S. (2015). Eco-cities and Sustainable Urbanism. In International Encyclopedia of the Social & Behavioral Sciences, pp. 829- 837.	This paper focuses on the eco-city and related concepts and the practices of sustainable urbanism that have since the early 2000s gained growing international popularity and entered mainstream policy as a consequence of the forceful combination of global climate change concerns and a rapid urbanizing world population.	
8	Bayulken, B., & Huisingh, D. (2015). Are lessons from eco-towns helping planners make more effective progress in transforming cities into sustainable urban systems: a literature review (part 2 of 2). Journal of	This paper summarises and systematises the insights that have been obtained from eco-town based urban developments implemented in the North-western Europe with particular emphasis given into the examples from the Netherlands, Sweden and Germany.	







- 9 Hu, M. C., Wu, C. Y., & Shih, T. (2015). Creating a new socio-technical regime in China: Evidence from the Sino-Singapore Tianjin Eco-City. Futures, 70, 1-12.
- Marsal-Llacuna, M. L., & Segal, M. E. (2016). The Intelligenter Method (I) for making "smarter" city projects and plans. Cities, 55, 127-138.
- 11 Jong, M., Joss, S., Schraven, D., Zhan, C., & Weijnen, M. (2015). Sustainable–smart– resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. Journal of Cleaner Production, 109, 25-38.
- Ahvenniemi, H., Huovila, A., Pinto-Seppä, I., & Airaksinen, M. (2017). What are the differences between sustainable and smart cities?. Cities, 60, 234-245.
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- Dhingra, M., & Chattopadhyay, S. (2016). Advancing smartness of traditional settlementscase analysis of Indian and Arab old cities. International Journal of Sustainable Built Environment, 5(2), 549-563.
- 16 Fu, Y., & Zhang, X. (2017). Trajectory of urban sustainability concepts: A 35-year bibliometric analysis. Cities, 60, 113-123.
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This paper reveals that an expansion of the scale of urbanisation and its transformation into the focal point of the hub-and-spoke eco-city model will enable China to advance as an international pioneer, by the creation of a new sociotechnical regime dependent on green and ecologically sustainable systems.

This paper proposes a first-of-its-kind method for the design of truly smart city projects and the elaboration of smarter urban planning. The Intelligenter Method is based on the innovative idea of collaborations discovery in urban systems.

This paper aims to investigate, through a comprehensive bibliometric analysis, the 12 most common city categories/typologies.

The paper analyses 16 sets of city assessment frameworks (eight smart city and eight urban sustainability assessment frameworks) comprising 958 indicators altogether by dividing the indicators under three impact categories and 12 sectors.

This paper through its Elite cities framework measures progress on 33 key indicators selected to represent priority issues within eight primary categories. An excel-based tool was developed to package the key indicators, indicator benchmarks, explanation of indicators, point calculation functions and transparency-oriented data recording instructions.

This paper addresses the problem of the eco-city paradigm assessment with a multi-method approach. It grounds three research questions with focus to eco-cities and applies alternative methodologies in an attempt to answer them.

The paper aims to investigate the concept of smart sustainable cities in traditionally planned and organically grown settlements. Smart Cities Mission is an ambitious project of Government of India targeting 100 cities for improving their urban quality of life.

This paper conducts a descriptive summary, a clustering analysis, and multidimensional scaling of major city concepts, by establishing a co-word matrix of high-frequency keywords occurring in the Science Citations Index and Social Science Citations Index databases.

This paper aims to identify the forces shaping the smart city conception and, by doing so, begins replacing the currently abstract image of what it means to be a smart city.

- 18 Yigitcanlar, T., (2015). Smart cities: an effective urban development and management model? Australian Planner, 52(1), 27-34.
- 19 Lara, A., Costa, E., Furlani, T., & Yigitcanlar, T., (2016). Smartness that matters: comprehensive and human-centred characterisation of smart cities. Journal of Open Innovation, 2(8), 1-13
- 20 Cohen, B., & Amorós, J. E. (2014). Municipal demand-side policy tools and the strategic management of technology life cycles. Technovation, 34(12), 797-806.
- 21 Edvardsson, I., Yigitcanlar, T., & Pancholi, S., (2016). Knowledge cities research and practice under the microscope: a review of the literature. Knowledge Management Research and Practice, 14(4), 537-564.
- Tan, S., Yang, J., Yan, J., Lee, C., Hashim, H.,
   & Chen, B. (2017). A holistic low carbon city indicator framework for sustainable development. Applied Energy, 185, 1919-1930.
- 23 Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in Smart City initiatives: Some stylised facts. Cities, 38, 25-36.
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   Fernandez, F., Bailey, C., Barbosa, S. B., &
   da Silva Neiva, S. (2016). The adoption of
   strategies for sustainable cities: A
   comparative study between Newcastle and
   Florianópolis focused on urban mobility.
   Journal of Cleaner Production, 113, 681-694.
- 25 Hu, M. C., Wadin, J. L., Lo, H. C., & Huang, J. Y. (2016). Transformation toward an ecocity: lessons from three Asian cities. Journal of Cleaner Production, 123, 77-87.

This paper aims to firstly, investigate the role of smart urban technologies in the progress of smart city formation, and thus providing conceptual clarity on smart cities, and; secondly, undertake a critical review of application attempts of the smart city model by looking into emerging practices of ubiquitous eco-cities as exemplar smart city initiatives from Korea.

This paper aims to undertake a comprehensive review of how smart cities are perceived in the literature and in the light of the findings propose a clearer definition with strong smart community focus.

This paper develops a conceptual framework that helps to understand how local governments might develop demandside policy tools that stimulate the development and diffusion of sustainable-driven innovations that enhance local economic development.

This paper aims to scrutinise and provide a clear understanding on the evolution of knowledge city research and practice

This paper develops an indicator framework for the evaluation of low-carbon city from the perspectives of economic, energy pattern, social and living, carbon and environment, urban mobility, solid waste, and water.

This paper provides policy makers and city managers with useful guidelines to define and drive their smart city strategy and planning actions towards the most appropriate domains of implementation.

This paper aims to analyse the differences between public transportation in Newcastle upon Tyne, the city considered the most sustainable in the UK, and Florianopolis, a city with great potential for sustainable policies located in Southern Brazil.

This paper elucidates the effects of different national approaches to eco-city development and their antecedents of the build comparing three Asian cities.



#### Similarities and differences between reviewed literature

Out of 25 articles reviewed, 11 of them contained information about models, frameworks and tools. Articles 7, 8, 17, 18 and 20 (see Table 1) provide information and discussions on concepts such as ecocity, sustainable urbanism, eco-towns, and smart city/smart cities. Another five of them, those with the numbers of 11, 12, 16, 19 and 21 present results of bibliometric analysis and/or systematic review. Three of them, articles 3, 15 and 18, present analyses of solutions in green economy and smart cities, article number 6 uses mathematical models to build statistics to monitor smart cities, and article 23 provide detailed guidelines for cities.

#### Models, frameworks and tools

A total of 11 articles presented research on models, frameworks or tools developed with smart cities and green sustainability in mind. None of the articles presented the same model, framework or tool. Table 2 briefly presents occurrences and a summary of each article.

#### Table 2: Models, frameworks and tools

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Literature	Model	Summary
Yigitcanlar, T., & Lee, S. H. (2014). Korean ubiquitous-eco- city: A smart-sustainable urban form or a branding hoax?. Technological Forecasting and Social Change, 89, 100-114.	Korea city model, u-eco- city	U-eco-city is basically an ICT and eco-technology. The principal premise of a u-eco-city is to provide a high quality of life and place to residents, workers and visitors with low- to-no negative impacts on the natural environment with support from the state-of-the-art technologies in their planning, development and management.
Kramers, A., Höjer, M., Lövehagen, N., & Wangel, J. (2014). Smart sustainable cities– Exploring ICT solutions for reduced energy use in cities. Environmental Modelling & Software, 56, 52-62.	Analytical framework	The analytical framework is intended to be of use to researches, city and regional authorities and ICT companies interested in acquiring a better understanding of how ICT investments could contribute to reduce energy use in cities.
Lazaroiu, G. C., & Roscia, M. (2012). Definition methodology for the smart cities model. Energy, 47(1), 326-332.	Model for computing the smart city indices	The model uses a procedure based on fuzzy logic for indices. It could help in policy making process as starting point of discussion between stakeholders, as well as citizens in final decision of adoption measures and best evaluated options.
Lee, J. H., Hancock, M. G., & Hu, M. C. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. Technological Forecasting and Social Change, 89, 80-99.	Conceptual framework	This research study generates taxonomies of 6 key conceptual dimensions and 17 sub-dimensions of smart city practices.

Hu, M. C., Wu, C. Y., & Shih, T. (2015). Creating a new socio- technical regime in China: Evidence from the Sino- Singapore Tianjin Eco-City. Futures, 70, 1-12.	Eco-city model	This model comprises a cluster with one or two cities playing the central hub role, surrounded by several neighbouring city spokes, closely linked to the hub by means of connected transportation, state grid networks, and economic ties.
Marsal-Llacuna, M. L., & Segal, M. E. (2016). The Intelligenter Method (I) for making "smarter" city projects and plans. Cities, 55, 127-138.	Intelligenter method	The method is based on the innovative idea of collaborations discovery in urban systems. It shows that what makes an urban project or a plan smart is not its sophisticated architecture or complex master planning in a technological environment.
Zhou, N., He, G., Williams, C., & Fridley, D. (2015). Elite cities: a low-carbon eco-city evaluation tool for China. Ecological Indicators, 48, 448-456.	Elite cities tool	The tool measures progress on 33 key indicators selected to represent priority issues within eight primary categories. It could be a useful and effective tool for local city government in defining the broad outlines of a low-carbon eco-city and assessing the progress of cities efforts towards this goal.
Tsolakis, N., & Anthopoulos, L. (2015). Eco-cities: An integrated system dynamics framework and a concise research taxonomy. Sustainable Cities and Society, 17, 1-14.	Holistic system dynamics methodological framework	The framework proposed, as a means to assist decision- makers, local governments and managers designing and adopting effective policies for monitoring and assessing the sustainable performance of eco-cities.
Cohen, B., & Amorós, J. E. (2014). Municipal demand-side policy tools and the strategic management of technology life cycles. Technovation, 34(12), 797-806.	Conceptual framework	This research has sought to develop a grounded theoretical model for the integration of innovation policy and diffusion of innovation theory.
<ul> <li>Tan, S., Yang, J., Yan, J., Lee,</li> <li>C., Hashim, H., &amp; Chen, B.</li> <li>(2017). A holistic low carbon city indicator framework for sustainable development.</li> <li>Applied Energy, 185, 1919-1930.</li> </ul>	Indicator framework	The low carbon city indicator framework analyses the low- carbon development progress of cities on 20 quantitative indicators across seven categories, covering city economic development, energy pattern, social and living, carbon and environmental, urban mobility, waste, and water.
Hu, M. C., Wadin, J. L., Lo, H. C., & Huang, J. Y. (2016). Transformation toward an eco- city: lessons from three Asian cities. Journal of Cleaner Production, 123, 77-87.	3Es framework	The major concerns of our time reveal that a framework for assessing the sustainability performance of an eco-city requires the systematic integration of various aspects of sustainability. Therefore, this paper proposes a 3Es Framework (i.e., efficiency, economy, and effectiveness).

It is important to point out that five of the models, frameworks and tools of 11 in total use ICT. These are:

- Korea city model, u-eco-city:
  - Analytical framework;





- Model for computing smart city indices;
- Intelligenter method, and;
- o Holistic system dynamics methodological framework.

Six of them come up with hints of indicators or categories that can be used in smart cities.

- Model for computing smart city indices:
  - Conceptual framework;
  - Eco-city model;
  - Elite cities tool;
  - Framework for the evaluation of low-carbon city, and;
  - o 3Es framework (efficiency, economy, and effectiveness).

The model for computing smart city indices is the only one that uses both ICT and the indexes for smart cities.

#### Authors and research locality

Reviewed papers involved a total of 70 authors, with only three of them appearing in at least two papers. These two authors are: Mei-Chih Hu (China), Maria-Lluïsa Marsal-Llacuna (Spain), and Tan Yigitcanlar (Australia). The total number of country of origin of the authors was 18 countries. Table 3 lists the names of countries that were repeated more than once.

**Table 3:** List of country of origin of authors

Country	Author
China	6
USA	3
Australia	3
Korea	2
Greece	2
Spain	2

## Keywords

Figure 1 below shows a cloud of tags with the keywords quoted in the selected articles.

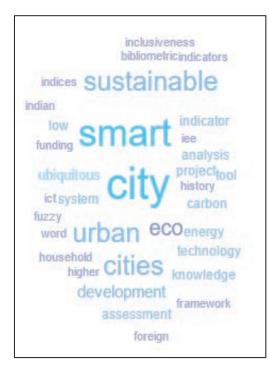


Figure 1: Cloud of Tags

## Journals

Reviewed 25 articles were published in 15 journals. Table 4 displays the journals that had more than two articles published.

Journals	Articles	Impact Factor 2015
Cities	5	2.051
Journal of Cleaner Production	4	4.959
Technological Forecasting & Social Change	3	2.678

Table 4: Journals with high quantity of articles

## Year of publication

We analysed the information of the reviewed articles and verified that the publication year of the articles. The articles were published between 2012 and 2017 (the analysis conducted in February 2017), and in the year 2015 there were the largest number of publications on the subject, a total of 10 articles. Looking at the publication years of the documents, we have identified that the 'smart city and sustainability' topic has become popular only during the last five years. Figure 2 shows the timeline of the publications.



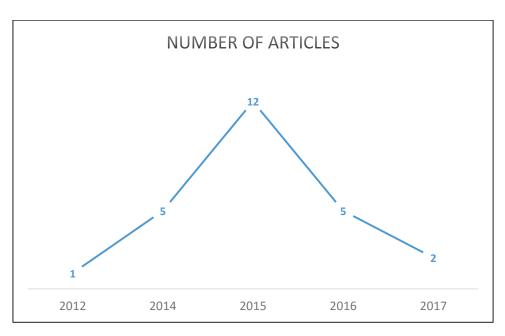


Figure 2: Timeline of publications

## **Discussion and Conclusion**

Environmental externalities mainly generated from population increase, rapid urbanization, high private motor vehicle dependency, deregulated industrialization, and mass livestock production have placed serious concerns for the future of our wellbeing, and even our existence in the long run. Realization of the fact that urgent measures must be taken to combat environmental externalities responsibly, effectively, and efficiently have resulted in the rediscovery of the need for more eco-friendly practices. Subsequently, during the last few decades, sustainability and sustainable development have become popular topics not only for scholars, particularly in the fields of environmental economics, technology and science, urban planning, development, and management, but also for urban policy makers and professional practitioners (Yigitcanlar et al. 2015). The emergence of these new concepts starting from early 1970s is an outcome of the response to the growing concerns about the impacts of development practices on the state of the environment (Yigitcanlar and Kamruzzaman 2015).

Over the past decade smart urban technologies, as part of the smart and sustainable city agenda, have begun to blanket our cities with an aim of forming the backbone of a large and intelligent infrastructure. Along with this development, dissemination of the sustainability ideology has had a significant imprint on the planning and development of our cities. Today, the smart city concept is viewed as a vision, manifesto or promise aiming to constitute the 21st century's sustainable and ideal city form. In other words, smart city is an efficient, technologically advanced, green and socially inclusive city (Vanolo 2014). This is to say, smart city applications place a particular technology focus at the forefront of generating solutions for ecological, societal, economic, and management challenges (Yigitcanlar 2016).

This paper presented a theoretical basis on the concepts of smart city and sustainability through a thorough review of the literature. It generated some insight for to understand the relationship between the concepts of sustainable urban development and smart cities. The challenge of making cities more

attractive to people brings the need for clarity in terms and concepts, unfortunately it is not the case with smart cities—although it is seen as a city that uses technology to generate environmental gains and sustainable outcomes. On the other hand, different than smart cities sustainable cities refer to the commitment to sustainable urban development. Moreover, despite their promise to deliver sustainable outcomes with the aid of advanced technology, smart cities are heavily criticised as being just a buzz phrase that has outlived their usefulness (Kunzmann 2014; Shelton et al. 2015; Yigitcanlar 2016). The provocation of this paper is, therefore, whether smart cities concept and practice can bring sustainability to our cities. The paper points out the need for prospective studies in answering this critical issue, where the review provided here could be a stepping stone for future studies.

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## Total Factor Productivity and the Features of Economic Growth: the Case of Lithuania and Latvia

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#### Abstract

The increase of competitiveness and productivity is the objective of improvement of every economic system. In this case, the economic development is closely related to the ability to retain competitive, the proper use of the available labour force and capital and to ensure the growth of the gross domestic product (or a company's turnover). Productivity is perceived as the ability to properly use the production factors to create value-added, implement innovations and to maintain the country's competitiveness. In the macroeconomic researches of different scholars (Solow, Saliola, Seker, Kathuria, Puharts etc.) special attention is given to the quantitative measurement of the various factors of development. These researches have shown that one of the more accurate methods of the productivity measurement is a calculation of total factor productivity. In the article, the total factor productivity is calculated by industry both in Lithuania and in Latvia. In this case, the proportion of the gross domestic product growth, which is explained by the labour and capital factors productivity growth, is emphasized. At the end of the article it is concluded, in what industries the growth of labour and capital are important in assessing the growth of the gross domestic product, in what industries are distinguished.

Keywords: economic development, gross domestic product, productivity, total factor productivity.

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# A Ground-up "Quaternary" Innovation Strategy for South Korea Using Entrepreneurial Ecosystem Platforms

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## Abstract

This paper offers an account of the recent economic slowdown in the growth trajectory formerly enjoyed by South Korea as one of the first "Asian Tigers". Indicators are provided that, unlike the others, Hong Kong, Singapore and Taiwan that have continued their upward profile, South Korea has stagnated. It is argued that the others and some more recent Asian growth economies have moved upwards to higher value, high skill and high profitability levels and deindustrialising as they did so. This even applies to recent breakthrough economies like China and Vietnam. In each case, "financialization" has been an important element in the growth of the Quaternary economy, even in such relative newcomers as Vietnam, where privatization of services has attracted private equity and other foreign direct investment financiers. Thus manufacturing is less pronounced than it was. Meanwhile, South Korea has a weak international presence of banks and other financial sectors because of the domestic focus in its indigenous growth model. Other weaknesses of closed versus open innovation and "cronyism" at the behest of the Chaebol system can be laid at the door of South Korea's traditional conglomerates. A different model of "thin globalisation" led by knowledge-intensive high-tech, biotech and cleantech with prodigious financialization is characteristic of the new fast-growth regions and countries elsewhere, notably Israel, Silicon Valley and Cambridge. Here flattened hierarchies, reliable networking, and "crossover" innovation are pronounced and from which South Korean industrialists and policymakers could usefully learn to recover past growth performance.

**Keywords:** South Korea; Quaternary sector; Deindustrialisation; Chaebol; Crossover Innovation; Thin Globalisation; High Profitability

## Introduction

In this contribution, the plan is to reconsider the importance of "embeddedness" to regional economic development. One reason for this is that recent research in economic sociology has raised questions about its contemporary usefulness given critique of two elements: one intrinsic to the perspective; the other being a feature of evolutionary tendencies in the political economy of today and the near future. In





brief, the critique draws attention to a recent questioning of "embeddedness" thinking treating the "economy" and specifically the "market" as an asocial constraint that limits social action on, for example, employment and the need for human labour (Ford, 2015). Thus social action is precisely what embeddedness refers to as the social fabric within which all social action is imbricated in societal relations, including economic ones. The second question refers to an emergent characteristic of contemporary political economy that is almost the reverse: namely in a political economy which has become increasingly "financialized" (Krippner, 2011) in which automated trading systems, electronic matching engines, varieties of decision algorithm and artificial intelligence (AI) have grown, how feasible is it for individuals to be socially embedded in what appears to be an increasingly "postsocial" economic world? In other words, has the market become "performative" (MacKenzie, 2008) in mimicking the theorems of neoclassical economics and can social action still control techniques that have developed an effectively asocial way of functioning?

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Second, in re-thinking industrial policy when "normal market processes" reach hitherto unhindered obstacles, it may be helpful to treat it as a discovery process. So the appearance of economic obstacles reveals that government has imperfect information. This may further hinder its capability to overcome problems associated with inappropriate innovation to assist removal of such obstacles. Accordingly, as the handmaiden of policy, the result will express government failure. But since interventions are meant to smooth the flow of markets by means of market correcting initiative, absence of accomplishment is also suffered as "market failure" by the private sector. In some quarters, entrepreneurial demand for such innovation is low because private actors perceive new activities to be of low profitability (Rodrik, 2004). However, thirdly, if through the lens of "financialization", we look at certain micro-economies paying attention also to macroeconomic level data, we see profitability is high for what we refer to (after Rodrik, 2011) as "The Quaternary," we see low profitability lies in manufacturing, services and – worst of all – agriculture. But productivity comes from selling Quaternaries to them. Thus it is innovation that enables restructuring and productivity growth, which are often constrained, to repeat, not on the supply side but on the demand side. So the developmental dilemma is that innovation is often undercut by lack of demand from its potential users in the real economy – the entrepreneurs. So, while government needs to evolve demand-inducing policies it may need to maintain its "embedded" autonomy from private interests. But it can elicit useful information from the "embedded" private sector by engagement with it. Such "embedded autonomy" (Evans, 1995) from the ground-up, may release demand impulses that help

#### South Korea as an Exemplar

South Korea experienced one of the most impressive turnarounds from being one of the lowest to highest GDP reference points after the Korean war (1950-1953), decades of imperialist exploitation by Japan (1910-1945) and an unreformed property rights land reform unaffected by centuries of feudalistic social relations. Growth was successfully achieved by interventionist government land reform, industry policies and the state as "global controller" institution for national economic organisation of the *Chaebols* developing a growth sector focus, especially in heavy engineering and light manufacturing. Thus large-scale corporate and government "embeddedness" expressed a good record on public administration of, for example, "export subsidies" by South Korea (Rodrik, 2011). For a time government policy on heavy investment in fossil fuel and exceptional reliance on nuclear energy contributed to rapid post-war growth.

overcome developmental blockages, which is the aim of the following discussion.

But more recently, a hitherto prevailing "anti-green" policy perspective persisted in South Korea while elsewhere pollution and sustainability concerns were already being addressed in other OECD economies. Suddenly attention was paid regarding South Korea's "fossil & nuclear" legacy energy policy when change occurred by Presidential Decree in 2010. It can be stated that South Korea retained its "embedded autonomy" leadership profile but that it had become outdated. Latterly, some of the leading developmental large firms have revealed problems, e.g. Hanjin, bankrupted in 2017, Samsung (SDI – "closed innovation and battery fires" internal supplier) and evidence of "cronyism" and corruption. Thus the hitherto harmonious implementation of "investment guarantees" had begotten the problem of "cronyism". This took the form of a presidential indictment in relation to a \$38 billion "transfer" from Samsung. Subsequently, evidence of expensive gifts to President Park from Lotte Inc. for \$17million and smaller cosmetic surgery infractions involving seventeen Blue House visits were added to the indictment. So the model of post-war economic growth became shaky shortly after the local variant of the killer disease SARS (MEIRS) was also found to have origins in South Korea's leading Samsung medical clinic. However, because of its emphasis on "imitating" the Japanese "developmental state" model of rapid industrialisation by major investment in heavy industry, notably steel and shipbuilding, followed by light engineering in consumer goods (automotives and electronics) South Korea experienced a somewhat asymmetrical "financialization" if indeed that is a correct descriptor. Because the Chaebols contained



Fig. 1. Overall Comparative GDP in Selected Asian Economies 1980-2017

their own banks, each supplying preferential investment to its industrial "family" South Korea never developed the kind of international banking system that other "Asian Tigers", notably Hong Kong and Singapore did at the centre of *their* developmental strategies. This was for good reasons given that those two island economies had already developed as trade, commerce and financial centres before independence and they had little option but to do so, although both later developed profitable "quaternary"





economic activities like ICT and biotechnology to accompany their financialization. Significantly, South Korea's GDP per person (purchasing-power parity; PPP) has long lagged somewhat compared to the three "Tiger Island" economies. But, it is also noteworthy that Japan's relative economic stagnation since 1990 means that South Korea was expected (by IMF) to by-pass Japan in 2017 as did Singapore in 1993, Hong Kong in 1997 and Taiwan in 2010. But the most startling re-ranking will be when South Korea becomes richer than Japan, since in 1980 South Korea's GDP per person was barely a quarter the level of Japan's.

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However, our key indicator for the future is the trajectory of the "Quaternary" measured by profitability. While the trend in profitability had been upward, 2013 saw a decline in bank profitability. South Korean banks reported \$8.2bn in combined net profits in 2012, a drop of 23.2 per cent from 2011, as their net interest margin – a key measure of banks' profitability – fell to 2.1 per cent, its lowest level of the past decade apart from the crisis years of 2007-9. The country's banks face squeezing margins due to their heavy reliance on *interest* income, while their non-interest income remains small. To compensate, they are under increasing pressure to expand into non-banking activities like insurance (KB Financial Group) and derivatives (e.g. Woori Finance) rather unsuccessfully. South Korean banks remain weak in investment banking, which requires thorough risk control. Consumer credit offers little room for growth, given the already high levels of debt among Korean households. Also, penetrating foreign markets has been a difficult, due to their lack of brand value and international networks (Jung-a S, 2013). Moreover, the profitability of the four main Seoul-based companies, Shinhan Financial Group Co. Ltd., Hana Financial Group Inc., KB Financial Group Inc. and Woori Bank dropped for two consecutive years from 2013. Their combined profit declined by half, to 4.78 trillion won (US\$4 billion) at the end of 2013 from 9.19 trillion won (US\$8 billion) two years earlier.

If we move to other knowledge activities, we find profitability down there too. South Korea's 30 largest business groups saw their profitability plunge to the lowest level since the global financial crisis in 2008. The combined operating profit of the nation's 30 largest conglomerates by assets came to 57.56 trillion won (US\$49.34 billion) last year, down 4.3 percent from 60.17 trillion won (US\$51.58 billion) in 2008. The figure decreased by as much as 34.8 percent, or 30.69 trillion won (US\$26.31 billion), from the peak of 88.25 trillion won (US\$75.65 billion) in 2010.

Their operating profits have rapidly decreased in the last four years from 82.39 trillion won (US\$70.63 billion) in 2011, 76.16 trillion won (US\$65.29 billion) in 2012, 70.4 trillion won (US\$60.35 billion) in 2013, to 57.56 trillion won (US\$49.34 billion) in 2014. Although the business profit rates of Samsung Group and Hyundai Motor Group were higher than those of 2008, the figures of both companies were showing a downward trend after hitting peaks in 2010 and 2011, respectively. Samsung's operating profit rate reached 11 percent in 2010, then kept decreasing from 9.7 percent in 2012 and 8.9 percent in 2013 to 6.4 percent last year. For Hyundai Motor Group, the figure also dropped from 8.7 percent in 2011, 7.8 percent in 2012, and 7.2 percent in 2013 to 6.9 percent last year (Jung Suk-yee, 2015). HSBC, Europe's biggest bank, further scaled down its South Korean operations by closing its retail business, following the sale of its insurance business in 2013. Thus outlook for consumer banking in South Korea remained a concern to firms there. Standard

Chartered said earlier in 2013 that it had seen a decline in asset quality in the country and would reassess the value of its goodwill.

So in respect of the hypothesis of "financialization" - meaning the share of profits going to interest and dividends is growing, and the rate of profit considering nonfinancial corporates converges to the real rate of profitability - does not appear to be the case for South Korea. The reverse is the case, where the rate of financial outflow - that is, the sum of interest, dividends and rents relative to those of nonfinancial corporates - has remained relatively stable at 50% since the 1980s (Hart-Landsberg, Jeong & Westra, 2017) Exporters are creating fewer jobs in South Korea as the Chaebol move production offshore to look for cheaper labour. That has left the domestic economy hurting: small and medium-sized businesses are still failing and the high-value services sector is lagging well behind other countries. According to the OECD: "This has raised concerns about Korea's traditional catch-up strategy led by exports produced by large Chaebol companies", the OECD Report on South Korea said in its recent study (OECD, 2016). There has also been increasing economic polarisation in the post 2008 downturn. Economic inequality increased noticeably during and after the 1997 crisis and the Great Recession of 2008-9. South Korea's average Gini coefficient — a measure of inequality — for 1990-1995 was 0.258, but with rising inequality its coefficient increased to 0.298 in 1999. It continued to increase, reaching 0.315 in 2010. The same trend can be seen in income distribution: the share held by the top 10% of income holders divided by that of the bottom 10% has increased from 3.30 in 1990 to 4.90 in 2010. The income share of the top 1% was 16.6% of national income in 2012, not far short of the extremes in the US and much worse than in Japan (Roberts, 2017)

However, it is noteworthy that Singapore's profitability has also recently been downgraded. Thus third quarter 2016 profitability of Singapore's big three banks declined in asset quality because of their exposures to loans and investment in the oil and gas service companies. This goes against Rodrik's (1995) revisionist but plausible explanation for the economic take-off of Singapore and Taiwan, which was the sharp increase in investment demand that took place in the early 1960s. The reason for

this investment boom – unlike the accounts of such agencies as the IMF and World Bank that stress export orientation - is the efforts of the respective governments massively to enhance government co-ordination and fashioning of innovative measures to promote profitability. Profitability from export growth at the time was modest by comparison. A much more plausible explanation for the economic take-off is thus the sharp increase in investment demand that took place in the early 1960s. Rodrik's (1995) heterodox argument is that in the early 1960s and thereafter the Korean and Taiwanese governments managed to engineer and enhance a significant increase in the private return to capital which increased profitability.

Space does not allow further analysis of these differences between the comparatively low "quaternary" economic development of the recent decade or two in South Korea's growth trajectory. We simply assert from the limited evidence mobilised, that two important deductions can be made from the comparative data and analysis proposed by economic growth theorists such as Rodrik (1995;





2011) The first of these is that manufacturing employment and GDP share remain high in South Korea. Meanwhile some even later industrialising countries have already begun de-industrializing, notably China and Vietnam. Conversely, the "Tiger" economies, notably Singapore and Hong Kong, and their Asian successors have "financialized" their economies more than South Korea (e.g. also Vietnam) and have augmented such quaternary activity with other knowledge-intensive, high value, high skill and high profitability quaternary activities as in Taiwan. These include activities such as innovative ICT, software, systems design, medical biotechnology and R&D. In this respect their economic profiles are closer to those of regions like Silicon Valley, Greater Cambridgeshire and Israel, which are among the most knowledge-intensive "quaternary" regions in the world.

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## **Interactive or Crossover Innovation**

In this section of the paper, we propose to utilise the information so far displayed alongside some key insights about the mechanisms that may help understanding of the differential trajectories of South Korea in comparison with some other Asian growth economies. We shall begin with outlining some key features of "innovation governance" in the advanced regional innovation systems listed at the end of the previous section before comparing and contrasting such governance with what has typified or diverged from that emergent new "innovation governance" mode. First, we may say that high-tech platform ecosystems or complexes like Silicon Valley, Cambridge and Israel do not display strong top-down governmental modes of economic decision-making in policy or strategy. In other words there is seldom, if ever, a peak committee in which economic deliberations that directly affect specific platform industries by producing detailed action-lines that favour or disfavour specific technologies. That is not to say that in a general way, certain bundles of "cross-cutting" new technology capabilities or problems that may indeed occur in the form of "technology pathologies" may be fashioned. These may evolve as broad frameworks for alerting or sensitising "actors of consequence" of a clearer priority of recognition by "policy champions". A good example is "Homeland Security" which consists of many diverse but technologically interlocking targets, problems and opportunities. In the US as many as seventeen different information and intelligence agencies engage directly with intelligence gathering at home and abroad. These involve mobilising "Big Data" gathering and analysis, algorithm writing, cybersecurity, cyberwarfare, including cyberforensics, drone design and applications and multiple kinds of tracking, verifying, intercepting and, if necessary, arresting or otherwise preventing "technology pathologies" from threatening individual lives and communities. Without labouring the point, such "crossover" innovation opportunities also occur, in different combinations but including overlaps across the boundaries of "Big Platforms" such as Biomedicine, Elderly Healthcare, Artificial Intelligence, Renewable Energy and Sustainable Mobility, sometimes "fuzzily" designed to meet "Societal Grand Challenges".

Such often "post-political" activity bundles are moulded by "policy champions" of various kinds. For example, Artificial Intelligence, with its close linkages to Robotics and Nanotechnology has a few "protean" influential champions in the US such as Ray Kurzweil, an apologist for AI for decades (Ford, 2015; Barrat, 2013). Kurzweil himself is widely seen as an attention-seeking entrepreneur and proselytiser for only the positive implications of AI. He is influential, having his pedagogical efforts sponsored by, amongst other Californian businesses, Google, Genentech and Cisco Systems. His inventive effort has touched such technologies as optical character recognition, computer-generated

speech and music synthesis, all of which relate to augmentation of human senses. He was awarded twenty doctoral degrees from the likes of Babson College, Bloomfield College, Clarkson University, DePaul University, Hofstra University, Michigan State University, Rensselaer Polytechnic Institute and Worcester Polytechnic Institute, and been honoured by US presidents Johnson, Reagan and Clinton. Among his awards to the technological, humanities and musical communities are the following: 2000 The Lemelson-MIT Prize. This \$500,000 award is the largest in the U.S. in invention and innovation. 1999 The National Medal of Technology, the nation's highest honor in technology. 1998 The Stevie Wonder / SAP "Vision Award" for Product of the Year a \$150,000 prize (being used by the Kurzweil Foundation to provide scholarships to blind students), and the 2008 American Creativity Association Lifetime Achievement Award. It can obviously be agreed that the optimist Kurzweil is widely seen as a "crossover" innovator and an AI "champion" despite his cultist association with Silicon Valley's "Singularity University" (reminiscent in some ways of L. Ron Hubbard and "Scientology") which Kurzweil founded in 2008.

Without contemplating the "cultist" evangelizing of Kurzweil's obsession with a fictitious fake version of the astrophysical phenomenon of the "singularity" when even light can no longer escape from a black hole in space, three things that follow are pertinent to our utilisation of his curriculum vita in support of the function of "champions" as arbiters of post-political action framing. First, it is noteworthy the extent to which Kurzweil's innovative career expresses crossover innovativeness with respect to: the invention of a classical music synthesizing computer involving designing computer technologies such as machine reading to assist the disabled and to enrich the arts, including winning awards for film production. Second, the institutional nodes with which Kurzweil's interaction occurs are solid entities in the worlds of academic research entrepreneurship, government and large corporations. After long advisory roles with firms listed above, he was in 2013 appointed head of engineering at Google. He had worked with Google's co-founder Larry Page on special projects over several years. His executive appointment occurred as Google began assembling the largest artificial intelligence (AI) laboratory in existence. Acquisitions involved military robotics firm Boston Dynamics, thermostat maker Nest and cutting-edge Cambridge (UK) AI firm DeepMind. These were added to smaller purchases of Bot & Dolly, Meka Robotics, Holomni, Redwood Robotics and Schaft, and another AI startup, DNNresearch. It also hired Geoffrey Hinton, a British computer scientist who is rated the world's leading expert on neural networks (Cadwaladr, 2014). Finally, Kurzweil is an avid publicist for his serious and more questionable analyses and predictions having published seven books translated into eleven languages.

No other technology – specifically AI (with robotics [Ford, 2015] and nanotechnologies) – has anywhere near as "protean" the influence on key decision actors ranging from DARPA to Google as the aforementioned Ray Kurzweil but others take on relevant roles from other more sceptical viewpoints. Three of these, cited in Barrat (2013) include I. J. Good, Eliezer Yudkowski, and Stephen Omohundro. Good, who died at 92 in 2009, was a British expatriate mathematician and former Bletchley Park codebreaker colleague of Alan Turing. Good was responsible for coining the term "information explosion" to describe the impact of AI on human intelligence when it could be anticipated. Stanley Kubrick turned to Good as the adviser on the 1968 film 2001: A Space Odyssey. It was Jack Good with his insights on intelligent machines, who helped create the infamous character of HAL, the AI computer in the film. In Good's seminal paper "Speculations concerning the first ultra-intelligent machine" he defined this – a forerunner to "Singularity" thinking - as follows:





Let an ultra-intelligent machine be defined as a machine that can far surpass all the intellectual activities of any man (sic) however clever. Since the design of machines is one of these intellectual activities, an ultra-intelligent machine could design even better machines; there would then unquestionably be an 'intelligence explosion,' and the intelligence of man would be left far behind. Thus the first ultra-intelligent machine is the *last* invention that man need ever make, provided that the machine is docile enough to tell us how to keep it under control. (Good, 1965)

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Accordingly, Good was a "champion" and influential at the highest governmental, academic and corporate levels with crossover theoretical interests from Bayesian mathematics to computer programming design and manufacturing to film consultancy. Moreover, he was careful not to take an over-optimistic line on the controllability of AI unless - as he wrote - "docility" could be built into the resulting technology. Other more sceptical AI "champions" who take a more practical but still pessimistically inclined view regarding the difficulty of ensuring "docility" from future AI or "artificial general intelligence" (AGI) as they term it, include gurus such as Eliezer Yudkowski, and Stephen Omohundro, noted earlier and as profiled extensively in Barrat (2013). Omohundro is optimistic, but this is based on his underlying notion that all AI is lethal because of the well-known software engineering problem that much programming is bad work, i.e. sloppy and incompetent, as Microsoft Word users have known for decades for its almost constant de-bugging upgrades. Bad programming is estimated to cost the US economy \$60 billion per year. This implies a vast need for "self-improving software" a variety of "evolutionary programming" that may evolve from currently practised "machine learning". Article space disallows fuller explication of such potentially influential views, save to say that Yudkowski - who invented the AI Box – a kind of Turing machine that led some players of its "game" to believe that a "thinking engine" had been invented, insists AGI would be catastrophic for humanity unless it is designed to be "Friendly AI", But as Barrat (2013) observes critics argue that progressing towards AGI is necessitated by the even greater dangers of "artificial specialised intelligence" (ASI) falling into the hands of:

" so many reckless and dangerous nations on the planet – North Korea and Iran for example – and organised crime in Russia and state-sponsored criminals in China launching.....cyberattacks, relinquishment would simply cede the future to crackpots and gangsters" (Barrat, 2013, 200-01)

Hence we see the origins of the engineer's linear determinist thinking enlarged prodigiously and apocalyptically. The initial "mindlessness" of contemporary incremental innovators is captured in the following statement from Uber founder and Chief Technical Officer (CTO) Oscar Salazar who admitted:

"We are adding technology to a society without thinking about the consequences. I think government, industry and society need to work more together, because it is going to get crazier and crazier." (Fairchild, C, 2017)

Here – belatedly - is recognition that as governments fail adequately to regulate technological experiments, good champions are also hard to find when their infantile aspirations are mainly "disruptive"

(Christensen, 1997) and informed by the likes of Facebook's Mark Zuckerberg's earlier mission statement to "move fast and break things" (the origin of bad programming; Taplin, 2017). It has finally dawned on the Ubernauts that, as Fairchild (2017) also notes:

"Advances in artificial intelligence and automation could mean as 50% of today's US jobs will go away, according to some estimates. Joined on stage by other high-profile members of the tech community, (chair Kara) Swisher forced her panelists to defend Silicon Valley's seeming incapability to take responsibility for the downstream effects of its innovation. (Ibid)

Most governments and tech entrepreneurs excuse their mindlessness regarding the effects of AI automation upon workforces by stressing the importance of retooling and reskilling the workforce for tech jobs in the future. As engineers, in the main, they completely fail to see the paradox that they are responsible for the future absence of positions that it will be futile to train anyone for (Streeck, 2016). We shall return to this conundrum of engineering's linear model of non-reflective obtuseness later, but for the moment we cite Frey & Osborne's (2013) estimate of 64 million US jobs (47% of the total) having the potential to be automated within "perhaps a decade or two" (Frey & Osborne, 2013).

## **Policy without Global Controllers**

This narrative demonstrates that technological policy innovation needs "Champions" although they do not have to be evangelical or cultist in their behaviour along the lines of Ray Kurzweil, even though he clearly fits in with a particular strand of American science fiction "envisioning" that suits the vacuous purposelessness of the careless engineering and software programming that clearly often characterises high-tech innovation processes. Even when there is some degree of "adult supervision" of highly sensitive explorative and purposeful algorithm design, other mistakes can be thoughtlessly committed. Thus the story of the "cyberecosystem" and its often dystopian as distinct from cyberutopian outcomes is often prefaced by reference to and discussion of the work of disaster sociologist Charles Perrow. In his oft-cited book "Normal Accidents" (Perrow, 1999) and in particular his critique of "tight coupling" describes a system whose parts have immediate and severe impact upon each other.

A case in point is the so-called "smart grid", another is the financial system (MacKenzie, 2008) or food refrigeration system, healthcare system, defence system and so on. All of these and many other such systems are potentially vulnerable regarding "department of homeland security" (DHS) issues. In 2007 DHS tested the robustness of the grid at the Idaho National Laboratory by selecting a typical online turbine generator, "hacking" it and altering its settings. Accordingly, it malfunctioned as the turbine self-destructed from inside. Its "supervisory control and data acquisition" system (SCADA) the "global controller" encrypted security programming of the type used in many systems critical settings noted above failed. On the bass of this, a new kind of malicious software (malware) to cause such destruction to hostile systems was conceived. It was called Stuxware. It was specifically designed for the US (NSA) and Israeli intelligence services to destroy a Siemens logic controller used in a gas centrifuge nuclear fuel enrichment plant in Iran by subverting its virus-prone MS Windows PC operating system. Spies carried flash drives releasing the Stuxnet virus throughout the plant's local area networks (LAN) to identify undiscovered security holes in the operating system.





Stuxnet worked and, as noted, it was likely sponsored by US and Israeli intelligence agencies but the private Equation Group has been identified as advising in the US and Mossad's agents activating the Israeli contribution. Un-named private consultants in Tel Aviv were also interviewed in website reports and testing is asserted to have been conducted at the Idaho National Laboratory nuclear research facility in the US (the same one where HDS conducted its stress-test) and at Dimona's Negev Nuclear Research Center, Israel's nuclear weapons facility. But, even so, Stuxnet, which was supposed to self-destruct after multiple malware operations escaped, allowing thousands of copies to be accidentally distributed. Experts conclude that this fate is typical of the lack of thinking beyond the short-term that characterises "act fast and break things" thinking about the likelihood of "normal accidents" occurring.

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While this narrative does not seek to present platform ecosystems of the Quaternary kind under discussion as paragons of virtue, it is clear that even the tightest hierarchical control assumed to be typical of military hierarchies is not immune to major failures of administration predicted in Perrow's (1999) "normal accidents" analysis. Although we have yet to turn to the implications of this narrative for the prodigious hierarchical control of Chaebols like Samsung in the South Korean context it should nevertheless give pause for concern during that national economy's period of relative stagnation compared to the past. One reason is that a tradition of Neo-Confucianist hierarchy, obedience and control associated with Chaebol tradition is no longer the administrative power in industrial organization that it once was. More recently, notions of "flattened hierarchies", "intrapreneurship" and "open innovation" have affected learning in some large corporate entities as they have struggled to compete with more flexible, nimble and agile regional and global supply and knowledge networks. Typically, this way of operating has characterised the SME platform ecosystems of the Quaternary activities pronounced in the Silicon Valley, Cambridge and Israeli set-ups and in the global financial "superhubs, "biomedical megacentres" that are nowadays the leading "frame" for learning innovative organizational "(non)governance" (Nadivi, 2017).

Accordingly a highly "networked" collaborative enterprise complex characterises, for example the "complex adaptive super-systems" that manage global financial systems. These elements of "superhub globalisation" with numerous nodes distributed across the planet contrast with the "thin globalisation" networks more typical of the other knowledge-intensive Quaternary activities associated with "Big Data", cybersecurity, systems design, software algorithms, biopharmaceuticals and cleantech. As noted earlier, these have high rate of networking among technology entrepreneurs, university researchers and government or military representatives and clients. Such platform ecosystems are thus not top-down hierarchical administrative or bureaucratic systems in any meaningful way. It is thus a decentralised, associational "Innovation Advocacy" model of industry organization. There is usually no formal strategy; the main driver has been incremental, evolutionary, sometimes rapid, change. "Superhubs" for financial services and \*biotech megacentres" particularly in the UK and US tend to be open not managed economies and there has been little or no recognisable industrial strategy The UK's recent attempt at an industrial strategy in 2017 was disparagingly referred to as a political "toyshop" Finally, we now see, typically new innovation models emerging in the likes of Cambridge where "crossover" mutations from microelectronics to advanced combustion engines and healthcare are being fashioned (Eason & Dean, 2016).

#### Cambridge Innovation Advocacy Without a "Global Controller"

In Cambridge the "soft infrastructure" of entrepreneurship and innovation marketing support has the following intermediaries active at one or other time assisting the ICT, biotech, software and systems and cleantech sectors. The Cambridge Network, which links together members and provides services for academic entrepreneurship. St. John's Innovation Centre incubation environment accelerated the growth of ambitious innovative start-up businesses. Cambridge Science Park, established in 1970 was the new setting on which the ICT cluster began to grow rapidly. There were some 39 new companies from 1960 to 1969. In the 1970s, 137 were formed. By 1990, there were 100 per year. These initiatives are now supported by knowledge-intensive intermediaries such as ideaSpace, which is a community of people in Cambridge starting high impact new ventures. Hence ideaSpace members are creating new business models (Kirk, Cotton & Rees, 2016).

What we might term examples of "Soft Infrastructure, Soft Power" includes institutions like Cambridge Enterprise which helps Cambridge University students and academics to commercialise innovative ideas by establishing a business. In the field of biotechnology, One Nucleus is a not-for profit Biotechnology membership organisation which aims to maximise the global competitiveness of its members. Supporting this is Cambridge Biotechnology Campus, which houses 7,000 professionals and scientists. Of significance also is The Wellcome Genome Campus is home to some of the world's foremost institutes and organisations in genomics (Sanger Institute) and computational biology at Hinxton Tech Park. This facility is a long-established and highly valued support infrastructure also for biotechnology - Babraham Biosciences Incubator & Research Campus. A newer are a of cluster ecosystem evolution involves clean technology, represented by Cambridge CleanTech. This is also a member organisation for cleantech start-ups and evolved firms, replicating the "associational" or collaborative mode of start-up industry organisation. Bestriding this associational infrastructure are cluster-platform "champions", notably Hermann Hauser, co-founder of Acorn with Christopher Curry, who was part of a Cambridge II initiative. Hauser's venture capital company Amadeus (with funding from the likes of software transplant Microsoft) was a leading actor in helping start-up companies. Thereafter, in collaborative efforts to access support for growth in Cambridge, which by 2017 had grown to the status of a city-regional mayoralty consolidated as the Cambridge-Peterborough, built partly on the growth insights of the past partnership among Alec Broers (Vice-Chancellor of Cambridge University), spatial planner Marcial Echenique (Cambridge University School of Architecture and a transport planning specialist and David Cleevely (Analysys telecom consultant founder) who, collectively, decided to assist the – subsequently successful - attempt to develop Cambridge's high-tech future.

This marked the evolution of "Cambridge Phenomenon 2", (SQW, 2011) which in 1997-8 looked at various issues such as land use, transport systems and telephony. The aim was to seek to accommodate growth through new Science Park development to link the university and industry. The university saw need for seedcorn finance and participated in seed capital funds, including the Quantum Fund, and Cambridge Research and Innovation Ltd. Entrepreneurs also became venture capitalists: Amadeus Capital (Hermann Hauser); Merlin Ventures, a biotechnology fund (Chris Evans founded Chiroscience) and the Gateway Fund founded by local financier Nigel Brown. Thus the "champions" were able to envision how future growth rests on continued acquisition of research funding, understood as the key knowledge core of – especially – ICT and biotechnology innovation excellence. A future key is the identification of *flexible research funding* that furthers and fosters "knowledge at interfaces" ("crossover") types of interdisciplinary research profile to evolve along multiple inter-dependent





research pathways. Departure by the UK from the European Union presages major uncertainty about Science and Technology "framework funding" as represented by the EU's Horizon 2020 research programming. This has meant a novel financing development bolstering research at Cambridge University has occurred as follows. Because of UK (and EU) financial weakness, so-called "quantitative easing" more commonly known as "printing money" is practised by the Bank of England (and in the Eurozone, the European Central Bank). In the UK the Bank of England currently buys bonds issued by some universities, including Cambridge. The largest university bond was a £350 million issue from Cambridge in 2012 with a maturity date of 2052. Such bonds are sold to finance university research and teaching - deemed officially to make a material contribution to the UK economy. Accordingly, the Bank of England now also has a contributory role in funding long-term Cambridge University research (Wilson, 2016). As a final and recent indication of the financing prowess of the UK's leading seats of academic entrepreneurship in the country's changing circumstances, the following is indicative. A comparison of University venture funds shows the UK at the global top of the league (Table 1). Within the KAUST (King Abdullah University of Science & Technology of Saudi Arabia) University Venture Fund data for the UK, Cambridge Innovation Capital (a private fund) was a key investor in intellectual property, raising £75 million. From 2011 to 2016 University of Cambridge Enterprise (public knowledge transfer office of the university) administered deals involving 11 companies that were sold or stock exchange listed with a combined value of £1.3

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Country	Magnitude	
UK	\$5 billion	
US	\$4.5 billion	
China	\$2 billion	
France	\$1.1 billion	
Japan	\$0.6 billion	

Source: KAUST Innovation Fund (2016)

billion. These spinouts own their own IP and were incubated in the university with regular peer-review of progress before coming to market. As hinted earlier, much of this initial investment capital comes from the Gulf and Asia (Frean, 2016).

Many of the implications of the global financial crisis, and some or all these listed key priorities, will as already noted, be affected by the UK exit from the EU with its negative and positive effects upon the cluster-platform. Thus access to high skilled migrant labour from the EU is directly affected by migration policy from the UK state. It is less a driver of negative effects than non-EU technological talent recruitment which, as we saw, is seen as often more modern in its curriculum than EU labour. Thus labour shortages may in different ways occur to EU and non-EU talent recruitment. As SQW (2011) say, the cluster:

"...must recruit workers they need, recognising a particular shortage of top quality management and marketing skills but also the imperative to attract internationally excellent professionals from all spheres" (SQW, 2011, vi).

This means EU-start-ups, management and research leaders may continue to be sought while non-EU trained medical diagnosticians and analysts or technologists in medical and ICT fields will remain in demand. Finance will remain an imperative if high-tech growth occurs while the UK's declining currency makes acquisitions from abroad more likely and attractive.

Finally, although Cambridge foreign acquisitions still occur as noted with Cambridge Consultants Ltd's (CCL) acquisition of US firm Synapse, but such acquisitions became 20% dearer directly after the Brexit plebiscite (with assets 20% cheaper to outsiders). Until then this was part of CCL's strategy to evolve a track record of creating high-value organisations built around disruptive technology, an exemplar of "thin" globalisation. Thus four of Cambridge's \$15 billion capitalisation firms - Cambridge Silicon Radio (CSR), Xaar, Vectura and Domino Printing Sciences - were among those spun off by CCL. Other spin-offs include Alphamosaic and Inca, who were subsequently acquired by Broadcom for \$123m and Japan's Dainippon Screen for \$60m. With the expansion of its US presence, CCL would also be bringing its venturing activity to the extensively "financialized" US capital markets. Now there is greater uncertainty about basic and applied research funding that hitherto came to Cambridge research from programmes such as Horizon 2020. The UK government has given some reassurance that substitution of such funding will occur short-term, but the final arrangement awaits the results of Brexit negotiations. By contrast as shown, long-term uncertainty is in part insured against by the issuing of Cambridge University bonds that are currently available for purchase by the UK central bank's quantitative easing policy, as long as it lasts. With inflation on the rise in 2017 monetary policy will remain constrained and interest rates straining but likely to be kept at historic lows during the UK's "resilience-free" economic era, likely to last ten years or more since the 2007-8 global financial crisis.

So, to return to South Korea's current evolutionary arrest in its upward growth trajectory, South Korea is like an island, surrounded by sea and cut-off from the land-mass immediately to its north by an extremely hostile political power in North Korea, aided somewhat reluctantly in its political posture of local and global aggression by its globally prodigious geopolitical ally, China. Not surprisingly, South Korea, while globally competitive in consumer goods markets is quite locked-in to a manufacturing paradigm. It has become somewhat isolated regarding global good practice in industrial organization despite its success in the past in succeeding in rapid industrialisation. The Chaebol system by which industrial groups divide along sectoral boundaries, supported by an in-house domestic banking system, managed by an extremely hierarchical and rather bureaucratic administrative system, now seems rather outdated and lacking in forward impetus.

The problems of "cronyism" towards the disgraced former South Korean leader Park Geun-Hye with claims of enormous gifts to Presidential charitable interests and worse are testimony to the weakening of the traditional elite system of industry management. The scandal of the burning battery was one caused ultimately by a mentality that favoured "closed innovation" in a world that had generally become happier with market transactions involving "open innovation". The in-house supplier chosen by Samsung was not expert in battery technology but SDI won the in-house supplier contract anyway. SDI stands for Samsung Digital Imaging which is actually an optoelectronics (or photonics) subsidiary of Samsung spun-off from Samsung Optoelectronics in 2009. The Burning battery in the Galaxy 7 smartphone cost Samsung some \$5billion in 2016-7. Half the faulty batteries were produced by SDI while the other half were produced by affiliate Amperex Technology without fault. In a different field of Samsung operations where global networks with other major corporates are pronounced, Samsung Biologics is jointly owned by Samsung C&T Corp. and Durham, North Carolina-based





Quintiles each holding 10 percent. Samsung Biologics will contract-make medicines comprising living cells. Samsung Group plans to expand into producing copies of biologics including Rituxan leukaemia and lymphoma treatments sold by Roche AG and Biogen Idec Inc. of Boston, MA. The Samsung Medical Centre is South Korea's leading clinic. However, it transpired in 2015 that the national outbreak of a mutated form of Severe Acute Respiratory Syndrome (SARS) or (Middle Eastern IRS) originated in the Samsung Medical Centre. These, in different ways point to a worrying degree of "corporate overreach" by South Korea's leading conglomerate.

## Conclusions

As a small-scale yet traditionally high-grade university research centre, Cambridge learnt the lesson of Intellectual Property in 1975 when local research launched a new industry - biotechnology - the commercial returns from which were exploited by academics and risk capitalists based across the world in the University of California's San Francisco Medical School. Thereafter, a relatively liberal intellectual property regime prevailed with the discoverers or academic inventors evolving into innovators as they were encouraged to exploit their own IPR alongside that of the university by agreement. This meant that the growth trajectory self-guided towards an "open innovation" model of knowledge exploitation relatively unhindered by corporate requirements or interests except insofar as market-based contracts were fulfilled between global customers and local suppliers of commercialised knowledge-intensive output. Surrounding this research exploration/exploitation kernel, a facilitative bottom-up innovative and entrepreneurial infrastructure of "associative" intermediaries and "champions" evolved towards an economic governance form known in development studies as "Embedded Autonomy". This is the opposite of a "Developmental State" model of economic growth once practised in early fast-growth Asian economies like South Korea, Singapore and Taiwan. As we saw earlier the last two of these, alongside Hong Kong, have largely moderated their "developmental state" models in favour of the "thin globalisation" of a knowledge-intensive "Quaternary" trajectory, deindustrialising away from manufacturing-led growth as they proceed. However, due to its deep path dependence on Chaebol-led state development thinking, South Korea has been unable or unwilling to join them, resulting in deteriorating economic indicators in consequence.

The self-sustaining ambition of he "Asian Tiger" pioneers has generally been to overcome the developmental blockage identified by Rodrik (2011), which has been to stimulate demand for innovation by stimulating the supply to meet demanding customers' requirements for creating technology (not sector) entrepreneurs. Such technologies are then capable of becoming "general purpose technologies" not simply sector-limited technologies. Crossover innovations in leading Quaternary cluster-platform complexes like Silicon Valley, Cambridge and Israel naturally find applications among cluster ecosystems, especially where they co-exist in proximity with ready applications in new economic activities occurring outside their original technology base. Rather than relying upon corporate or state hierarchies to "pick winners" the local "Platform Champions" conduct local and national lobbying through their shared interest in promoting "Innovation Advocacy". In the case of Cambridge anatomised above it began with the first champions for the nascent ICT cluster, and then evolved as a group of interrelated, albeit diverse clusters that subsequently grew into, currently, four pillars of a set of

complementary, advanced technology knowledge-intensive or Quaternary cluster-platforms. From this, local-global marketing of "crossover" excellence leads to high employment, skills and profitability growth, something which all development experts hope to deliver.

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## Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal

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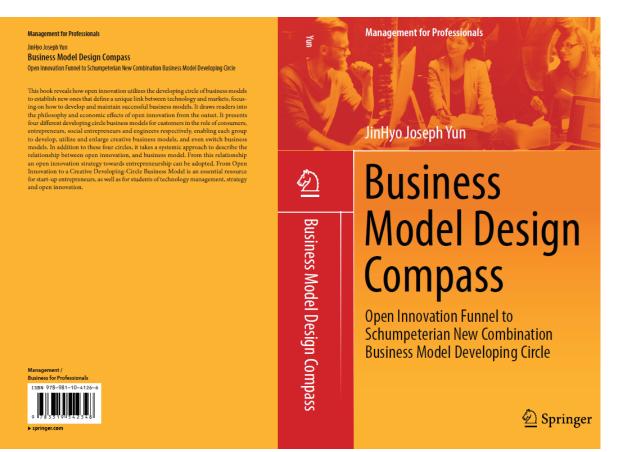
## 'The Business Model Design Compass' of Dr. JinHyo Joseph Yun Published by Springer

Dr. JinHyo Joseph Yun, principal researcher at the Convergence Research Center for Future Automotive Technology (Professor of Open Innovation Academemy of SOItmC <u>www.openinnovaitontmc.org</u>), published 'the Business Model Design Compass' by the Springer, German publishing company.

In the book, Dr. Yun explored the open relationship between technology and markets and established a crucial link between them. It takes a systematic approach to describe the relationship between technology and market, focusing on how to develop and maintain successful business models.







- Explores the open relationship between technology and markets and establishes a crucial link between them
- > Introduces entrepreneurs to the developing-circle based business model
- Considers the entire process of open innovation for creating concrete business models
- Demonstrates how to create new business models from the perspectives of a customers, users, social entrepreneurs, and engineers

This book reveals how open innovation utilizes the developing circle of business models to establish new ones that define a unique link between technology and markets, focusing on how to develop and maintain successful business models. It draws readers into the philosophy and economic effects of open innovation from the outset. It presents four different developing circle business models for customers in the role of consumers, entrepreneurs, social entrepreneurs and engineers respectively, enabling each group to develop, utilize and enlarge creative business models, and even switch business models.

In addition to these four circles, it takes a systemic approach to describe the relationship between open innovation, and business model. From this relationship an open innovation strategy towards entrepreneurship can be adopted. From Open Innovation to a Creative Developing-Circle Business Model is an essential resource for start-up entrepreneurs, as well as for students of technology management, strategy and open innovation.

Eminent scholars such as Distinguished Professor Loet Leydesdorff who is the pioneer of the Tiple-Helix, collaboration among the industry, university, and government, Distinguished Professor Ulrich Witt who is worldwide famous for Schumpeter economic theory, Distinguished professor Anil K. Gupta who is the founder of the Honey Bee Network which is world best social open innovation platform, Professor Fred Philips who is the Editor In Chief of *Technological Forecasting and Social Change*, Professor KongRae Lee who is the founder of *Asia Journal of Technology Innovation*, Professor Venni Krishna who is the editor in chief of *Science, Technology, and Society*, and Professor Yigltcanlar Tan who is the editor in chief of *International Journal of Knowledge Based Development* congratulated and recommended the publishing of this book.

Currently, Dr. Yun serves as the president of Society of Open Innovation: Technology, Market, and Complexity (SOItmC www.openinnovationtmc.org ) and plays a critical role in developing open innovation business model. More than 1,000 scholars from 30 countries are member of SOItmC.

He is also the editor in chief of the editorial board of the Journal of Open Innovation: Technology, Market, and Complexity (JOItmC <u>www.jopeninnovation.com</u>). More than 100 scholars from about 20 leading universities including Tokyo University, Tsinghua University, and the University of Cambridge are on the editorial board.

Dr. Yun said, "The business model development based on open innovation will be very crucial to Korea in which not many research are underway in this field as well as to the world in the face of the fourth industrial revolution. I hope this book will provide clues for entrepreneurs, students, and corporation, and policymakers to respond to the new industrial environment."

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## Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal

## Abstracts

Samsung Galaxy Note 7 has been withdrawn from the market after occurrences of its explosion after launch in 2016. Our research wants to answer three questions as follows.

How did the Samsung Galaxy Note 7 withdrawal occur?

What caused this event to take place?

How should we understand the causes and processes of this event?

From among the qualitative inquiry methods, this study used case study research.

From this research, we found out three implications.

First is the benefits and costs of closed innovation strategy in Samsung Electronics.

Second is the internal impact of the Galaxy Note 7 explosion on Samsung Electronics.

Three is that the success in open innovation strategy requires much investment and effects.

**Keyword:** Samsung Galaxy Note 7 explosion, closed innovation. Benefits of closed innovation, Cost of closed innovation, not invented here syndrome

#### Introduction

Samsung Electronics is one of the leading electronics companies in the world, with the largest market share in terms of sales. From the wide array of smartphones it has manufactured, only the Samsung Galaxy Note 7 has been withdrawn from the market after occurrences of its explosion after launch in 2016. In the past, smartphone manufacturers, such as Samsung, Apple, and Blackberry, faced diverse scandals such as smartphone explosions after launch; however, cases in which a specific smartphone was withdrawn from the market because of such explosions were only one case. Given the novelty and impact of this case of the Samsung Galaxy Note 7, this study aims to analyze the reason behind the withdrawal of this device in relation to its explosion, the withdrawal process, and the impact of the incident in depth.

#### **Research questions**

How did the Samsung Galaxy Note 7 withdrawal occur?

What caused this event to take place?

How should we understand the causes and processes of this event ?

This study was conducted to find the answers to the above three questions. First, it focused not on the physical cause of the explosion, but on the cause that led to the incident in terms of business administration. Through the analysis, we may understand the technical innovation strategy of Samsung smartphones in detail.

#### **Research method**

From among the qualitative inquiry methods, this study used case study research. Case study research is "defined as a qualitative approach in which the investigator explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, and documents and reports), and reports a case description and case themes" (Creswell, 2012, pp. 96–97). The case target of this study is the explosion of the Samsung Galaxy Note 7. First, this study analyzed the articles of Korean and overseas newspapers such as the Financial Times for the period of August 26 to November 16, 2016. The keywords used were "Galaxy Note 7 explosion." Second, we contacted Korean newspaper reporters who had written articles related to the scandal, as well as employees of Samsung Electronics, both former and current, by e-mail, and some were interviewed to provide a more in-depth discussion. For the interviews, questionnaires were distributed on May 12, 2017. Interview details are described in Table 1.

Target	Interview	Channel
	Schedule	
C, Newspaper reporter	May 12, 2017	E-mail
J, Newspaper reporter	May 15, 2017	E-mail
L from Samsung Electronics	May 15, 2017	E-mail, +interview
J, a specialist of business strategy	May 16, 2017	E-mail, +interview
C from Samsung Electronics	May 17, 2017	E-mail
C from Samsung Electronics	May 17, 2017	E-mail, +interview
J from Samsung Electronics	May 15, 2017	E-mail
J from Ex-Samsung Electronics	May 15, 2017	E-mail
P, a specialist of business strategy	May 19, 2017	E-mail, +interview

Table 1 Schedules and targets of in-depth interviews

The half-structured interview questionnaire is described in Appendix 1. Because of the complex requirements involved in interviewing, such as contacting and interviewing participants to generate data, and analyzing that data to obtain observations and new knowledge, this process takes a huge amount of time and money (Seidman, 2013, p. 11). Third, this study analyzed books and research papers that described the process of technology innovation and development at Samsung, which became the background of the development of the Samsung Galaxy Note 7, and identified information on the causes and related information about the explosions. This was done because understanding the strategies and history of technology innovation and development of Samsung itself is vital to identifying the essence of the explosion and to developing an in-depth description and analysis of this case.

#### Literature review and research framework

#### Literature review

Nowadays, new economic pressures on innovation are forming, developing costs of new products are rising, and product life cycles are being shortened. To counter these trends, there is a need for companies to come up with innovative ideas to introduce their business models; in this process, internal product





development makes use of outside resources and inside intellectual property is managed externally (Chesbrough, 2007).

DIST

Even though an open approach to innovation presents the opportunity for firms to come up with product features that would have been difficult to plan out under concrete closed integration, when partner companies set different goals, open innovation also restricts the group's ability to finalize the product's technological trajectory (Almirall & Casadesus-Masanell, 2010). Thus, both discovery and divergence are treated as benefits and costs of open innovation.

Open innovation concepts have proven themselves as relevant to both "high-technology" companies such as Lucent, 3Com, IBM, Intel, and Millennium Pharmaceuticals, and those not belonging to this group but that have adopted the concept early on (H. Chesbrough & Crowther, 2006). According to Chesbrough and Crowther (2006), key success factors of inbound open innovation include he provision of a top-down direction and encouragement of practices of open innovation; allocating responsibility for success; network-building in important areas; proper alignment of criteria and rewards to motivate success, be it in an open or closed environment.

There are several advantages to utilizing open innovation in risk-laden activities, such as the pioneering of new technologies or business opportunities, deferred financial costs, early exits translating to reduced downward losses, and delayed exit in case of spin-off ventures (Vanhaverbeke, Van de Vrande, & Chesbrough, 2008). However, according to Vanhaverbeke, de Vrande, and Chesbrough (2008), innovative firms have to develop new capabilities and methods to discover the full "real option" potential of open innovation practices.

In the process of the transformation of consumer electronics, open innovation has industrial dynamics. It should be noted that other categories of companies, such as small suppliers of components, modules, and end-user products in high-end markets, as well as manufacturers and assemblers of components and systems, also play significant roles in the innovative enhancement of such electronics (Christensen, Olesen, & Kjær, 2005).

What are the changes in a company's organizational structure and management system when it shifts from closed to open innovation? According to a study in which the adoption of open innovation by four Italian firms, operating in mature, asset-intensive industries, was described, the journey from closed to open innovation involves the four main dimensions of the company's organization, i.e., inter-organizational networks, organizational structures, evaluation processes, and knowledge management systems (Chiaroni, Chiesa, & Frattini, 2010).

In the developmental changes in the semiconductor (DRAM technology) field, Samsung Electronics followed a spiral process model of technological innovation in which there are four steps:

(a) Entrance of foreign companies into the Korean market and their refusal to transfer their technologies to Samsung, initiating its indigenous technological innovation capabilities (ITICs);

(b) Samsung started technological innovation capabilities (TICs) by means of reverse engineering of imported foreign technologies and by transfer of technology;

(c) Samsung improved technological innovation (TI) by means of an adaptive technological innovation strategy and, finally;

(d) Developed the capability of establishing its own ITICs, becoming one of the leading companies in the world that competes with firms from advanced countries in the global market (Ali, Muhammad, & Park, 2011).

Innovation is a result of multiple combinations such as the dynamic combination between exploitation and exploration, the open combination between absorption and distribution, the vertical combination between upstream and downstream, the functional combination between intensive and extensive, and the multiple combination between synergic and sporadic (Hong, 2012). According to Hong (2012), in the innovation activities for Samsung's code-division multiple access (CDMA) digital phone development, a strong vertical combination gave the company a competitive advantage over rivals.

However, in the case of smartphone apps, in contrast to Apple, first movers of the platform employed a closed strategy for quality control of the platform and to ensure customer loyalty. With this, Samsung has employed the platform strategy of "openness," which allows free entry of participants, and "sharing" of created value, which is considered vital, along with an excellent platform environment (Kim, Hong, & Kim, 2014).

According to McAfee and Brynjolfsson (2014), the world is at a turning point at which the effects of digital technologies can only truly be shown through automation and the creation of "unprecedented things." There is nothing new about digital technologies with computer hardware, software, and networks at their core, but after the third revolution, they are transforming the economy as they become more complex and integrated (Schwab, 2017, p. 7). The fourth industrial revolution, which is based on physical technology breakthroughs such as autonomous vehicles, 3-D printing, advanced robotics, new materials; and on digital breakthroughs such as the Internet of Things (IOT), radio frequency identification (RFID), Bitcoin; as well as several digital–based biological innovations, is diffusing much faster and more widely than previous so-called revolutions (Schwab, 2017, p. 8). With the arrival of the fourth industrial revolution, there have been several effects on business: 1) customer expectations are shifting; 2) products are being enhanced by data, thus improving asset productivity; 3) new partnerships are being formed as companies learn the importance of new forms of collaboration; and 4) operating models are being transformed into new digital models (Schwab, 2017, p. 53). This revolution is reshaping human reality, including the areas of business and economy, involving the following:

1) Hyperhistory, which is the situation of individual and social well-being dependent on ICTs;

2) ICTs as interpreting and creating technologies;

3) ICTs as technologies of the self;

4) Enhancing, augmenting, and reengineering technologies;

5) The self-constitutive value of privacy;

6) Shifting and decreasing intelligence with the stupidly smart;

7) ICT-friendly environment; and

8) The emergence of a political multi-agent system (MAS) (Floridi, 2014, pp. 3, 40, 59, 96, 118, 131, 144, 175).



In other words, with the acceleration of the fourth industrial revolution, which can also be called the second IT revolution, in which ICT spreads to all industries, companies are actively making attempts to form creative and new connections and combinations between technology and the market, beyond their current boundaries, in almost all industries, including mature and asset-intensive industries and high-tech industries (Chiaroni et al., 2010).

### **Research Framework**

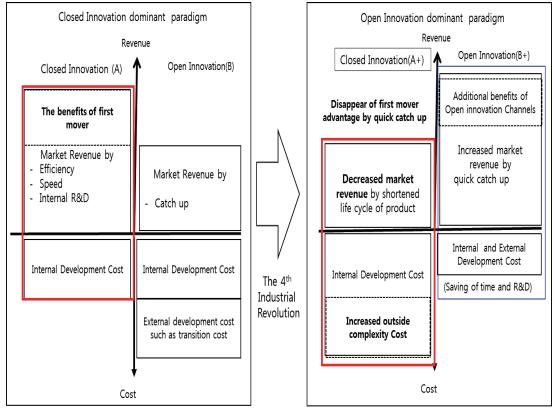


Fig. 1. Research framework

As shown in Figure 1, this study focused on the aspect of the rapidly changing cost and revenue structures of cases of closed and open innovation as the fourth industrial revolution accelerates. That is to say, the framework of this study was to analyze the cause of the Galaxy Note 7 explosion, part of the Samsung smartphone business, which business used closed innovation strategy under an open innovation–dominant paradigm, and the process of handling the incident, from two aspects. First, we analyzed the change of revenue and cost of Samsung's closed innovation policy according to the paradigm shift from the closed innovation–dominant paradigm to the open innovation–dominant paradigm. That is, we compared A and A+ in Figure 1. Second, we analyzed Samsung's closed innovation under the open innovation–dominant paradigm by comparing it with the open innovation strategy of other companies such as Apple. That is, we compared A+ and B+ in Figure 1.

### Ex ante analysis

Global status of the smartphone business, and Samsung

In terms of global supply status of lithium-ion batteries, which are used for smartphones, Samsung SDI ranked first, accounting for 23%; Panasonic was in second place, with 21%, followed by LG Chem (15%), Amperex Technology (10%), and Sony (about 8%); these figures are for 2015. This indicates that Samsung is achieving the world's largest production of smartphone batteries. The global market share of Samsung smartphones has rapidly increased over the past 10 years, as shown in Figure 2, from 1.8% in 2007 to 32.3% in 2013, at which time Samsung developed the world's first 5-inch large-screen smartphone, and on to 22.1% in 2016. Recently, however, Samsung's market share has slightly decreased because of the rise of Xiaomi, Vivo, Oppo, and Huawei.

According to an experiment conducted by the German branch of Samsung Electronics, in terms of battery capacity and time of smartphones, LG Electronics's G5 sustained 2,800 mAh for 6 hours, 31 minutes, and 49 seconds; the Huawei P9 had a value of 3,000 mAh for 6 hours, 51 minutes, and 43 seconds; Sony Xperia X had a value of 2,620 mAh for 7 hours, 15 minutes, and 35 seconds; HTC 10 had a value of 3,000 mHa for 8 hours and 3 seconds; Apple iPhone 6S had a value of 1,715 mAh for 8 hours, 13 minutes, and 57 seconds; Samsung Galaxy S7 Edge had a value of 3,600 mAh for 10 hours, 30 minutes, and 14 seconds; and Samsung Galaxy S7 had a value of 3,000 mAh for 10 hours, 59 minutes, and 11 seconds. In other words, with regard to the total usage time for each smartphone battery, Samsung ranked first. However, in terms of the total use time for a smartphone battery against the battery capacity, the battery efficiency of Samsung smartphones was vely low. In fact, to improve battery efficiency, Samsung Electronics has made efforts to reduce smartphone battery size by using more compact components. The ratio of the battery size in the Galaxy Note 3 was 21.0% in September 2013; that of the Galaxy Note 4 was 21.2% in October 2014; that of the Galaxy Note 5 was 20.4% in August 2015; that of the Galaxy S7 Edge was 22.7% in March 2016; and that of the Galaxy Note 7 was 19.4% in August 2016. Samsung Electronics has made intensive efforts to increase the smartphone battery time and capacity and to decrease the battery size over the past two to three years.

In 2015, smartphones, that is, mobile devices, accounted for about 50% of all sales of Samsung Electronics. Its mobile devices formed 44.6% of this total; non-mobile computers were 1.3%; device solutions—semiconductors / memory cards were 21.1%; display panels—LCD and OLED panels were 12.2%; visual display business—digital TVs were 13.0%; and other consumer electronics—printers, air conditioners, and refrigerators were 7.8% among the sales of Samsung Electronics. The ratio of the sales of smartphones at Samsung Electronics rapidly increased.

### **Overview of Samsung Galaxy Note 7 explosion**

As the combination of various components of a product, its size and range, and its development speed significantly grow, the possibility of an unexpected mutant, which is a risk, in a product system increases; it is believed that this risk exists for all such complex products (Mitroff & Anagnos, 2001, pp. 23–25). Crises faced by companies are related to either their corporate systems or to their products, and involve technical factors and managerial factors such as organizational structure, human factors, organizational culture, and the philosophy of top executives (Mitroff & Anagnos, 2001, p. 44).



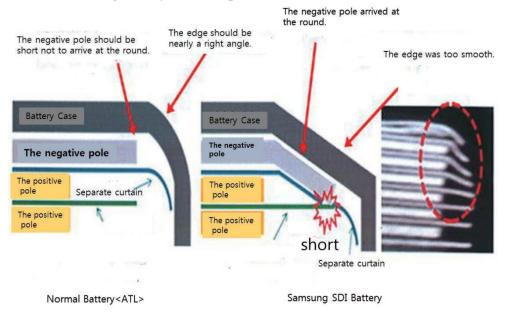


19         Samsung Electronics officially launched the Galaxy Note 7 in Korea and the U           24         A user on a Korean Internet community board showed a photo of a burned Note 7.           29         A video showing a burned Galaxy Note 7 was uploaded on YouTube.           September         31         Samsung Electronics suspended the supply of the Galaxy Note 7 to Korean service providers.           October         1         The Korean Agency for Technology and Standards requested a report on the of the investigation into the explosion by Samsung Electronics.           2         Samsung Electronics officially announced that a battery fault had caus explosion and decided to stop selling the smartphone and to make replacement           8         The Federal Aviation Administration recommended now allowing the Galaxy Note 7.           9         The Consumer Product Safety Commission (CPSC) recommended users stop the Galaxy Note 7.           10         Samsung Electronics instructed Korean and American customers to stop us Galaxy Note 7.           10         Samsung Electronics started to replace the Galaxy Note 7 with a n in all stores across the nation.           November         1         Samsung Electronics started to sell the new Galaxy Note 7.           19         Korean mobile service providers started to replace the Galaxy Note 7 with a n in all stores across the nation.           November         1         Samsung Electronics started to sell the new Galaxy Note 7.           5 <td< th=""><th>Time (2016)</th><th>Date</th><th>Development</th></td<>	Time (2016)	Date	Development
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7 units around the world. (Discontinued)		11	Samsung Electronics announced it would suspend selling and replacing Galaxy Note 7 units around the world. (Discontinued)

### Table 2 Development of the Samsung Galaxy Note 7 explosion

Source: SiSa In (Oct. 27, 2016, No. 475 "Galaxy Note 7 Explosion, How did Samsung Electronics aggravate the situation."

The characteristic of the development of this incident was that the risk and impact of the incident dramatically expanded and likely became uncontrollable when the Korean Agency for Technology and Standards, the Consumer Product Safety Commission, and Samsung Electronics interactively handled this problem. When Samsung Electronics responded to this issue, it did not interact with its customers because its focus was on interacting with the risk management organizations of the U.S.A. and Korea. Thus, the risk of this incident dramatically increased, leading to the discontinuation of the smartphone unit.



### Technical cause of Samsung Galaxy Note 7 explosion

Fig. 2 Conceptual diagram of the technical cause of the Galaxy Note 7 explosion

Sources:

Pressian, Oct. 12, 2016 "The battery explosion was caused by the wrong design of Samsung SDI." Hankookilbo, Sep. 2, 2016 "What is the cause of the Galaxy Note 7 explosion", and in-depth interview results.

At the time, Samsung Electronics explained that the explosion of the Galaxy Note 7 was caused by "a slight problem that occurred during the battery cell manufacturing process." Overall, according to the related article description and the interview with the person concerned, among the two channels supplying smartphone batteries to Samsung Electronics, China ATL and Samsung SDI, there was a problem in the batteries supplied by Samsung SDI. As shown in Figure 2, normal batteries should meet the two conditions supplied by ATL. First, the negative pole should be short so that it does not to arrive at the round end. Second, the edge should be nearly a right angle. However, the Samsung SDI batteries did not meet these two conditions and short-circuited, leading to eventual explosion. First, the negative pole arrived at the round end; second, the edge was too smooth.

As can be seen in Figure 3, when a 3,500 mAh battery with a size almost identical to the 3,600 mAh battery of the Galaxy S7 was inserted into a space that is significantly smaller than that of Galaxy S7, the battery short-circuited.





Fig. 3 Comparison between batteries of Galaxy Note 7 and Galaxy S7

# Change of benefits and cost of closed innovation in paradigm shift Tradition of Samsung's innovation: closed innovation in a closed innovation-dominant paradigm (A)

Byung-Chul Lee, the founder of the Samsung Group, said that all businesses have their own risks, and yet some businesses are indeed riskier than others. Thus, he stressed that related risks should be eliminated one by one in any kind of plan, which proved to be one of his entrepreneurial gifts (Yajiman Ganji, Lee (translation), 2006, p. 119). With this, he also suggested that the manageable innovation promotion of closed innovation is the innovative spirit of Samsung, saying that "The duty of an entrepreneur is to do business that no one does or can do" (Yajiman Ganji, Lee (translation), 2006, p. 165). For this purpose, he founded the Samsung Electronics Industry Co., Ltd. in January 1969, a time when Korea did not have any technological foundation. Despite his thoughts on closed innovation, however, he established open innovation based on technology accumulation as his corporate vision. As a contributor to a newspaper, he mentioned that "The electronics industry can have extensive joint development of new fields and technologies only when it systemizes and mutually assists domestic companies;" he clarified the development direction of the industry, saying it should be based on its own technology development accumulation. After that, Samsung worked with advanced technology companies until the 1970s, creating companies like Samsung-Sanyo Electronics (renamed Samsung Electro-Mechanics), Samsung NEC (renamed Samsung Electronic Tubes), and Samsung Corning. Samsung also focused on securing its own technologies for a short period. The efficient introduction and absorption of technologies and capital, an aggressively competitive internal system, and improvementfocused technology development were stressed in the main electronic businesses of the company.

Source: Ohmynews, Sep. 2, 2016.

In its aim for development, Samsung aggressively and boldly invested in the semiconductor field, attempting to acquire first-mover advantage (Choi, 1996; Kim, 1997; Mathews & Cho, 2007, p. 25). This innovation of Samsung Semiconductor, with its diverse strategies such as rapid, aggressive, and massive investment, mass production system establishment, fast achievement of goals, and various process innovation, technology selection, and intensification and diversification to reduce production costs, formed an archetype of the closed innovation strategy of the closed innovation–dominant paradigm (Shin & Jang, 2006, pp. 37, 48, 58, 66). Samsung Electronics formulated a strategy of securing first-mover advantage through massive investment and research and development (R & D) and maintaining of these things in the semiconductor field. More concretely, to maintain and develop the advantage of leaders in the semiconductor sector, Samsung promoted speed management based on a strict internal control system, a diversified structure that can carry out all matters in the company; synergy between internal organizations; and a combination of internal R & D and production that allows internal R & D to directly lead its own production; this allowed Samsung to realize a strong closed innovation strategy.

Samsung's way of management is called the "Samsung-Style Paradox Management," which presents the closed innovation strategy in the closed innovation–dominant paradigm with the following paradoxes: 1) Become a large and prompt organization with an emphasis on both status and execution; 2) Observe horizontal and vertical diversification and specialization; and 3) Mix and match the strengths of American and Japanese management styles (Song & Lee, 2014, p. 20). These three core success factors, pointed out as a paradox management, such as prompt decision-making and execution, synergy through convergence, and evolutionary change, are in congruence with the core success factors of closed innovation in the closed innovation–dominant paradigm. With this, Samsung-Style Paradox Management includes the following: 1) Fusion of leadership for East to meet West, 2) Perpetual crisis and contingency planning, and 3) Speed for the survival of the fastest (Kim & Valdez, 2014; pp. 97, 99, 103). The strong points of closed innovation under the closed innovation–dominant paradigm is are identical to the key factors of paradox management of Samsung, such as the massive R & D investment and fast speed to maximize the first-mover advantage, the leading of marketization of faster R & D performance through internally diversified recombination, and continuous evolution through internal R & D and internal fusion.

The Frankfurt Declaration of Kun-Hee Lee in 1993, which was a "new management declaration," was the climax of the closed innovation strategy in the closed innovation–dominant paradigm. There, Lee stressed essential innovation such as quality rather than quantity and love for customers and human beings rather than instant and superficial improvement (Son and Lee, 2013; p. 149). Leading the market through internal investment in R & D and rapid response to customer requirements, and by meeting customer expectations quickly, was the direction Lee wanted to pursue.

### Samsung under a new environment: closed innovation in the open innovation-dominant paradigm (A+)

Samsung is a dominant company in home appliances like TVs and washing machines, but it is its smartphones that have made Samsung a household name like Walt Disney and Toyota Motors (Grobart, 2013). The Samsung smartphone business embraced Android, the open-access operating system (OS) of Google, in 2009, but its first smartphone did not attract much attention from the public. Despite this, however, in 2010 Samsung introduced the Samsung Galaxy S line and launched various smartphone models with bigger screens, ranging from 2.8-inch to 5-inch units; these screens were different from those of other smartphones. This method of manufacturing devices with similar functions yet of different



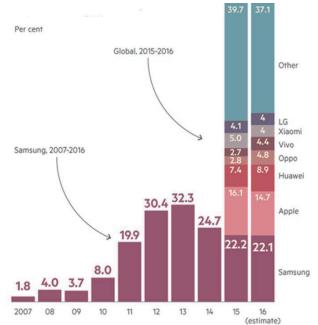


sizes to identify which would do well in the market is an uncommon practice given its high cost (Grobart, 2013), but it was made possible because Samsung promoted the closed innovation strategy, which involved a vertical integration production structure in which its display, memory, processors, and other high-tech parts were internally produced and assembled. While Apple produced a minimum number of smartphone models with a unique design, Samsung rapidly produced smartphones with all kinds of designs, watched the market's response to all of them, and modified the products. In other words, Apple achieved the vertical integration of the smartphone OS, but Samsung achieved the vertical integration of hardware and, through extensive closed innovation, identified the product that customers wanted and then rapidly produced it.

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Since its first launch of the Galaxy smartphone series in 2010, Samsung has seen customer demand for large-screen smartphones. As shown in Figure 4, Samsung's global market share was 19% in 2011, 30.4% in 2012, and 32.3%, 2013, ranking first in terms of the total production of smartphones in the world. However, the highest market share of Samsung smartphones was achieved through a typical closed innovation strategy. In other words, Samsung itself produced its main smartphone parts and innovated them as much as it could, in addition to producing smartphones with various types and structures and finding and meeting customer demand and expectations.

However, we need to pay attention to the shift of the smartphone business environment from the closed innovation-dominant paradigm to the open innovation-dominant paradigm. Thus, the global market share of Samsung smartphones rapidly dropped from 32.3% in 2013 to 22.1% in 2016. During Samsung's downturn, Chinese smartphone manufacturers, such as Xiaomi, Vivo, Oppo, and Huawei, grew. The benefits of the first mover in the market, acquired through the development of various product lines together and massive investment, was lost in a very short period. Since then, new product competitors have grown exponentially and extended their market share. As of May 2017, Chinese smartphones accounted for about 20% of the European market.



**Fig. 4** Smartphone market share of Samsung from 2007 to 2016 Source: Financial Times (November 10, 2016), and Strategy Analytics.

The reason that Samsung enjoyed the advantages of being a global leader in the memory semiconductor and display fields, and ranked first in the global market through the use of the closed innovation strategy, is that this strategy matched the closed innovation–dominant paradigm of the industry. Since that time, however, the reason that Samsung's smartphone business has faced a significant decrease in its global market share of over 10% in the three years after it achieved global top smartphone market share, is that Samsung's closed innovation strategy did not match with the open innovation–dominant paradigm of the smartphone industry.

### Risk surging by closed innovation strategy and management of Samsung Electronics

The main risk of closed innovation under the open innovation-dominant paradigm, in terms of management, is that the first-mover advantage has a shorter product life cycle. As a prime example, Samsung Electronics experienced a rapid reduction in its global market share from 32.3% in 2013 to 20.1% in 2016—a short period of three years. Samsung promoted the traditional closed innovation strategy, in which it developed new and diverse smartphones and launched them quickly in the market. This speed-focused management strategy, however, eventually led to the major oversight that led to the Samsung Galaxy Note 7 explosion.

According to interviews and articles, it can be assumed that the development of numerous sizes of batteries by Samsung SDI, shortly after the internal built-in battery was adopted, caused a battery pack design fault that stemmed from problems of management.

Samsung verified the quality of its smartphones through a fast process; this efficiency of the closed innovation process, such as internal development, use, and verification, however, increased the possibility of product uncertainties or incidents.

To maximize the efficiency and speed of more diverse smartphones rapidly, Samsung Electronics and Samsung reorganized their decision-making structure into an efficiency-based hierarchical structure, rather than a horizontal creativity-centered structure. During the process, the smartphone and smartphone battery production departments and sectors did not engage in horizontal and active discussions, and the unilateral and hierarchical culture increased the uncertainty in the development of new and diverse product lines.

### Benefits and costs of closed innovation strategy

### Evidence of closed innovation strategy by Samsung

Samsung Electronics pursued the closed innovation strategy. It has released many smartphone models within a short cycle, and by surveying the customers' responses to them, improved the units. The strategy was used in the Galaxy S and Galaxy Note series, which are Samsung's main mobile devices. According to Appendix 2, 10 phones under the Samsung Galaxy S series were released from 2010 to 2016. In addition, according to the Appendix 3, 8 phones under the Samsung Galaxy Note series were launched from September 2011 to 2016. In other words, from 2010 to 2016, Samsung Electronics released 18 smartphones only in the Galaxy S and Galaxy Note series. On average Samsung has launched a new smartphone model every 4.7 months since 2010. It should be noted as well that Samsung also released low-end models during the same period. In contrast, Apple launched just 10 smartphones, namely the iPhone, iPhone 3G, iPhone 3GS, iPhone 4, iPhone 4S, iPhone 5, iPhone 5S, iPhone 6, iPhone 6S, and iPhone 7, over the past 10 years since its first iPhone was released in 2007.





Under this situation, Samsung Electronics enjoyed first-mover advantage for large-screen smartphones when the Galaxy S3 (a 4.8-inch phone) in 2012 and the Galaxy S4 (5.0-inch phone) in 2013 drew much attention from customers in the global market. However, Samsung's leading position rapidly shrank in just two to three years because of Apple's iPhone 6 series, released in 2014, and Chinese smartphone manufacturers' production of large-screen devices.

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While Samsung Electronics was quickly developing and releasing new devices, no one can deny that the process complexity increased. Since the company first adopted a built-in battery in 2015, the battery pack design, the battery operating time, and the battery capacity have been sources of high uncertainty. Because the company has implemented various functions for smartphones over short periods of time, such as increasing the battery operating time and capacity and decreasing the battery volume, related uncertainties have increased.

### Benefits of closed innovation strategy by Samsung Electronics

Samsung achieved the top share in the global smartphone market through its "excellent research and development capacity and well-accumulated innovative workforces." In fact, though, the company was passive about M&As with other companies, except for the Harman case. By strengthening its internal capacity, Samsung has made efforts to improve unification of its systems from parts to finished products. With continuous investment in R & D and differentiation from other companies in terms of performance and quality, Samsung Electronics successfully launched the Galaxy series and explored new smartphone fields, like the Galaxy Note. In addition, it continued to develop product differentiation such as edge screen, iris recognition, and Bixby AI. While pursuing the traditional best follower strategy, Samsung Electronics successfully accumulated amazing technical capabilities, such as excellent manufacturing capacity and its own procurement capability, unmatched by other competitors, through vertical integration in the hardware sector, allowing the company to produce internally completed products. "One genius can feed millions of others"-this management philosophy of Kun-Hee Lee already stresses the management strategy of Samsung, which focuses on internal capacity. In fact, current and former employees of Samsung Electronics, as well as reporters and experts, all mentioned that the main success factor of Samsung smartphones was "Samsung Electronics's internal R & D and internal innovation capacity accumulation."

In terms of the existence and contribution of open innovation when Samsung Electronics obtained its high global market share, current employees, reporters, and experts had different opinions. In addition, they thought the contribution was not high according to interviews. However, the recent movements of Samsung Electronics, such as the acquisition of LoopPay of the US, which became Samsung Pay, through use of massive internal reserves, and that of Harman, a top global acoustic apparatus company, have shown the use of a new open innovation strategy.

### Costs of closed innovation strategy by Samsung Electronics

It was said that the cause of the Galaxy Note 7 battery explosion in terms of management was "internal research and development and innovation capability accumulation." This was cemented by the results obtained from this study's in-depth interviews with current and former employees of Samsung Electronics, reporters, and experts. For example, as Samsung Electronics continuously received its smartphone batteries from Samsung SDI, its own efforts made to improve the quality of batteries through

diversification of battery suppliers became insufficient. Samsung Electronics itself pointed out that the supplier in Samsung Group had to meet fixed deadlines and that there was not enough time to fully verify the batteries. In addition, an opinion that its long corporate culture of command and discipline had been accumulated through a long closed innovation process, leading to the battery explosion, was suggested several times. There was another opinion that the incident was caused by the internal way of operating the overall value chain including R & D in Samsung Electronics. If there are different opinions in an organization, they should be clearly expressed and handled. However, that process was considered as having low efficiency and appeared to be rejected. In other words, the high efficiency of Samsung's management system is the actual cause of its products being more exposed to risk factors or uncertainties.

The interviewees also agreed that the explosion was not caused by the result of the "externally excellent R & D performance and innovation capacity acquisition process"; that is, in terms of management, they all thought the explosion was not related to the open innovation strategy at all.

# Where should Samsung Electronics go?—The future of Samsung's smartphone innovation strategy

Members and nonmembers of Samsung all agreed that the company needed to continuously and actively obtain innovation capacity from "the outside" and continue to have the top innovation capacity globally. In particular, the current department heads of Samsung Electronics, who directly witnessed the acquisition of Harman, highly agreed with this opinion. Strictly speaking, the current employees of Samsung Electronics who were there at the time of the scandal and the successful acquisition of Harman and Viv Labs strongly recommended the open innovation strategy as the future development strategy of Samsung Electronics. With the acquisition of Harman, the company itself experienced the possibility of launching a new business and the usefulness of technology acquisition. It is necessary for Samsung Electronics to watch the technologies and markets of global startups and aggressively and initially invest in companies in order to create new business in the future. A former department head of Samsung Electronics who did not experience the success of open innovation suggested promoting both closed and open innovation. In particular, in the case of the software sector, even though Samsung Electronics has exerted much effort to develop internal capacity, this effort has clear limits in acquiring technologies over a short period. Recently, Samsung's active M&A actions are in the same vein. However, as Samsung Electronics does not have high open innovation capacity like that of Google and Apple, it is suggested that maximizing the acquisition of open innovation capacity by actively seeking to cooperate with venture companies or small- and medium-size companies around the world with advanced technologies should be the core project for the company. Achieving the mass production of a new business over a short period by a big business like Samsung Electronics through an M & A or partnership with a start-up or SME is the way to overcome the growth limits of capitalism as described in Schumpeterian Dynamics of Open Innovation (Yun, 2015).

### **Discussion, and Conclusion**

### Discussion

# Causal Model of 4<sup>th</sup> Industrial Revolution and Innovation Paradigm Shift from CI into OI

As the 4<sup>th</sup> industrial revolution is being motivated, the paradigm of innovation is changing from closed innovation to open innovation. The 4<sup>th</sup> industrial revolution means higher technology innovation





acceleration by smart IT. As in the <Appendix 3> causal loop model, if a higher technology innovation acceleration situation does not change in the 4<sup>th</sup> industrial revolution, bigger open innovation will be motivated continuously. But in higher technology innovation, smaller closed innovation will be motivated continuously. If the technology innovation acceleration increases, a new combination will also increase, and the value of timely acquisition of external innovation compared to that of the proprietary exploitation of internal innovation will also increase. In the end, the innovation paradigm will shift from closed innovation to open innovation. In addition, organization learning for open innovation or closed innovation usage will motivate additional open innovation or closed innovation.

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But if the technology innovation acceleration decreases, open innovation will decrease continuously, and closed innovation will increase continuously. This is to say, this causal loop model is dynamic reversible, in contrast to the Senge's Success to the Successful (Senge, 1990, p 25).

In this model, there are 2 reinforcing loops, as follows. One is the open innovation-reinforcing loop. The other is the closed innovation-reinforcing loop.

Table 1. 2 Reinforcing Loops in causal model of 4<sup>th</sup> industrial revolution

R1 (R1) Advantage of Open Innovation and Internal Development  $\uparrow \rightarrow$  Relative Advantage of Open Innovation compared to Closed Innovation  $\uparrow \rightarrow$  Usage of Open Innovation (OI Innovation Usage)  $\uparrow \rightarrow$  Organizational Learning for OI Usage  $\uparrow \rightarrow$  Efficiency of OI Usage  $\uparrow \rightarrow$  reinforcing Advantage of Open Innovation and Internal Development  $\uparrow$  loop

R2

Closed (R2) Advantage of Closed Innovation and External Acquisition  $\uparrow \Rightarrow$  Relative Advantage Innovation of Open Innovation compared to Closed Innovation  $\downarrow \Rightarrow$  Usage of Closed Innovation (CI reinforcing Usage)  $\uparrow \Rightarrow$  Organizational Learning for CI Usage  $\uparrow \Rightarrow$  Efficiency of CI Usage  $\uparrow \Rightarrow$ loop Advantage of Closed Innovation and External Acquisition  $\uparrow$ 

### Conclusion

### Benefits and costs of closed innovation strategy in Samsung Electronics

First, the global top market share of Samsung smartphones was mainly due to its successful closed innovation strategy. Second, the leading cause of the Galaxy Note 7 explosion in terms of management was also that strategy. That is, Samsung Electronics's internal R & D and technology innovation capacity accumulation allowed the rapid development of newer and more diverse smartphones than those of other smartphone manufacturers, the launching of those products in global markets, and the increasing of Samsung's market share around the world. However, this fast internal innovation process eventually led to the Galaxy Note 7 explosion.

### Internal impact of the Galaxy Note 7 explosion on Samsung Electronics

Samsung Electronics has successfully grown as a global company in the memory semiconductor, home appliance, and display fields with its long-term closed innovation strategy; through this strategy, it was able to become a global smartphone manufacturer with the number one global market share. The Galaxy Note 7 explosion gives an opportunity to remove the Not-Invented-Here syndrome of the

company, focusing on the closed innovation strategy (Čirjevskis, 2016; Witt, 2016). This shows that more and more current employees of Samsung Electronics agree with the necessity and possibility of applying an open innovation strategy for a short period. However, former employees of the company who only experienced success in closed innovation maintain their preference for the closed innovation strategy. Current employees who experienced the explosion look at the necessity and possibility of the open innovation strategy with high expectations.

### Success in open innovation strategy requires much investment and effects

Jeff Bezos, CEO and founder of Amazon, experienced a painful failure in many M&As that he initially invested in with the capital acquired by going public with his company. His experiences in failure and accumulation of open innovation capacity became a driving force of open innovation based technology innovation capacity accumulation and development (Stone, 2013, p. 201). The open innovation strategy involves high complexity and costs. The largest cost is internal resistance (Yun, Won, & Park, 2016). In addition to the Not-Invented-Here syndrome, internal resistance against destructive innovation that is beyond the existing products and services is the largest cost. Samsung Electronics has been successful in significantly reducing the largest cost generated by the open innovation process of the smartphone business division caused by the Galaxy Note 7 explosion. Systematically combining the open innovation strategy with the Samsung smartphone business sector is vital for the future of Samsung Electronics as well as the smartphone business division. The process of systematically combining open innovation strategy and a company can be achieved by setting a business model as an important innovation target (Yun, Won, Jeong, et al., 2016; Yun, Won, Park, Yang, & Zhao, 2017). The internalization of the open innovation strategy in the Samsung Electronics system, above all, requires the strong support of the creative entrepreneurial spirit of its CEO (Yun, Park, Kim, & Yang, 2016). Because of the Galaxy Note 7 battery explosion, whether Samsung Electronics CEO's active suggestion of the direction leads to the construction of an open business model platform at Samsung Electronics needs to be analyzed in the future.

### **Research limitations and future study**

This study intensively analyzed the causes and impact of the smartphone battery explosion of Samsung Electronics, the company with the largest global market share, and the smartphone unit's withdrawal from the market, which was considered a novel case in terms of business strategy. For this, local and overseas news articles, previous research, and in-depth e-mail interviews with related experts were utilized.

Through the interviews with the current employees of Samsung Electronics for each section and the analysis of the internally diverse systems, R & D on the procedures, steps, and system of open innovation of Samsung Electronics is important for future study.

### Acknowledgments

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# Appendix 1

# Half-structured questionnaire for in-depth interview about the cause and impact of the Samsung Galaxy S Note 7 explosion and withdrawal scandal

# 1. Purpose of this research

Recently, the Samsung Galaxy S8 was released and is attracting much attention around the world. Given Samsung's status, we want to identify the cause and impact of the Galaxy Note 7 explosion in terms of management.

# 2. Use of research results

First, this research result will be presented by Professor JinHyo Joseph Yun, president of SOItmC, during his keynote speech in SOItmC 2017.

Second, this research result will be reviewed and published as an SOItmC 2017 special issue paper of JOItmC.

Third, this research result will be used as basic research data for management strategy consulting for Samsung and similar Korean and overseas companies.

# 3. Composition and answers of questions

There are four main items, each of which poses quantitative questions following a five-level Likert scale. An explanation (qualitative) behind the answers is necessary per item.

Second, an interviewee can answer each question for up to 3 minutes, and this entire questionnaire for 18–20 minutes.

Third, if you can have an in-depth interview individually, please answer the questions in this questionnaire and accept the in-depth interview request.

### 4. Interview

Please indicate to what extent you agree or disagree with each statement.

1) Samsung smartphones achieved the world's largest market share in a short period.

(1) The achievement was caused by its excellent research and development and its innovation capacity that has been well accumulated internally. (Excellence of internal resources)

1 Strongly disagree 2 Disagree 3 Neutral 4 Agree 5 Strongly agree

<Please describe the cases or evidence.>

(2) The achievement was caused by the acquisition and internalization of globally excellent research and development performance and innovation capacity. (Use of external resources)

① Strongly disagree ② Disagree ③ Neutral ④ Agree ⑤ Strongly agree

<Please describe cases or evidence.>

2) Unlike other battery explosion incidents of iPhones and other smartphones, the case of the Galaxy Note 7 had an enormous impact on Samsung Electronics.

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(1) Samsung Electronics only focused on "internal" research development capacity accumulation and "internal" innovation capacity accumulation.

① Strongly disagree ② Disagree ③ Neutral ④ Agree ⑤ Strongly agree

<Please describe the cases or evidence.>

(2) The incident occurred during the process of "externally" acquiring excellent research and development performance and innovation capacity.

1 Strongly disagree 2 Disagree 3 Neutral 4 Agree 5 Strongly agree

<Please describe the cases or evidence.>

3) We would like to ask you about the impact of the Galaxy Note 7 explosion.

(1) The explosion incident will continuously have a negative impact on the future of the Samsung smartphone business because the negative image and customer perception of Samsung and its products have not been removed.

1 Strongly disagree 2 Disagree 3 Neutral 4 Agree 5 Strongly agree

<Please describe the cases or evidence.>

(2) The explosion incident will give an opportunity for Samsung Electronics to strengthen the selflearning and countermeasure capability of its smartphone business and finally develop its business further.

① Strongly disagree ② Disagree ③ Neutral ④ Agree ⑤ Strongly agree <Please describe the cases or evidence.>

4) We would like to ask you about the future strategy of the Samsung smartphone business.

(1) By continuously accumulating "internal" research and development capacity, Samsung is set to have the global top innovation capacity and lead the innovation of the global smartphone business.

(1) Strongly disagree (2) Disagree (3) Neutral (4) Agree (5) Strongly agree

<Please provide concrete suggestions.>

(2) By continuously acquiring innovation capacity actively and "externally," Samsung is set to continuously secure the global top innovation capacity.

1 Strongly disagree 2 Disagree 3 Neutral 4 Agree 5 Strongly agree

<Please provide concrete suggestions.>

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Galaxy	Galaxy S1	Galaxy S2	Galaxy S3	Galaxy S4	Galaxy S5		Galaxy S6		Galaxy S7	
S Series						Galaxy S6	Galaxy S6 Edge	S6 Edge Plus	Galaxy S7	Galaxy S7 Edge
Issue data	Jun. 2010	Apr. 2011	Jun. 2012	Apr. 2013	Apr. 2014		Apr. 2015		Mar. 2016	
Display	4.0 inch	4.3 inch	4.8 inch	5.0 inch	5.1 inch	5.1 inch	5.1 inch dual covered	5.7 inch duel covered	5.1 inch	5.5 inch duel covered
Mobile AP	Exynos 3110	Exynos 4210	Snapdragon S4 Exynos 4412	Snapdragon 800 Exynos4412	Snapdragon 801 Exynos 5422	Exynos 7420	Exynos 7420	Exynos 7420	Exynos 8890 Snapdragon 820	Exynos 8890 Snapdragon 820
Camera	Front 0.3M Back 5M	Front 2M Back 8M	Front 1.9M Back 8M	Front 2M Back 13M	Front 2M Back 16M	Front 5M Back 16M	Front 5M Back 16M	Front 5M Back 16M	Front 5M Back 12M Dual pixel	Front 5M Back 12M Dual pixel
Inner memory	8, 16GB	16, 32 GB	16, 32, 64 GB	16,32,64 GB	32, 64 GB	32, 64 GB	32, 64, 128 GB	32 GB	32, 64 GB	32, 64, 128 GB
so	Android 2.1	Android 2.3	Android 4.0	Android 4.2	Android 4.4	Android 5.0	Android 5.0	Android 5.1	Android 6.0	Android 6.0

Source: Etnews, Apr. 26, 2017

Appendix 2. Samsung Galaxy Note Series

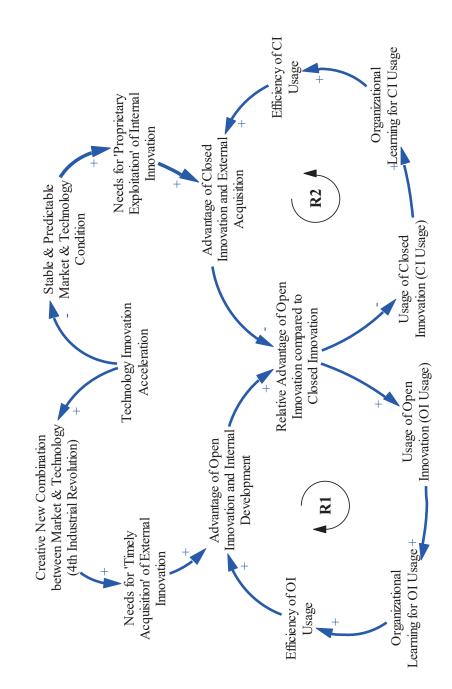
Galaxy Note Series	Galaxy Note 1	Galaxy Note 2	Galaxy Note 3	Galaxy Note 3 Neo	Galaxy Note 4	Galaxy Note 5	Galaxy Note 6	Galaxy Note 7
Issue data	Sep. 2011	Aug. 2012	Sep. 2013	Jan. 2014	Sep. 2014	Apr. 2015	Aug. 2015	Aug. 2016
Display	5.29 inch	5.55 inch	5.7 inch	5.5 inch	5.7 inch	5.1 inch	5.7 inch	5.7 inch
so	Android 2.3	Android 4.2	Android 4.3	Android 4.3 Android 4.4 Android 4.4 Android 4.4	Android 4.4	Android 4.4	Android 5.1	Android 6.0

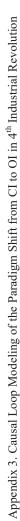
Source: Samsung Galaxy Note Series Home Page















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# Taking Advantage of Emergence for Complex Innovation Eco-Systems

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### Taking Advantage of Emergence for Complex Innovation Eco-Systems

Our most pressing societal problems such as enhancing health care, developing alternate energy, revitalizing cities, and advancing the economy are complex innovation eco-systems. Complex innovation eco-systems are the next frontier in technology and innovation management, and require a transformation in strategic and institutional management so that managers can muster the staying power to persist and learn far into the future. I develop a framework to explain how participants can strategize across an entire eco-system, deal with the profound ambiguity from complexity, and handle the very long cycle times of complex innovations. Transformed strategic and institutional management combines abductive learning routines with clock-time and event-time pacing to map a portfolio of value creating opportunities far into the future. Eco-system participants use learning events, which represent available knowledge, to hypothesize new value creating opportunities and new kinds of governance structures for specific collaborations, evaluate these opportunities and governance structures by trying them out to explore assumptions and surface new possibilities, and reframe them over time.

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# Taking Advantage of Emergence for Complex Innovation Eco-Systems

Many of society's most pressing problems are complex innovation eco-systems. Pharmaceuticals, health care more generally, alternate energy systems, climate control, education, and myriad social problems rely on ongoing innovation to continually generate new projects, products, programs, processes, capabilities, and value creation opportunities that address these critical challenges. These "grand challenges" (Ferraro et al 2015) represent the next frontier in technology and innovation management, because they require new theory for managing multiple organizations, agents, and agencies, and new theory for collaborative learning about the co-evolution of sciences and technologies among vast, globally dispersed networks of knowledge workers.

Taking advantage of emergence is a central capability around which new theories for complex innovation eco-systems will build. Innovators in complex eco-systems must take advantage of the emergence of knowledge about sciences, technologies, user needs, delivery systems and so on for their new products and programs, because knowledge for innovation does not already exist. Taking advantage of emergence refers to grabbing the inherently fragmented and noisy information that abounds in complex eco-systems, configuring information bits into potential solutions for concrete problems, and using these configurations to learn about what might work, what else seems relevant, and how to reframe ideas to accumulate more noisy bits of information into better and better solutions.

To take advantage of emergence, new theory must tackle three distinctive challenges: 1) involve the entire system, not single firms; 2) encompass ambiguities of complexity, which means that the simple rationality typical of conventional economic-based strategy cannot work (Tsoukas 2005; Grandori 2010); and 3) incorporate very long term horizons rather than short term clock-time and schedules. I build on recent research by myself and colleagues to propose one new thrust that tackles these three challenges: building the strategic and institutional infrastructure to anchor and guide product, process, and program innovation.

First, to incorporate the entire system, Dougherty (2016) suggests a way to unpack the complexity without obscuring the inherent interdependencies among activities. Rather than chop complex problems into separate bits to be worked on separately, complex systems require that four entire problem-setting and problem-solving cycles of innovation be worked on simultaneously and continuously. These four problem cycles are: projects – working on the innovation project (which, like curing cancer, are enormous, global networks); processes – continually integrating diverse emergent sciences to support projects; strategies – experimenting with value creating opportunities that map far into the future; and institutions – generating collaborative commons. Second, to encompass ambiguities, Dunne and Dougherty (2016) develop abductive reasoning to work on all these problems. Third, to address long term emergence and mustering the requisite staying power to persist and learn despite short term pressures, Dougherty et al (2013) develop a way to leverage diverse temporal structures (kairos along with chronos) to leverage emergent knowing and gauge progress over the very long term.

This essay focuses on the strategic and institutional cycles of problem setting and solving. These cycles are the least well developed, but unless people continually work on these particular problems to





frame project and process development, innovators in complex eco-systems cannot take advantage of emergence. and so they cannot innovate very well at all. "Strategic and institutional" managers include the managers of the many businesses in the innovation system along with those in many other agencies, public and private, who work on pulling resources together to enhance, commercialize, make better use of, and rethink opportunities. I also rely on examples from bio-pharmaceuticals to illustrate points, but hope that those interested in other complex innovation eco-systems can think about applying these ideas to their domains as well.

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Two limits of existing research in technology, science, and innovation management prevent effective development of theory for complex innovation eco-systems: looking mostly at the firm level, and assuming away emergence. First, most research concentrates on the firm level, and addresses eco-system concerns with generic dynamics such as technology trajectories or a presumed flow of knowledge from science to industry. But complex eco-systems require active, deliberate management of these dynamics that is focused on specific concrete problems so that new products and processes can continually emerge and be experimented with, rethought, and revamped over time. We know that all innovations at the firm level require strategic guidance that defines the goals of innovation, creates long term resource development to support particular thrusts, and provides a strategic direction to shape and guide day to day activities (Leonard-Barton 1995). The same logic applies to complex innovation eco-systems, but now the strategizing must occur across the system in collaboration among many agents and agencies. Managers not only need to develop and implement long term strategies, they also need to continually create governance structures of various kinds that enable collaboration.

An example helps to illustrate the strategic and institutional problem setting and solving cycles. Participants in the biopharmaceutical complex innovation system have already developed a large repertoire of possible strategies, so there is no shortage of ideas for what managers ought to do. Among these ideas are: 1) develop new classes of therapeutic compounds and treatment modalities; 2) deliver therapies via collaborations with hospitals and patient associations; 3) discover drug families that address diverse genetic make-ups among patients; 4) deploy emerging sciences and technologies such as diagnostics, or research areas like epigenetics into networks of commercial collaborations; and 5) shift to open innovation (Christensen et al 2009; Pisano 2006; West and Nightingale 2009; Chesbrough 2003). A perusal of literatures on other complex innovation eco-systems would reveal a similarly rich repertoire of possibilities for addressing these various grand challenges. All these possible strategic thrusts listed above involve collaboration among a variety of agents and agencies, both public and private, so most new strategies also require ongoing development of governance arrangements so that diverse agents and agencies can collaborate on innovative strategies, processes, and projects.

However, societies fail to implement these possible strategies, in part, I suggest, because we do not develop the infrastructure for setting and solving strategic and institutional challenges. Pharmaceutical companies compete mostly in block-buster strategies, and throw away emerging possibilities in therapies that might not become major money makers. Bio-medical scientists generate astonishing new ideas in genomics, gene therapy, systems biology, bio-informatics, proteomics and so on, but they do not develop how particular ideas interact with other sciences to enable drug discovery – which continues to flounder (Scannell et al 2012). Educational systems seem to blame teachers for all the failures, and do not interrogate how well the knowledge system, strategic, and institutional challenges are being addressed to enhance classroom teaching. Focusing on the healthcare complex innovation eco-system, Nelson says

(2005: 208):

Today, some of our most difficult problems involve developing the social technologies needed to make new physical technologies effective. Arguably the lion's share of the strains in our health care systems are the result of advances in physical and medicinal technologies that societies have not yet learned how to manage or pay for.

Nelson's new social technologies include strategic and institutional problem setting and solving capabilities to figure out how to manage and pay for all the advances in physical and medicinal technologies. More importantly, it would take these two capabilities to figure out how to configure all of these advances into viable new products, programs, and strategies that actually improve health (Dougherty 2016). Participants in these complex innovation eco-systems must allow the needed knowledge to emerge and evolve more fully, muster the staying power to persist and learn so they can take advantage of emergence, and build interdependent product and program configurations from all these one off inventions, so that they can actually innovate, not simply invent.

The second limit in the literature now is the tendency to ignore emergence over the long term, and focus instead on sudden revolutions. Many scholars suggest that a biotechnology revolution will sweep away existing medicinal sciences and replace them with new abilities – no need for ongoing problem setting and solving for strategic and institutional challenges. However, Pisano (2006), Hopkins et al (2007), and Gittelman (2015) argue that a biotechnology revolution is a myth, because the knowledge needed for innovation has already taken, and will continue to take, decades to emerge. This emergence depends on a co-evolutionary process in which changes in sciences, technologies, industries, clinical care, and regulations will mutually constitute one another (Nightingale 2004). This long time horizon subjects new technologies to large and increasing development costs, not to swift revolutions. Similarly, knowledge intensive endeavors in health, education, or environmental issues embody broad, diffuse objectives rather than clear ends with defined means for achieving them. According to Ansell (2011), these diffuse objectives become ongoing processes of working on them, or possibilities toward which problem solving processes tend.

The essay explains how strategic and institutional managers can shape and guide the complex innovation process productively by: 1) engaging in abductive learning routines to work through institutional strategic problems, and 2) balancing different temporal structures (*kairos* as well as *chronos*) to muster the staying power to persist and learn over the long term. I first draw on the history of industrial management and innovation to explain why transformation in managing strategic and institutional problem setting and solving for complex eco-systems is necessary in the early 21<sup>st</sup> century. Next, I explain how abductive reasoning and multiple temporal structures address these new challenges. Finally, I describe how participants can develop portfolios of value creating opportunities that map far into the future, and establish institutional collaborative commons in order to develop, experiment with, and implement these strategic opportunities.

### Transforming Institutional and Strategic Management to Take Advantage of Emergence

The first transformation in strategic and institutional management in modern society took place during the 19<sup>th</sup> century, when enterprise management shifted from small, sole proprietorships to large organizations around new technologies. In his historical analysis of the rise of industrial society,





Chandler (1977) argues that organization and strategy are as important in building economic growth as are investments in R&D. Technological innovation and organizational innovation are interdependent, because new forms of business organization and institutional arrangements are invented to solve specific economic problems (Pisano 2010). For example, technical advances in steam power, steel making, or mechanical engineering may have made railroads and mass production technically feasible, but a host of novel organizational and institutional arrangements made these technical advances economically feasible. These novel arrangements include administrative hierarchies, professional managers, university programs to train those managers and engineers, formalized capital budgeting systems, accounting and control systems, and corporate governance structures that separate ownership and management. Chandler had this to say about railroads (1977:120, quoted in Pisano 2010):

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No other business enterprise up to that time had had to govern a large number of men and offices scattered over wide geographical areas. Management of such enterprises had to have many salaried managers and had to be organized into functional departments and had to have a continuing flow of internal information if it was to operate at all.

Other capital intensive businesses evolved in a similar way (Nelson 20005). According to Pisano (2010:467): "After reading Chandler, it is hard to think about technological innovation as anything but tightly intertwined with organizational and institutional innovation." A variety of governance structures emerged as well to orchestrate the co-evolution of new sciences and technologies, even though it is often assumed that the "free market" does all the institutional work (Nelson 2005). Emerging technologies like railroads, telephones, and electrical power required considerable government investment and involvement, along with "new" innovations such as public monopolies or eminent domain. But the centrality of strategic and institutional work for innovation tends to get pushed into the background.

If we fast forward to the 1970s, we see that 19<sup>th</sup> century innovations in institutional and strategic management could not deal with new technologies and diverse markets and opportunities. These old innovations focused on economies of scale, and on optimizing existing functioning based on separating steps in the production process, top-down control mechanisms that assume defined means to reach clearly defined ends, and clock-time approaches to gauge progress (e.g., time and motion studies, quarterly reports, yearly plans). These approaches could not allow for continuous product and process innovation. The locus of innovation in many industries moved from the US and Europe to Asia where new businesses emerged to accommodate new technologies of scope and divergent opportunities (Hayes and Abernathy 1980; Clark and Fujimoto 1991).

During the 1970s and 80s, a second transformation in strategic and institutional management ensued to address continuous innovation in products, processes, and business models (Schon 1967; Souder 1985). Regarding strategy, managers and scholars of innovation realized that product and process innovation cannot occur without an effective innovation strategy to develop long term capabilities in technology, marketing, and manufacturing (Day 1990; Roussel et al 1991; Cooper 1998), guide particular innovation efforts so they could draw on these resources, and leverage businesses into emerging markets. Strategic managers could not focus only on optimizing the current functioning of the enterprise. Technologies and markets emerge and evolve, so value creating activities must also continually transform qualitatively. Regarding institutions, monopolies no longer worked and were broken up. They were replaced with more flexible alliances, government sponsored development efforts (e.g., SEMETEC), technology

platform business models (Microsoft WINTEL, airframe manufacturers), standard setting bodies, and other collaborative governance structures.

But as surveys by the Product Development Management Association show (Markham and Lee 2013), more than 90% of the product innovations are incremental. The strategic transformation from the 1980s relied primarily on leveraging existing knowledge, on leveraging architectures for streams of products, and on developing methods for innovation processes that proceeded sequentially through predefined stages, from clear product concepts to market launch. With notable exceptions (e.g., Van de Ven et al 1999), many writers emphasized how to rethink managing and organizing to generate continuous streams of incremental new products (Cooper 1998; Beckman et al 1994). But even incremental innovations required transformation from vertical to horizontal organizing based on multi-functional teams, and from staying the course to enabling new possibilities. Many studies detailed the trials and tribulations of organizations that tried to transform even for incremental innovations (Tushman and O'Reilly 1997), and the significant changes in management that being even incrementally innovative required (Van de Ven 1986; Garud et al 2011; Jelinek and Schoonhoven 1990; Danneels 2008).

Another major transformation in strategic and institutional management processes for innovation is required now to deal with the ambiguities and long term horizons of complex innovation eco-systems. Waves of technological revolutions in digitalization, electronics, communications systems, and other domains generate complex shifts in technology capabilities and market applications. The current explosion in biomedical sciences and other fields generates many very new possibilities for better resolutions of social and economic challenges in health, climate management, economic revitalization and other pressing social needs. Pisano (2010:480) argues that new organizational forms and institutional arrangements are necessary again for science based businesses like pharmaceuticals:

Like the railroads and large scale manufacturing enterprises of 100 years ago, science-based businesses will be a potent source of economic growth in the 21<sup>st</sup> century. And now, as then, these new businesses will demand new organizational forms and new institutional arrangements. In short, we are once again confronted by a serious need to invent new organizational forms and institutional arrangements to deal with a new set of economic problems.

Existing strategic and institutional approaches remain short term oriented and rigid, which preclude taking advantage of emergence. Scholars have already discussed the very new kinds of strategic and institutional processes that are needed. Stacey (1995) argues that managers need to shape and guide the complex innovation process and negotiate their direction in real time by focusing on process rather than content. According to Anderson (1999), managers cannot impose controls a priori, because complex systems react to direction in unpredictable ways. Anderson suggests that managers instead establish and modify the direction and boundaries within which innovations emerge by setting constraints on local actions, observing intermediary outcomes, and tuning the process by altering the constraints. And as already noted, Ansell (2011) points out that complex problems involve diffuse objectives that become ongoing processes of working on them, or possibilities toward which problem solving processes tend. In the next section, I suggest how managers can enact these new ways of eco-system managing by addressing the specific challenges of ambiguity and long term development.





## Abductive Reasoning and Multiple Temporal Structures

### Abductive Learning Routines to Take Advantage of Emergence in Complex Eco-Systems

Considerable research addresses complexity so its challenges are somewhat familiar (Tsoukas 2005; Plowman et al 2007; Garud et al 2011). Complexity means that relations between cause and effect are unknown and must be discovered. Innovators of complex products must figure out what the elements of the product or strategy will be because there are no architectures for complex innovations. Innovators must also figure out how various elements interact to generate the desired functionality, because unknown interdependencies among elements produce unpredictable and potentially disastrous consequences.

Complexity requires a discovery style of reasoning in which people try to understand what seems to be going on, rather than confirm pre-existing expectations. Nightingale (2004) summarizes literature in science and technology that indicates that scientists working at the frontiers of knowledge do not just confirm hypotheses, because existing knowledge is too weak to point sharply to a solution, and because experiments will mostly fail. Instead, scientists tinker with experimental conditions by actively intervening to create something to learn from, and use that knowledge to move limited to build up understandings, inform judgments, and create patterns to learn from (Pavitt 1999). Schon (1983) describes the process of problem setting in complex settings, where professional practitioners identify the "things" of a situation by reflecting in practice to uncover surprises, criticize their initial understandings, and impose a frame on the situation. Orr (1996), Mayr (2000), Denrell et al (2004), Grinnell (2009), and Van de Ven (2007) among many others describe similar processes of reasoning used by scientists, management scholars, technicians, computer experts, and other knowledge professionals.

Management scholars propose abduction as the style of reasoning that enables the discovery style (Weick 2005; Grandori 2010; Van de Ven 2015). Abduction is the deliberate reasoning that leads to scientific discoveries (Nesher 2001). According to Peirce, abduction is the best answer we have to problems of discovery, since abduction alone among the forms of reasoning originates possible explanations and introduces new ideas. Weick (2005) describes the abductive process as "clues giving rise to speculations, conjectures, and assessments of plausibility rather than a search among known rules to see which ones might best fit the facts." Simon (1977) also discusses the abductive process of discovering laws in raw data based on pattern recognition and abduction of hypotheses on laws that may regulate observed patterns.

Abduction "is the process of reasoning in which explanatory hypotheses are formed and evaluated" (Magnani 2001:18). Dunne and Dougherty's (2016) research on drug discovery scientists extends this definition to encompass formulating, evaluating, and reframing hypotheses in continual cycles of research. I extend their work to explain the process of reasoning that underlies the strategic and institutional management of complex innovation systems.

Cycling through three abductive learning routines enables institutional and strategic managers to focus on process rather than content (Stacey 1995), and continually establish and modify the direction and boundaries within which innovations emerge (Anderson 1999). The first abductive learning routine is using clues to imagine a configuration of interdependencies among strategic or institutional elements that might constitute a viable strategic value creating opportunity or governance structure. There are no architectures for radical products, strategies, or institutional arrangements, so researchers begin by imagining possible architectures. Not any hypothesis will do for complex challenges, because hypotheses about one cause leading to one effect will not work. Dunne and Dougherty (2016) explain how drug discovery scientists imagine a configuration of interactions among molecular compounds, the disease in question, and the rest of human biology. They construct a coherent story about how a chemical compound will behave in the body against the disease. In the same manner, I suggest that strategic and institutional managers construct a story about how a way to collaborate or a way to create value will develop over time.

Each element of hypothesizing captures emergent and noisy information. For value creating opportunities in bio-pharmaceuticals, the content of the strategic hypothesis is a configuration of possible interdependencies among knowledge elements that would constitute a value creating opportunity such as alternate delivery processes or new variations on an established drug that meets different genetic make-ups. The content of the institutional hypothesis would be a configuration among relational elements and rules (e.g., types of leadership, rules for IP) that would comprise the governance system among participating agents and agencies or a particular set of value creating opportunities. Managers figure out the relevant parts of their strategic or institutional possibility, and more importantly, how these parts work together and depend on each other. Centering on the interdependencies rather than only on the parts highlights the major source of uncertainty in complex systems, where failures often arise because of unexpected interactions (Scannell et al 2012). By focusing on a reasonable set of interdependencies among parts, managers attend to the possible strategy or program in action as it functions in the real world. The hypothesis reflects how elements mutually generate the desired outcomes.

Using clues grabs information, too, because clues convert existing information into directions that lead out of perplexity, as the dictionary definition suggests. According to Weick (2005), clues point to a world in which they are meaningful, and so give rise to speculations, conjectures, and assessments of plausibility rather than focus attention on a search among known rules to see which ones might best fit the facts. In complex innovation eco-systems, innovators do not have clear knowledge, but they do have clues. Clues capture knowledge resources that are available to managers for leveraging strategically. Managers use clues project and process learning to imagine configurations of interdependencies among strategic resources that might produce a viable new process, business model, collaborative network, and so on. Scientific conceptualizations and findings are clues, not answers, clues to possible configurations of interdependencies that may work in the real world.

Imagination also grabs noisy information. Weick (2005) emphasizes imagination, which "conceives a whole design almost at once, which it then fills out and gives body to by particular association.... The mind thinks simultaneously of specific parts and of their one organizing principle" (Engell 1981, 82-83). Imagination is "... the ability to conceive of something, seen only fragmentarily or superficially, as a complete, perfected and integral whole" (Merriam Webster's dictionary 1984, 415). "Imagination is the power to present in concrete, particular forms and expressions what before had been only general and abstract knowledge, hazy feeling, or impression" (Engell 1981:101).

The second abductive learning routine evaluates imagined configurations of interdependencies among knowledge resources or relational elements. Evaluation assesses whether or not and how the predicted relationships between the resources and potential opportunities work, and what else can the system do better. The hypothesis imagines the configuration working in the context of action, and the evaluation process further contextualizes and situates the possible new strategic opportunity. Looking at the configuration in action assesses the nature of the mechanisms that animate the possibilities.





Evaluating enables managers to use the hypothesized configuration to sift through all the noisy information as they open up around possibilities to explore them, and then narrow down to situated aspects of interdependencies. Evaluating burrows into the mechanisms to explore how and why the configuration might work, what else may be going on, and what are the limits and contingencies. Evaluation questions can include can we learn more about this configuration in the real world; what else needs to be involved; and how much some interdependencies matter or not; how far out can we see in the emerging possibilities; can we surface new consequences? In keeping with the discovery styles of research, researchers need to collectively implement ideas and experiment with them to see whether and how they work.

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The third abductive learning routine cycles back to the imagined configurations by refining or reframing the hypothesized interdependencies that are involved. Participants in the strategic or institutional problem setting and solving cycles critically examine assumptions, deliberate over different perspectives, and bridge possible differences into new shared directions (Ansell 2011). Inquiry is based on the clash of different perspectives and communication for probing, adjudicating, and bridging these differences. Different people see different aspects of the product possibility and how it might function in the application setting. Iteratively integrating helps to overcome competency traps, push ideas, cross check possibilities, and generate a joint representation. Managers might refine and replace milestones, and develop new performance objectives that reflect new alternatives and consequences learned from evaluation (Grandori 2010). By reframing, managers holistically assess what they know so far and what they have learned. Reframing cycles back with a new hypothesis for the configuration of interdependencies, to be evaluated and reframed again.

### Strategically Managing Time with Learning Events and Event-time Pacing

In addition to complexity, the product cycle time for complex innovations is extremely long, averaging more than 8 years for radical products in established firms (Liefer et al 2000), and thirteen years in pharmaceuticals (Collins 2011). Some problems never go away. Managers must muster the staying power to persist and learn so they can allow the complex processes of discovery and learning to emerge (Lynn et al 1996). Researchers have developed time pacing (Gersick 1994; Brown and Eisenhardt 1998) as a primary mechanism for coordinating activities around specific innovations, by regulating the intensity and direction of people's attention and efforts. However, for Gersick (1994) and Brown and Eisenhardt (1998), among other scholars, "time" refers only to clock-time. The passage of clock-time triggers change: a business launches new products every 6 months without regard for competitive actions, enters new markets every 3<sup>rd</sup> quarter and not when an opportunity appears, and starts product platforms every 24 months.

Despite its benefits for short term innovations like software products, clock-time makes near future deadlines most salient (Clark 1985), and shifts attention to exploitation, which undermines exploratory learning (Orlikowski and Yates 2002). Industrial society as developed in the 19<sup>th</sup> and 20<sup>th</sup> centuries has relied heavily on the social technology of clock-time with the invention of, for example, standard time, railroad schedules, and time and motion studies (Clark 1985). According to Mumford (1936, quoted in Clark 1985: 36), the clock is the most powerful metaphor in the western world, and has been more influential in the development of capitalism than the steam engine.

Time is more than what a clock counts. Time, according to Clark (1985:36), "...is a socially constructed, organizing device by which one set, or trajectory of events is used as a point of reference for

understanding, anticipating, and attempting to control other sets of events." People can develop longer time horizons if they combine diverse temporal structures to guide, orient, and coordinate their ongoing activities (Bluedorn 2002). Temporal structures are "...expressed in terms of clocks or events, and are created and used by people to give rhythm and form to their everyday work practices" (Orlikowski and Yates 2002:685). Plural temporal structures enable people to understand, anticipate, and attempt to control a wider variety of events. The literature on time and organizing captures these diverse temporal structures in two broad categories: *chronos* or clock time (the serial time of succession measured by the chronometer) and *kairos* or event time (the subjective living time of invention or people's sense that the time is right) (Garud et al 2011; Orlikowski and Yates 2002).

In an analysis of the tensions between strategic managers and discovery scientists in pharmaceuticals, Dougherty et al (2013) find that managers rely on short term clock-time pacing, while scientists pace their work by anticipated but unpredictable learning events. Both clock-time and event-time pacing are temporal – about time – because both mark durations and map out future trajectories by indicating when activities start or stop. Clock-time pacing marks beginnings and ends of activities with clocks and calendars, while event-time pacing marks beginnings and ends of activities with learning events that can be anticipated but when those events might occur is unpredictable.

Learning events capture emerging understandings in innovation, and reflect current and anticipated knowledge resources. Learning events emerge endogenously when innovators learn enough about the possibility they are working on to indicate the next thrust of their innovation work. Learning events are moments of closure in the exploratory searching that capture enough of the whole configuration of interdependencies to enable people to see what they know so far and to identify plausible next thrusts in their innovation work. These moments of closure redirect the work toward the ultimate goal of developing a good strategic path or a good value creating opportunity. In complex systems, learning events capture the most central resources: what we know so far and think we will learn. By highlighting event-time pacing, people's energy and attention focus on substantive learning, not only on the passage of clock time.

Dougherty et al (2013) suggest that strategic managers in pharmaceuticals can use clock-time pacing in tandem with event-time pacing to map out drug discovery possibilities farther into the future and accommodate the very long product cycle times. Each kind of time pacing identifies different trajectories of events and experiences. If they are used together rather than treated as conflicting practices to choose between, they can map out more of the future by encompassing more alternatives to be explored. Learning events from event-time pacing also enable people to align clock-time with event-time pacing, because learning events reflect both the *chronos* and the *kairos* of drug discovery and development. A learning event reflects the time it has taken to achieve it (*chronos*), and the subjective sense that an innovation is emerging (*kairos*).

Event-time pacing directs attention and effort to cycling through the abductive learning routines, which leaves clock-time pacing for directing attention and effort to the efficient use of resources for that cycling. Clock-time pacing coordinates ongoing process improvements that will more productively and efficiently support learning in projects and knowledge integrating efforts. Managers and innovators can also use clock-time pacing to gauge progress by measuring how efficiently people learn to apply new insights, develop supporting infrastructures for particular value creating models, examine which activities can be done more efficiently to surface interdependencies, identify barriers to learning that can





be overcome, and react to results of their experiments.

# Taking Advantage of Emergence to Continually Set and Solve Strategic and Institutional Problems in Complex Innovation Eco-Systems

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In this section, I describe how strategic and institutional managers can work on these problems over time. The institutional innovations in governance structures enable the development, evaluation, and reframing over time of value creating opportunities that map out directions for project (new drug therapies) and knowledge process (new integrations of sciences and technologies to support discovery) innovations.

### **Strategically Managing Value Creation to Anticipate Deeper Futures**

Strategic managers need to work collaboratively across the eco-system to leverage all the resources embedded in learning events that are generated by the product, process, and strategic problem setting and solving cycles. The simple question for strategizing in complex eco-systems is how can we generate value creating opportunities to shape and guide complex innovation projects and processes that emerge over very long periods? I suggest a diverse portfolio of value creating possibilities that direct emerging innovations into actual commercial or publicly valuable applications. The portfolio overall emerges and changes over time as it maps out opportunities in various time periods, and informs the entire eco-system about possibilities. The portfolio affords a deeper look in time because various possibilities work as stepping stones into the future. Strategic thinkers imagine where they can go with what the system is learning, and they shape and redirect that learning with ongoing ideas of value creation. They implement imagined configurations of learning events to see how they might work, to consider what else seems to be going on, and to surface new possibilities. Different groups of agents and agencies would collaborate over different sets of value creating opportunities, but the entire eco-system can generate a portfolio of possibilities.

Formulating Hypotheses by Imagining Configurations of Interdependencies: Strategic managers would consider what certain learning events that arise in innovation efforts (including developing strategies) suggest for a future value creating possibility, and consider how these learning resources could work together to create a viable configuration. Going forward in time, managers would hypothesize how the configuration they imagine will emerge based on current and anticipated learning events, what interdependencies might be involved, and to acquire and deploy those resources. I am describing basic business planning, except that this planning reaches out over time, anticipates emergent changes based on learning, and emerges continually. Imagining a configuration of interdependencies among knowledge resources from learning events includes identifying certain assumptions about what would make configurations a good opportunity, what are people going to learn for value creation by developing the configuration, and how will it help muster the staying power to persist and learn. Different values might include opening a new niche in the market and/or in therapeutics, generating some protection from competition, and providing a long term foothold.

A good exercise to learn about the cycle of abductive learning routines would be to interrogate current business models such as shutting down internal R&D and outsourcing the work, or focusing on blockbuster drugs. For example, what configuration of interdependencies among what knowledge resources generates value how by outsourcing R&D? What learning events are this strategy based on, and what are

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the underlying assumptions to be evaluated and reframed? What learning events give credence to the block-buster business model?

Other examples of possible value creating opportunities for pharmaceuticals include Christensen et al's (2009) suggestion that small firms can flourish with diagnostics that identify the specific customer base for particular drugs, and serve small markets and unserved customers. Rather than trumpet breakthroughs in biotechnology, with abductive reasoning one explores what a breakthrough depends on to be useful to innovation, or to effect in some way an important outcome. For example, what does this breakthrough technology depend on to help define a new business opportunity, and bring it into existence? And consider the Bill and Melinda Gates Foundation's work on developing malaria vaccines and other ways to address this debilitating disease in impoverished societies. Their mapping would consider a few different configurations of resources (including not just drug discovery but also marketing and distribution to areas that are difficult to reach), and then hypothesize what each would achieve and how, and what learning events are needed to gauge progress.

Another type of pharmaceutical value creating opportunity is figuring out what works well and what does not. Scannell et al (2012) point out that most of the R&D costs are in failures, so they recommend that firms develop a chief dead drug officer to investigate the failures. These failures are learning events. People in this role across the eco-system would set out the major factors responsible for the progressive decline in R&D productivity, and compare different therapeutic areas to explain the differences between them in productivity. Chief dead drug officers can explore the extent to which factors are tractable, such as where the molecular reductionism of rational drug design or the brute force screening of high throughput systems become distractions, and where do they help. Chief dead drug officers can measure the veracity of previous diagnostic forecasting exercises, and examine which clinical test requirements are most costly and least valuable.

Evaluating the Configuration of Interdependencies by Elaborating and Narrowing: These ideas are hypothesized configurations of interdependencies among learning events that might constitute a value creating opportunity that is to be empirically evaluated and reframed. Instead of assuming that outsourcing R&D to universities and biotech firms will automatically work, for example, strategic managers would implement this idea in a particular way (e.g., with a certain university or type of collaboration), and experiment with the hypothesized configurations to generate evaluative knowledge. By elaborating and narrowing around the interdependencies in the configurations, managers and innovators explore the actual interactions to see how and why their hypothesized configuration actually works. They elaborate out around a subset of interdependencies among resources to consider if these interdependencies are central or not, how and why, and what else they can learn. They narrow in on interdependencies that seem stable and useful, and then elaborate out again to see other possibilities. Elaborating and narrowing balances new knowledge with existing insights. For example, managers might narrow in on particular kinds of university collaborations, and elaborate out around how fully and usefully knowledge transfers as assumed, and if not why not. The goal is to evaluate if this configuration of resources can create value based on why managers thought it would, and to explore underlying assumptions in order to learn.

Evaluating hypothesized value creating opportunities combines clock time and event-time pacing. The goal is to make better judgments, not simply better decisions, about why and how this is a good business opportunity. Clock-time pacing questions include: 1) how long does it take us to figure out that we are at





a good or bad point; 2) how quickly can we evaluate learning events; 3) how quickly do others provide input to our analyses; 4) how quickly do we identify alternatives and choose among them to take next steps. Event-time pacing evaluative inquiries include: 1) we think we are here, is here good enough for a possible value opportunity; 2) are we able to handle a larger variety of configurations; 3) how much are we willing to pay to explore potential, and 4) are the learning events that emerge getting better and better? Both temporal structures can address strategic issues such as does this opportunity open a new niche, protect us from competition, extend our existing franchise adequately, give us a long term foothold, and allow us to know more about the opportunity as we also generate revenues.

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Tests of confirmation are part of evaluating the imagined configuration of interdependencies, but they do not stand alone. Strategic managers need to go beyond confirmation to develop insights into why and how a particular element affects the configuration, and what else may be involved. Since the goal is learning, managers go beyond does the configuration work or not, and consider how and why it works.

Reframing the Imagined Configuration of Interdependencies by Iteratively Integrating: The third strategic abductive learning routine cycles back to the imagined configurations by refining or reframing the interdependencies among knowledge resources that are involved. Participants in the strategic problem setting and solving process critically examine assumptions, deliberate over different perspectives, and bridge possible differences into new shared directions (Ansell 2011). Strategic managers might refine and replace milestones, and develop new performance objectives that reflect new alternatives and consequences learned from evaluation (Grandori 2010). Strategic managers would also rethink how clock-time and event-time pacing combine, and how well the combinations create a rich set of reference points that people can use to anticipate more possibilities further into the future. Reframing might revise the future trajectories of anticipated activities that need to be accomplished, and coordinate attention and effort to carry out those activities. Event-time pacing structures the inherently exploratory searching and helps to constrain the short term nature of clock-time by keeping the future open to emergent possibilities. Clock-time pacing helps to constrain the potentially expansive searching, and marshals the development of resources that can be clocked. Strategic managers in the innovation ecosystem identify new future trajectories and eliminate others based on emergent learning.

### **Institutional Innovating to Generate Collaborative Commons**

The strategic management problem setting and solving cycles cannot take advantage of emergence unless the eco-system also generates new governance structures that will enable the collaborations among disparate entities that must take place. As already noted, the emergence of new sciences and technologies into viable innovations has always depended on governance structures for collaboration, along with government and private support. However, complex innovation eco-systems require continuous innovation in governance structures, since the kinds of enterprises that require collaboration will continuously emerge and evolve. As Ansell (2011) explains, the objective of many of these collaborative problem setting and solving cycles will be to build up problem solving capabilities and to engage in ongoing problem solving efforts. Participants working on a particular category of strategies (e.g., using genomics, or developing different clinical trials) would identify, develop, and manage over time their particular configuration of rules and relations.

A simple question for institutional innovating I complex eco-systems is how can we work together effectively over time to plan, experiment with, learn from, and revamp value creating opportunities, ways

to integrate sciences and technologies to support actual innovation work, and/or specific therapeutic innovations? The institutional challenge is to develop a configuration of interdependencies among rules and relations that form the particular governance structure. I suggest that participants build on the non-market structures that already exist to include many organizations and agencies around diffuse objectives. These existing systems provide models for different kinds of governing structures that enable collective, long term co-evolution of sciences and technologies for innovation. These systems include open innovation (Chesbrough 2003), regional clusters (Gilbert 2012), network innovations (Iansiti and Levien 2004), industry platform systems (Gawer and Cusumano 2002), and the more general ideas about technology trajectories that build on the efforts of many different organizations and innovators (Dosi 1982; Floricel and Dougherty 2007).

For example, "open innovation" emphasizes the idea that knowledge is widely dispersed and that some innovations require multiple actors (Chesbrough 2003). Research demonstrates that open innovation requires participating firms to develop strategies for the long term, build capabilities for absorptive capacity (i.e., abilities to spot, bring in, and use emerging ideas), and build up abilities for long term partnering (Di Minin et al 2010). There is no simple "outsourcing." Regional clusters that foster technological innovation depend on diverse sources of knowledge, government policies that foster new technologies rather than allow incumbent firms to dominate, and rich networks of relationships that enable the exchange of tacit knowledge (see summary by Gilbert 2012). Organizations willingly participate because they can tap into supplier networks or access customers. These clusters demonstrate that for complex innovation eco-systems, multiple organizations can co-create a context of mutual learning that enables participants to muster the staying power to persist and learn.

Firms that compete also collaborate over standards setting, because standards, for example in communications systems, enable all firms to keep innovating (Piepenbrink 2015). Participants in standards setting bodies follow rules for IP and appropriation, for responsibilities for reciprocity, and for how changes in standards are continually orchestrated. Network and industry platform systems (Nambisan and Sawhey 2011) depend on the active leadership of large firms that continually upgrade the core technology or architecture, enable ongoing negotiations among participants for IP, and provide market access. In return, the large firms receive continual innovation in components and other network externalities that keep their core technology valuable. Ansell (2011) summarizes studies in the public domain among collaborating agencies around improved policing that depend on a rule of accountable autonomy.

These existing governance structures suggest a variety of rules and relational elements for collaboration that institutional managers can select from and work into configurations of interdependencies that they can hypothesize, evaluate, and reframe over time. These institutional elements include: 1) a problem solving focus: centering on what people need to collaborate over such jointly as developing a kind of drug therapy (e.g., immune therapy for particular cancers; combining drugs to form "cocktails," or trying out a new business model); 2) heterarchical organizing that enables participation and inclusion with various levels working on different aspects of the problem; 3) leadership by individuals and by large firms or coalitions of firms; 4) self-organizing, where organizations participate voluntarily because they gain value from that participation; 5) co-dependence among participants to reinforce active participation; 6) protected niches for value creation that includes end-to-end with customers, perhaps with disease foundations, clinical research groups; 7) intellectual property





protection and development; and 8) articulation of basic rules for partnering and accountability.

Institutional managers in the drug discovery eco-system (and for any other complex innovation problem) can begin by developing collaborative commons around specific pressing problems such as clinical trials for diverse therapies or advancing immunotherapy. Experiments with these and similar problems are already on-going (albeit in localized or one-off modes), and should provide considerable insight for formulating, evaluating, and reframing hypotheses about governance structures that enable ongoing collaboration around specific concrete problems. The difference for complex eco-systems would be that these emerging governance structures would continually be developed, experimented with, and revised based on progress with actual problems. People would not simply hold a big meeting and then go on about their separate work.

DEVIST

As Dougherty (2016) details, cycling through the abductive learning routines for institutional problem setting and solving begins with imagining a configuration of interdependencies among relational elements and rules that can produce the specific kind of collaboration needed to address a certain problem. For example, if the problem is developing improved models for the early evaluation of drug possibilities, participants would include large firms, research hospitals, regulators, and small firms. Leaders need to be appointed, perhaps a coalition with clear rules for IP, participation, and task forces to oversee particular processes. Evaluating digs into the hypothesized interdependencies to examine assumptions and figure out what works and not, and why and how. Over time, experiments generate insights into how to develop and deploy metrics about how well the collaboration is doing, update and revise the problem, arrive at joint decisions and agreements, and foster ongoing participation. Some collaborative commons will be relatively short-lived, while others may continue for years.

### Discussion

Taking advantage of the emergence of knowledge is central to developing the knowledge innovators need to work on important social and economic grand challenges. Complex innovation eco-systems need to take advantage of emergence to craft viable innovations in products, programs, or processes that tackle aspects of these grand challenges. The entire eco-system of different agents and agencies participates actively and collaboratively on innovation, because the requisite knowledge and skills are partial, fragmented, and widely dispersed. All this knowledge for innovation does not exist *a priori*: it will emerge unexpectedly and unpredictably as innovators engage in hands-on experiments with concrete problems. Dougherty (2016) details four integral cycles of innovation problem setting and solving in complex eco-systems and argues that each one must be addressed on its own merits, yet interactively with all of the other problems.

This essay argues that unless the strategic and institutional problem setting and solving cycles unfold productively and interactively with the project and process cycles, innovation cannot occur. The reason: the innovative problems and solutions unfold over many years, eco-system participants cannot muster the staying power to persist and learn for innovation over many, many years without strategies. Strategies for innovation integrate learning, direct activities, and shape ongoing knowledge co-evolution. Strategizing in complex innovation eco-systems requires a portfolio of future possibilities that maps out in various time periods potential value creating opportunities, because the knowledge needed for innovation emerges unpredictably and over a very long time. Imagine looking out 15-20 years and seeing a variety of possible value creating opportunities emerging, depending on various anticipated

learning events. The imagined portfolio represents the competitive or strategic landscape out in time. Different firms and agencies would imagine the overall portfolio of possible opportunities out in time, but from their own perspective. The portfolio affords a deeper look in time because various possibilities work as stepping stones into the future.

However, for complex innovation, strategy making occurs across the eco-system, and involves multiple, qualitatively different kinds of value creating opportunities that are collaboratively produced by multiple, different kinds of agents. Institutional innovation to generate governance structures for collaboration among the specific participants is also essential.

Abductive learning routines enables innovators across the eco-system to configure available knowledge resources into potential applications for emerging project and process innovations, evaluate those possibilities by exploring their implications and seeing what actually emerges, and reframe them over time. Abductive learning builds on both clock-time pacing and event-time pacing to allow innovators in all four cycles to muster the staying power to persist and learn. Persisting does not mean sticking to a course of action mindlessly. Rather, persisting means continually probing the forward development of a new product, new way to enable innovation, or value creating opportunity and learning about how to improve or redirect their emergence, including choosing to stop developing this opportunity. Cycling through abductive learning routines takes advantage of emergence when innovators imagine where they can go with what the system is learning, and they shape and redirect that learning with ongoing ideas of value creation. They implement imagined configurations of learning events to see how they might work, to consider what else seems to be going on, and to surface new possibilities.

Three research thrusts will enable the development and integration of the strategic and institutional cycles of problem setting and solving. One thrust is to examine how to strategize across multiple players. Technology and innovation management researchers have developed considerable insight into systems of innovation (e.g., clusters, industry platforms, network innovators), and can start to apply these ideas to complex innovation. It seems likely that complex innovation eco-systems need to focus on concrete problems so that participants can tinker with possibilities and alternatives. Ansell (2011) explains that in pragmatism, which relates to abductive reasoning, meaning depends on hands-on experiments that confront concrete problems. He argues that problems disrupt existing assumptions, call for fresh discovery, and pin disputes about principles down to particulars. Research can explore how concrete problem solving works in complex eco-systems, and what other kinds of relational elements are needed to keep participants engaged for the long term.

The second thrust of research is to delve into abduction. Many scholars already discuss abduction (e.g., Weick, Garud, Grandori). However, few studies provide in-depth empirical analyses of how innovators and managers actually can using this form of reasoning, so more research into the day-to-day innovation practices in complex innovation eco-systems is needed.

The third research thrust is to develop time. Participants in complex innovation eco-systems need to direct activities and gauge progress in a way that encompasses the very long term, because co-evolutionary emergence take lots of time. The dominant approach to time management now relies on the inherently short-term methods of clocks and calendars. Clock-time is reinforced by institutional pressures for quarterly reporting and annual planning. Research can explore how different kinds of time pacing identify different trajectories of events and experiences, and how multiple temporal structures can map out more of the future by encompassing more alternatives to be explored.





One way to develop event-time pacing would be to study how strategic managers can use event metrics to gauge progress and assess performance that derive from event-time pacing. Innovators and managers can gauge their progress by examining how useful are the configurations they are imagining, if they are deepening their understanding well enough to tackle the new problems that emerge as they develop their new strategy and if not why not, and question how promising are the alternatives and consequences suggested by the imagined configuration. Managers can also clock-time how long it takes to determine if learning events have occurred, how quickly people recognize emerging perturbations and evaluate learning events, how quickly others provide input to the evaluating and reframing, and how quickly innovators identify alternatives and choose among them to take next steps. Both temporal structures can address strategic issues such as does this opportunity open a new niche, protect us from competition, or give us a long term foothold.

DONST

Participants in complex innovation eco-systems can construct a portfolio of possible value creating opportunities that map out in time, and provide stepping stones into the future. They can also construct innovative governance structures that enable them to continually revise and reframe the portfolio by adding new ideas and dropping others. The portfolio into the future opens up possibilities for projects and strategic paths, and helps to guide these developments as innovators encounter alternatives and choose options. The portfolio enables participants to understand, anticipate, and attempt to control their complex innovations using abductive learning routines to build on available knowledge, generate new knowledge about strategic and institutional opportunities, and tinker far into the future productively.

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# Cluster policy: Insights from the German Leading Edge Cluster Competition

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### Abstract

With its Leading-Edge Cluster Competition (in German: Spitzencluster-Wettbewerb; LECC), the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF) is supporting innovation clusters in a nationwide contest for the first time. In three rounds, 15 cluster initiatives were selected and provided with funds to support them on their way to becoming international leaders in their field of technology, or, if they already held such a position, to maintain or expand their lead. Through a sustainable mobilisation of regional economic potential, supporting the strategic further development of Leading-Edge Clusters has the goal of increasing growth, securing or creating jobs and enhancing the attractiveness of Germany as a location for innovation and business. The paper presents results of an evaluation of the LECC.

### **Declarations:**

None of the authors has any competing interests in the manuscript.

### 1. Introduction: Impact of funding by the Leading-Edge Cluster Competition

With its Leading-Edge Cluster Competition (in German: Spitzencluster-Wettbewerb; LECC), the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF) is supporting innovation clusters in a nationwide contest for the first time. In three rounds, 15 cluster initiatives were selected and provided with funds to support them on their way to becoming international leaders in their field of technology, or, if they already held such a position, to maintain or expand their lead. Through a sustainable mobilisation of regional economic potential, supporting the strategic further development of Leading-Edge Clusters has the goal of increasing growth, securing or creating jobs and enhancing the attractiveness of Germany as a location for innovation and business.

The LECC applied a two-step selection procedure supported by a jury. The design of the selection process reflects the goals of the competition and takes into account the requirements for strategic coordination in a multi-stakeholder programme. The selection process was transparent and well communicated. As the feedback by the candidates consistently shows, there was sufficient time to coordinate and prepare the proposals. The selection criteria of the jury are plausible and were implemented adequately using a holistic approach that required the consideration of different dimensions of the programme requirements. The jury was independent and had opportunity to consult expert advice in decision-making. Figure 1 illustrates the distribution of LECC applicants over the course of the three rounds of the LECC competition.







Source: Accompanying evaluation of the LECC. – Abbreviations: In the 2nd round of the competition, two initiatives from the 1st round entered a joint application. One repeated applicant from the 2nd round also took part in the 3rd round.

As can be seen, the LECC was successful in motivating new cluster initiatives for the second and third round of the competition. Moreover, several initially unsuccessful cluster initiatives were able to advance their organisational and strategic development in a manner that they succeeded in a later round. In the second round of the competition, only contestants that had already participated in the first round – some of them in different constellations – were selected. In the third round, a number of new candidates succeeded.





The evaluation of the LECC selection process also involved a comparison with other, internationally visible technology development programmes of high nationwide importance: the Pôles de Compétitivité in France, the Competence Centers for Excellent Technologies in Austria (COMET), the Centre of Excellence programme (SHOK) in Finland, as well as (on the German state level) the "Cluster Offensive Bayern" (a Bavarian cluster programme).

Like the Pôles de Compétitivité and COMET, the LECC used an application-based approach to select funded initiatives. The regional (political) level also played a certain role during the pre-selection period in these programmes. This regional focus was less pronounced in the Pôles de Compétitivité. The SHOK programme and the Bavarian Cluster Offensive used a top-down approach that was initiated by a comprehensive analysis during the preparatory stage. The evaluation results show that the application procedure is a key factor for the cluster initiatives to focus and constitute their activities. In addition, the results show that the design of the LECC was suitable for achieving the programme's objectives. Like the LECC, the other selected programmes are implemented since several years.

In respect to targets, all these cluster programmes – except for the Bavarian "Cluster Offensive" – are focused primarily on research and innovation. A difference between the programmes is that the Pôles de Compétitivité and the LECC do not involve any funding of the underlying CM structures. However, there was no indication that the decision not to allocate funding to CM structures resulted in any disadvantages for either programme. After all, the cluster initiatives in both programmes showed a positive development. Another difference is the funding of infrastructures, which is possible within the Pôles de Compétitivité and SHOK and not in other programmes. All programmes, including the LECC, explicitly support applications for complementary funding on the national or EU level. The funding periods are of similar length and appear to be suitable for achieving the goals of supporting cluster development.

It is too early to quantify the extent to which the LECC has contributed to strengthening the clusters. However, it is possible to estimate whether the conditions are suitable for the competition to exert a noticeably positive influence in future. To answer this question, the role of Leading-Edge Clusters in their innovation environment was investigated in order to assess their regional and sectoral positioning.

Figure 2 shows the geographic distribution of the 15 Leading-Edge Clusters and roughly 640 cluster initiatives that were identified in Germany at the national or *Länder* level by the end of 2013. The sheer number of cluster initiatives, which in almost all cases receive funding, primarily by the states, shows the importance that promoting clusters has gained for innovation policy in Germany. While all the German *Länder* support clusters, the number of funded clusters and the intensity of support vary considerably. The Leading-Edge Clusters are integrated into existing network and cluster structures that are also supported by the *Länder*.

The financial support for *Länder* clusters is usually for a limited term only, sometimes using financial support from the European Fund for Regional Development (EFRE). The regional distribution of cluster initiatives results, among other factors, from the regional industrial structure: The more a region is industrialised, the greater the number of clusters initiatives and networks (e.g. in Northrhine-Westphalia and Baden-Wuerttemberg). There is a north-south divide in the distribution of the 15 Leading-Edge Clusters: Nine are located in southern Germany. In addition to the industrial structure, the observed regional differences also reflect the research intensity of the local economy. Finally, the observed differences also depend on the degree to which firms, science and government succeed at joining forces to pursue a common strategy.

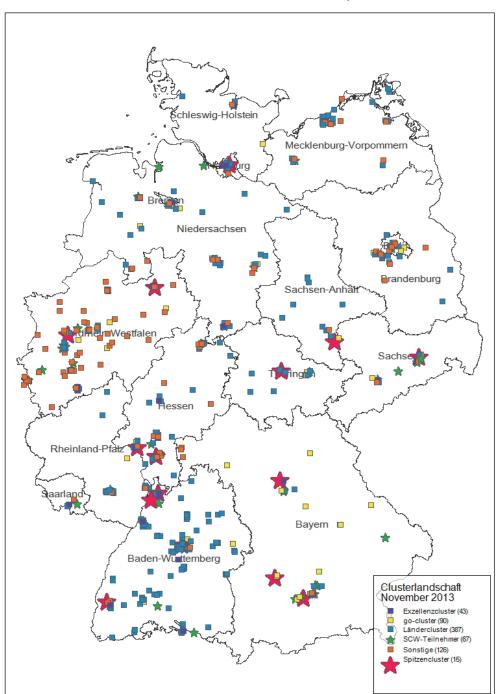


Figure 2 Clusters and networks at the federal and Länder level in Germany

Source: Accompanying evaluation of the LECC; based on an own inquiry (date: November 2013). – Comments: Locations are given for the contact address of the cluster organisations. If a cluster is represented in several categories (e.g. a Leading-Edge Cluster and member of go-cluster), then it will be shown only once in the graphic but counted several times in the key. The map was created using RegioGraph 13.



The LECC had no restrictions in respect to sectors or technology fields, which is why the Leading-Edge Clusters are rooted in different sectoral innovation environments that exhibit diverse patterns of research and innovation. Figure 3 compares the sectoral distribution of the Leading-Edge Clusters with the distribution of all the participants in the LECC, as well as the entirety of comparable innovation clusters in Germany that were identifiable at the national and *Länder* levels. The number of innovation cluster initiatives (370) is significantly lower than the total number of cluster initiatives. The latter also includes cluster initiatives that cannot be categorised as innovation clusters due to the industries in which they are active or other characteristics.

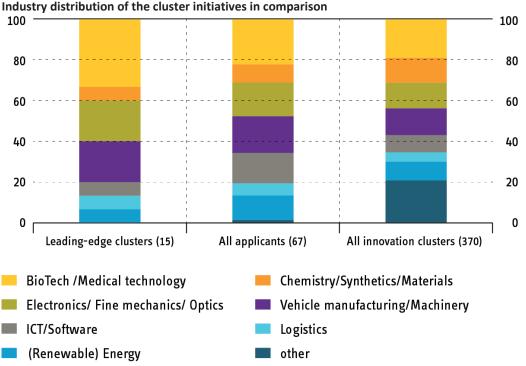


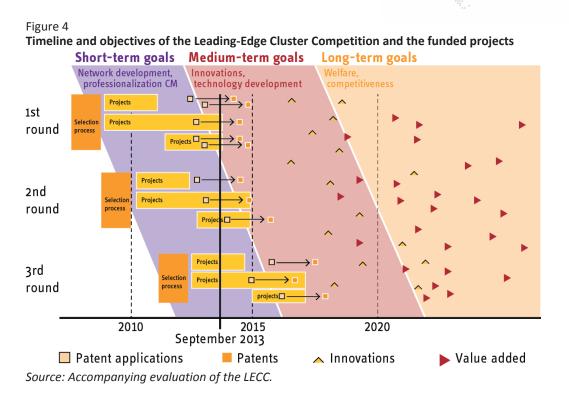
Figure 3

Source: Accompanying evaluation of the LECC, based on an own inquiry (date: November 2013).

The LECC had an above average number of applications from cluster initiatives in the fields of biotechnology and medical technology. A possible cause may be that several funding programmes for networks and clusters in this industry have been conducted in the past (e.g. BioRegio), which led to the development of structures that were beneficial in the LECC candidacy. This is true not only for the group of candidates, but even more for successful initiatives: The share of biotechnology and medical technology clusters is even higher in the 15 Leading-Edge Clusters.

This paper presents the results of the investigation for important aspects of the LECC. In order to arrive at an overall picture, the timeline of the various effects of the competition was examined in a first step. This assessment was based on data from the written surveys and expert interviews. The causal effects of the LECC were analysed in a second step. In a third step, the results of the competition at the various levels under investigation were brought together. This compilation served as the basis on which the special characteristics of the LECC in comparison with other funding instruments were investigated.

The effective dimensions of the LECC are reflected in the funding guidelines for the competition in the form of short-term, midterm and long-term objectives (figure 4). The general timeline of the effects outlined here was confirmed by the analysis.



The effects that correspond to these goals range from activities that were initiated (expenditure of additional funds by the stakeholders, networking, knowledge exchange, changes in the CM processes) to direct and indirect results of the cluster activities (innovation, technology development) to long-term economic effects (increased competitiveness, value-added, employment and wealth). To be certain that the results described here are actually caused the LECC, it would be ideal to make a comparison with the development of the Leading-Edge Clusters without the LECC. This so-called contrafactual situation is not observable. However, the methods of econometric group comparison analysis make it possible to scrutinize whether an observed effect has actually been caused by the LECC. These methods were used wherever the available data permitted. In many cases where this was not possible, the question whether observed results were caused by the LECC was addressed based on well-founded assessments.

The paper proceeds as follows: Section 2 analyses the positioning of the 15 clusters in the international (European) context. With sections 3, 4 and 5 we address different outcome dimensions of the LECC, networking, regional impact and effect on R&D investment. Section 6 concludes with policy implications.

### 2. Leading-Edge Clusters in the international context

An international comparison showed how Leading-Edge Clusters are rooted in their sectoral innovation systems and displayed their innovative potential. The assessment of this aspect is based on literature research, the examination of patent microdata from research and innovation surveys, and the results of interviews with industry experts, consultants and cluster stakeholders. Even though the industries or sectors as well as the clusters operating in these different environments are usually characterised by a high degree of heterogeneity, they exhibit some predominant and common patterns of research and innovation behaviour.



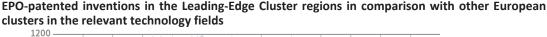


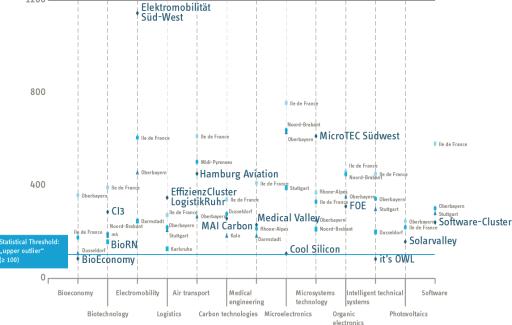
All Leading-Edge Clusters show strengths and potentials that characterise them as "leading-edge regions" when compared to other international clusters and enable them to maintain or expand their position in the international competition. The reasons for this good position are the existing technological strengths and scientific excellence, as well as the presence and regional involvement of globally operating, leading companies (such as in the clusters BioRN, Cl3, EffizienzCluster LogistikRuhr, Elektromobilität Süd-West, FOE, Hamburg Aviation, Medical Valley and Software Cluster). In some cases (it's OWL and MicroTEC Südwest), the *hidden champions* (major firms that attain a leading role in their respective markets) provide the momentum for innovative potential and future competitiveness.

In some fields, in particular biotechnology, innovations are driven primarily by basic research and therefore determined by the quality of key university institutions. In others, such as microelectronics, micro-system technology, medical technology, and intelligent technical systems, internationally renowned research facilities outside of universities significantly determine the positioning of the relevant clusters. Another factor that influences the position of the clusters in the international innovation environment is a core role as a production location (e.g. Cool Silicon, it's OWL and Solarvalley).

Figure 5 shows the technological positioning of various clusters in the European environment. It shows the extent to which the regions of the Leading-Edge Clusters have a position of international leadership in their field of technology with regard to their share of the patent applications at the European Patent Office (EPO). The patent analysis was performed in several steps: By using a combined query for selected classes of patents and technical terms, the number of patent applications for the relevant sector at the EPO was determined and then assigned to regions based on the location of the inventor.

#### Figure 5





Source: Accompanying evaluation of the LECC; own calculations based on data from PATSTAT and OECD-REGPAT. – Comments: Leading-Edge Cluster regions are shown as statistical outliers with regard to EPO patented inventions (to indicate technological leadership) in the relevant field of technology.

The statistical definition of an upper outlier was used to define "leading-edge regions". These are regions whose share of inventors is further away from the median than three times the interquartile range. On this basis, European "leading-edge regions" are identified, a group to which the regions of the Leading-Edge Clusters belong.

The analysis shows 12 of the 15 Leading-Edge Clusters as having a position of technological leadership in the European environment. Only the BioEconomy Cluster and it's OWL are slightly below the – albeit very strict – threshold for an upper outlier. Cool Silicon is only slightly above. All other clusters are more or less clearly above this ambitious threshold. Especially Solarvalley has become much more important with regard to patented inventions in recent years and is now clearly above the threshold.

### 3. Networking and knowledge exchange in the Leading-Edge Clusters

With the incentives for networking between regional actors, the LECC supports both the generation and the transfer of knowledge. Within the scope of cluster activities, networking and knowledge exchange may occur as part of the initiated projects, but also through personal contact outside of the project context or during informal meetings. Cooperation in R&D projects is of central importance in the LECC because it enhances networking relationships, initiates learning processes in the participating organisations, and enables the utilisation of synergies between actors. Learning processes take place through collaboration in projects where different individuals from companies and public research organisations participate. These individuals proceed to spread knowledge within their organisations.

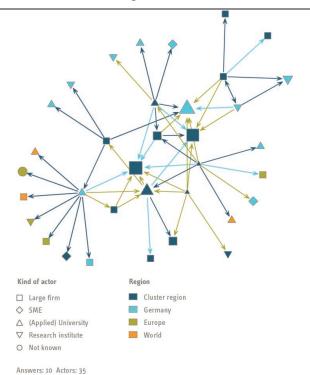
Such cooperation may either be bilateral or multilateral within larger project consortiums. A cooperation network as studied with the tools of network analysis represents all interconnections constituted by such cooperation. The analysis of networks goes beyond individual collaborative relationships and considers the structure resulting from all bilateral or multilateral cooperative ties so that the structural effects of cluster policies become visible (Giuliani and Pietrobelli 2014).

In order to analyse the impact of the LECC's support on networking and the structure of networks, the cooperation activities related to the LECC were investigated in the context of all partnerships. As a data source, the written surveys of the LECC-funded organisations in the clusters of the first round of competition in 2011 and 2013 as well as those of the second round of competition in 2012 were used. Additional information was collected from personal interviews with selected partners in the Leading-Edge Clusters.

Figure 6 exemplifies how this information is utilized to reconstruct network graphs for the collaborative network of the cluster Forum Organic Electronics.



Figure 6 Cooperation network of the cluster Forum Organic Electronics

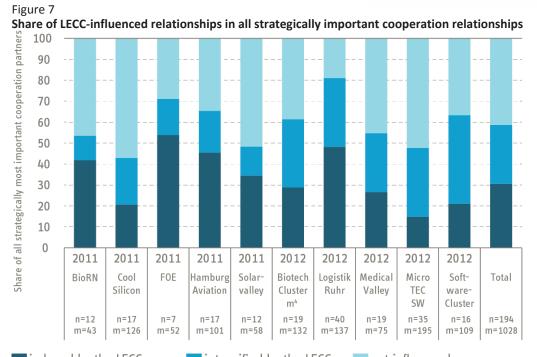


Source: Accompanying evaluation of the LECC; written survey of the LECC-funded organisations in 2013. – Comments: The size of the nodes is proportional to the frequency with which an actor is named as the most important cooperation partner. Arrows pointing in the direction of the named cooperation partner; dark blue = not initiated or intensified by the LECC, light blue = intensified by the LECC (existed before 2007), light green = initiated by the LECC (did not exist before 2007).

In addition to visualisation, which in this case illustrates the central importance of large corporations in the cluster region, the relational data allows for statistical calculations to describe network structures in the clusters. For example, there are significant differences with regard to size, regional involvement and other structural properties in the R&D cooperation networks of the ten Leading-Edge Clusters in the first two competition rounds.

The stimulus from the LECC had an impact on the *intensity and geographic range* of networking and changed the *centralisation structure* of networks. Since the start of the LECC, the intensity of network cooperation increased in all clusters of the first and second competition rounds, which became evident as collaborative activities significantly increased. This is primarily due to improved awareness of potential partners as consequence of the LECC. Especially for the businesses among the LECC-funded organisations, the importance of cooperation in their overall R&D activities has increased. R&D cooperation between competitors occurred much more frequently than on the national average, as a comparison with data from the Mannheim innovation panel shows.

The LECC initiated new R&D partnerships and intensified existing contacts. A substantial mobilisation effect, extending beyond the LECC-funded cooperation projects, can be observed in the initiated relationships (Cantner, Graf, Töpfer 2015). Figure 7 shows the influence of the LECC on relationships in R&D cooperation networks in Leading-Edge Clusters.



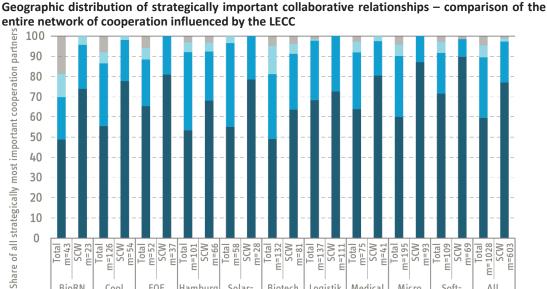
induced by the LECC intensified by the LECC not influenced Source: Accompanying evaluation of the LECC; written survey of LECC-funded organisations in 2011 and 2012. – Comments: n = Number of responses; m = Number of identified relationships within the cooperation network.

In some of the clusters (EffizienzCluster LogistikRuhr, FOE, Hamburg Aviation), almost one half of all relationships were initiated by the LECC. In the clusters MicroTEC Südwest and Cool Silicon, the LECC appears to primarily intensify existing relationships. These differences between clusters depend primarily on whether there were pre-existing, intensive R&D networks before the LECC or if these networks had to be built from scratch. The latter was the case in the Effizienzcluster LogistikRuhr, where many stakeholders had not been involved in R&D activities before the competition.

The number of cooperations that bridge the gap between science and business has increased. However, the relative importance of cooperation among public research organisations or between public research organisations and businesses has remained almost unchanged. As intended by the LECC, in many cases the competition was used to build new cooperative relationships within the Leading-Edge Clusters. Numerous new collaborations in project consortiums were initiated. However, these partners had in general not been completely unknown to each other.

The LECC also had the desired impact on the *geographic range* of networks. However, there are considerable differences with regard to the degree of regional networking and international engagement between the clusters (figure 8). For example, the Effizienzcluster LogistikRuhr and the Software Cluster show a comparatively high degree of networking within the cluster region. Hamburg Aviation and Solarvalley are primarily embedded on the national level, whereas the stakeholders in the two biotechnology clusters BioRN and Biotech Cluster m<sup>4</sup> are involved in markedly international networks. Despite these differences, the focus of all R&D cooperation networks lies within their cluster region. The R&D cooperations which were initiated by the LECC show a stronger regional element than other partnerships. This result illustrates that the LECC contributed to opening and exploiting regional innovative potential. For the successful clusters of the first round, Cantner, Graf and Töpfer (2015) observe differential developments regarding clusters' spatial embeddedness with two additional years of observation. Some clusters tend to increase their localisation, whereas others increase their connectivity to international partners.





SCW

Hamburg

Aviation

n=17

otal

m = 1.0166 58

otal

SCW

FOE

n=7

otal

SCW

m=1

Cool

Silicon

n=17

BioRN

n=12

SCW n=28

Solar-

vallev

n=12

otal

m=132 SCW

Biotech

Cluster

m4

n=19

=137 SCW

Logistik

Ruhr

n=40

m=1

Tota

m=81

m=195 SCW

Micro

TEC

SW

n=35

otal

SCW

otal

Ē

Medical

Valley

n=19

SCW 1=69

otal 60

m=1

Soft-

ware

Cluster

n=16

93

1028 5CW

Ë

All

clusters

n=194

m=603

otal

🔲 ... into the cluster region 🛛 🔜 ... into Germany 🔝 ... into Europe ... into the world Source: Accompanying evaluation of the LECC; written survey of LECC-funded organisations in 2011 and 2012. – Comments: n = Number of responses; m = Number of identified relationships within the cooperation network.

An examination of the centralisation structure of the networks shows that relationships formed during the early stages of the LECC are often more focused on key stakeholders (usually large corporations or public research organisations). Analyses of a change in centrality during later stages show that actors which were already central in the previous period and large firms benefit most, whereas universities and public research institutes become less central within the R&D networks (Cantner, Graf and Töpfer 2015). However, if the authors control for policy measures such as the number of funded projects and the total amount of funding renders all other variables insignificant. Apparently, those who benefit most from funding, also benefit most in terms of increased embeddedness in the network. During the LECC, these stakeholders have established themselves as important partners and made essential contributions for the technological and organisational development of the clusters. This development is understandable for competitions such as the LECC, because the common cluster strategies are usually developed under the leadership of a relatively small group of renowned and technologically competent actors that subsequently participated in the LECC-funded projects. Many SMEs used the LECC as an opportunity to build relationships with large corporations that would have been difficult to access otherwise. The establishment of long-term R&D contacts is especially important for SMEs in order to build relationships for innovation and assist the effective commercial exploitation of their developments.

The results of the analysis also show that some large corporations contact companies and research institutes for specific purposes, for example to solve current research problems or to benefit from their competence in the medium or long term. While excessive concentration of the networks on a few key actors may harbour a risk of becoming too dependent on their development, this study has found no indication of such a risk in practice.

Figure 8

10 0

All in all, the LECC's short-term goal of intensifying or enhancing the networking between innovative stakeholders in the cluster regions has been achieved. To what extent this enhanced networking will have a long-term impact on successful innovation depends on whether the cooperation with local or supra-regional partners will remain at a high level beyond the funding period. The results of the investigation show that many relationships that were initiated are intended for long-term cooperation and should therefore have a sustainable impact on the cluster networks.

### 4. Regional impacts of the Leading-Edge Cluster Competition

One of the stated goals of the LECC is to generate long-term value through the exploitation of regional innovation potentials. In this context, a main focus is on the analysis of mobilisation processes at the core and in the environment of the clusters. Specifically, the significance of regional location factors, of geographical proximity to R&D partners as well as first observable and potential future impacts of the competition on the cluster regions were investigated. At the moment, the immediate effects of the competition in the Leading-Edge Clusters can primarily be observed (input and activity effects, partially first outputs) while outcomes and economic impact will rather be observable in future years. Hence, it was necessary in a first step to categorise the clusters with regard to the relevance of technological and economic location factors for the LECC-funded organisations.

The investigation of the regional impacts of the LECC incorporates the information from the written survey of LECC-funded organisations, the interviews with the CMs and cluster actors and the findings from the analysis of the sectoral innovation systems and networking. The results of the surveys were primarily evaluated by means of descriptive analyses. In order to account for the heterogeneity of the responses between the clusters, the correlations between cluster specifics and response behaviour were estimated by means of multivariate regression methods.

The analysis of the relevance of regional location factors considers general economic conditions for cluster activities, for example regional labour and sales markets, the technological conditions, as well as geographical proximity to R&D partners as a determinant for knowledge exchange. With regard to regional location factors, actors in all clusters selected in the first two competition rounds rate the local supply of highly skilled employees (college and university graduates) as most important, followed by the availability of medium skilled workers. This underpins the importance of cluster activities to qualify current and future employees. Differences between the clusters with regard to the importance of the regional labour market can be explained by differences in the composition of actors or differences in the technological focus.

Compared to the local labour market, the local sales market is of minor importance for the LECCfunded organisations in the clusters of the first two competition rounds. Clusters with a comparatively high number of public research organisations show higher ratings for this item than other clusters. This can be explained by the fact that public research organisations tend to acquire their third-party funds locally – at least when it comes to third party funding by companies – while companies, even those with important local customers, operate to a greater extent on supra-regional markets. Industry-specific factors play a crucial role for the importance of the regional sales markets. For example, the revenues of Hamburg Aviation and Medical Valley are more concentrated on large local companies than in the case of the Biotech Cluster m<sup>4</sup>.

Regarding their technological environment, LECC-funded organisations mostly agree that, though *geographic proximity* facilitates R&D cooperation, it is not a necessary requirement for its success. 90% of the LECC-funded organisations consider cooperation with geographically close partners as less cost-intensive. 80% think that geographical proximity facilitates information exchange. 35% of the LECC-funded organisations regard geographical proximity as a central precondition for the success of the cooperation. However, technological aspects and the partners' qualification play a





superior role for the selection of cooperation partners than their geographical location. Accordingly, LECC-funded organisations concentrate their search for R&D partners rather on the national than on the regional level. Furthermore, organisations in Leading-Edge Cluster projects report higher satisfaction with the cooperation, when the partners have already worked before in other contexts. All in all, the analyses show that the requirements of Leading-Edge Cluster actors in respect to their regional environment are driven by their orientation towards knowledge-intensive industries. The supply of qualified employees and the requirements for regional R&D cooperation are of greater importance than the proximity to customers or suppliers.

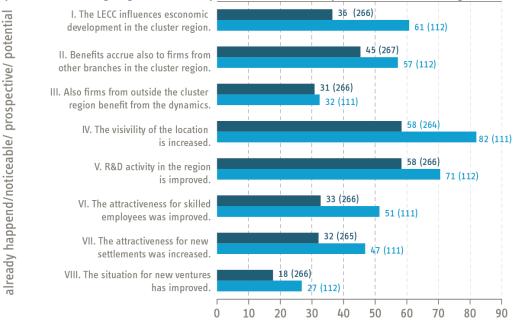
According to the LECC-funded organisations in all clusters of the first two competition rounds, the LECC has already triggered or will trigger *regional impetuses*. Figure 9 shows the assessment of potential or observable effects of the LECC separately for firms or research institute.

44% of the LECC-funded organisations expect that the success of the Leading-Edge Cluster will have a noticeable effect on the development of the cluster region. The largest effects of the LECC can be found in the increased visibility of the location and the improved regional R&D activity. Public research organisations exhibit a significantly more positive view – probably because of the greater importance of external funds for research and a resulting different view on the regional impacts.

The assessment of the impacts varies considerably between the clusters. This can mainly be explained by the clusters' composition, in particular the ratio of public research organisations to companies. Clusters with a high share of public research organisations have a considerably more positive view of the effects. Furthermore, geographically extended clusters, as well as clusters with a large number of LECC-funded organisations, appear on average to have a more sceptical view of the competition's effects on the region. A possible cause may be that the close geographical proximity between partners in more concentrated clusters fosters the exploitation of synergy effects.



Impact of the Leading-Edge Cluster Competition on the development of the cluster regions



### 📰 Firms 🛛 🗖 Research Institutes

Source: Accompanying evaluation of the LECC; written survey of LECC-funded organisations in the clusters of the first competition round in 2012 and the second competition round in 2013. – Comments: Percentage of actors who responded with a "1" or "2" on a scale from 1 (completely

agree) to 5 (disagree). The items in the two categories "prospective/potential" and "already happened/noticeable" are arranged in descending order of importance. The number of responses (n) is given in parentheses.

At the moment, several types of regional impulses of the LECC can already be observed, primarily an improved visibility of the Leading-Edge Cluster regions and enhanced regional R&D activity. The actor interviews yielded that collaboration in the joint projects has improved the innovative climate and resulted in the formation respectively in an advancement of a common culture of innovation. While the stimuli from the LECC may not be able to fully compensate for critical economic trends, the LECC-funded projects still laid the basis for future increases in the generation of regional value added. By intensifying and initiating further R&D cooperation, the LECC is primarily effective in earlier stages of the value chain. Hence, its effects on growth and employment are not noticeable in the short run.

### 5. Effects of the Leading-Edge Cluster Competition on R&D funding

While cluster policies that try to push regional development are rather popular, very little is known about the actual effects of such policies. Against this, the goal of our analysis was identify the effects of the specific policy instrument LECC on private R&D expenditure (for a comprehensive discussion of the analysis see Rothgang, Engel, Eckl ...).

Overall, the evidence on the effects of public R&D funding on private R&D is diverse (David et al. 2000, Czarnitzki, Ebersberger and Fier 2007). While some studies find no or only partial crowding out (Duguet 2004, Czarnitzki and Fier 2002), others indicate a full crowding out (e.g. Wallsten 2000). The results from other evaluations of cluster policies also do not indicate what magnitude of effect to ecxpect as the design of other cluster programs that have been analyzed in past evaluation studies is only partly comparable to the LECC (some focusing mainly on funding cluster organizations, others on business companies in regions with structural problems). These studies mainly based their analyses on output indicators like innovation activities (Falck, Heblich, Kipar 2010, DAMVAD 2011) or economic impact (Martin et al. 2011). The results indicate that cluster policies have increased innovation output in Bavaria (Falck, Heblich, Kipar 2010) and Denmark (DAMVAD 2011). Martin et al. (2011) could not identify productivity or employment effects of the French program that preceded the present *pôles de compétitivité*. To this date, we have not been able to find studies that scrutinize the effects of cluster policies on private R&D expenditure. This study makes a first attempt to evaluate the effect of a specific cluster R&D program with respect to the outcome in traditional R&D programs.

Any program evaluation is confronted with the fundamental evaluation problem: *what would have been the outcome for program participants if they had not participated in the program?* Our objective is to identify the effect of program participation for the participant parties, in our case the firms that received LECC funding. This "average treatment effect on the treated" (ATT) is assessed by measuring an outcome variable that captures impact of R&D grants on the treated as well as post-treatment performance. Finding a reliable estimate for the counterfactual state, the outcome if participants had not participated in the program, is the principal task of any evaluation study. Since experimental data is not available, the evaluation of R&D programs invariably has to rely on various *non-experimental* methods. The basic idea is that the outcome for participants in the counterfactual situation is estimated by the outcome of suitable non-participants. The validity of non-experimental approaches has been a matter of intense discussion for at least three decades (see e.g. Blundell and Costa Dias 2000, Smith and Todd 2005).

In our study, we apply 'hybrid matching', which combines propensity score matching with Mahalanobis distance for core variables (see Lechner 1998, Almus and Czarnitzki 2003 for details) and calculates the difference-in-differences estimator (DID) to approximate the ATT. This strategy is





often applied in labor market evaluation studies (see e.g., Heckman et al., 1998), as well as in studies that analyze effects of R&D subsidies (e.g., Czarnitzki, Ebersberger and Fier 2007).

With respect to overall effect of funding, a simple comparison of means in R&D intensity for funded firms with non-funded firms would potentially lead to an upward bias. As a consequence, considerable effort is necessary to construct an adequate counterfactual situation. Thus, we used nearest neighbor matching with replacement to identify one non-treated firm for each treated with the closest probability of mode change.<sup>1</sup> This procedure implies that a non-treated firm can be matched with more than one treated firm. Therefore, a correction for standard errors is required for statistical inference. We follow Lechner (2001) and apply his estimator for an asymptotic approximation of the standard errors.

With respect to particularities of cluster policies we ask further: "what would have been the outcome for LECC program participants if they had participated in other funding schemes?" We apply the same methodology to address this kind of treatment effect. In this second comparison, 'treated firms' are LECC funded firms and 'non-treated firms' the ones funded in other R&D programs.

The analysis is based on four data sets: Our main data source is the R&D statistic of the business sector (R&D survey data). which is collected by the Wissenschaftsstatistik of the Stifterverband (SV Wissenschaftsstatistik)<sup>2</sup> in a two-year cycle by means of a questionnaire addressed to all designated R&D-active companies in Germany ("full survey"). The current basic population for the full survey consists of about 24,000 enterprises and cooperative research institutes engaging in R&D during the survey period 2013. We obtained information on R&D efforts of these organizations for the years 2007, 2009 and 2011. Accounting data is gathered from the Dafne database, released in February 2012. The Federal Government Project Funding Information Database (PROFI)covers the civilian R&D funding of the German Federal Government and contains project-related information. From questionnaire data for LECC firms gathered by the evaluation team of LECC program, we add information on R&D expenditure, R&D personnel and firm particularities for cases where the data is missing in the other sources.

in order to measure the impact of the Leading-Edge Cluster Competition (LECC), an important cluster R&D program by Germanys Federal government, compared to non-funded firms as well as to firms funded by other Federal R&D programs. The LECC significantly increases R&D expenses in comparison to non-funded firms. The results of the Mahalanobis distance matching are depicted in Table 1. Starting with continuous growth rate (CGR) measures, R&D expenditures of LECC-funded companies increase by roughly 45 per cent, whereas matched non-funded firms reduce their R&D expenditures by 13.8 per cent (see variable 'CGR R&D expenditures'). The reduction is caused by a significant drop in internal R&D expenditures. In contrast to this, LECC-funded firms increase internal R&D expenditures and thus, LECC funding helps to stabilize internal R&D during the period of financial crisis 2007-2011. LECC-funded firms also perform better with respect to related R&D intensity measures, although the difference compared to non-funded firms significantly deviates from zero only for R&D expenditures related to the number of employees.

<sup>&</sup>lt;sup>1</sup> The matching procedure is carried out using software package *psmatch2* in STATA 12 (see Leuven and Sianesi 2003).

<sup>&</sup>lt;sup>2</sup> The R&D statistics of the SV Wissenschaftsstatistik are part of the official reporting on research, development and innovation of the Federal Government to the EU and the OECD. The underlying definitions of R&D indicators are based on internationally standardized rules that have been set in the "General Guidelines for Surveys on Research and Experimental Development" (Frascati Manual) of the OECD.

### Table 1: Group comparison after matching (LECC funded vs. non-funded, mean values)

_ Table 1: Group comparison after matching (LECC funded VS. non-funded, mea						
		LECC-	Non-		t-	-
_	Outcome variable	funded	funded	$ATT_{DiD}$	test	#
	All companies (2007-2011)					
	CGR R&D expenditures	0.45	-0.138	0.588	3.39 **	13
					*	5
	CGR internal R&D expend.	0.403	-0.122	0.525	2.99 **	11
					*	0
	CGR external R&D expend.	0.42	0.565	-0.145	0.43	10
						9
	CGR R&D personnel	0.279	0.022	0.257	2.14 **	72
	Δ R&D exp./employees	5.681	-0.229	5.91	2.56 **	13
						4
	Δ R&D exp./turnover	0.143	-2.555	2.698	1.22	13
						5
	∆ internal R&D exp./turnover	-1.67	-2.204	0.534	0.25	11
						0
	Δ external R&D exp./turnover	1.26	-0.35	1.61	1.85 *	11
						0
SME only (2007-2011)						
	CGR R&D expenditures	0.576	-0.197	0.774	3.74 **	80
					*	
	CGR internal R&D expend.	0.552	-0.217	0.77	3.36 **	57
					*	
	CGR external R&D expend.	0.624	-0.26	0.884	2.74 **	57
					*	
	CGR R&D personnel	0.295	-0.064	0.359	2.63 **	48
					*	
	Δ R&D exp./employees	6.155	-3.269	9.424	2.81 **	79
					*	
	$\Delta$ R&D exp./turnover	-0.943	-4.941	3.998	1.12	80
	Δ internal R&D exp./turnover	-4.273	-5.096	0.823	0.22	57
	Δ external R&D exp./turnover	1.901	-1.183	3.084	1.96 **	57
	Companies of the 2 <sup>nd</sup> round only (2009-2011)					
	CGR R&D expenditures	0.306	-0.431	0.737	3.26 **	88
					*	
	CGR internal R&D expend.	0.28	-0.415	0.695	3.04 **	72
					*	
	CGR external R&D expend.	0.531	-0.161	0.692	1.79 *	72
	CGR R&D personnel	0.101	-0.032	0.133	2.25 **	50
	$\Delta$ R&D-exp./employees	1.583	-0.157	1.739	0.52	88
	$\Delta$ R&D-exp./turnover	0.878	-2.713	3.591	1.45	88
	Δ internal R&D-exp./turnover	0.508	-2.866	3.374	1.46	72
_	Δ external R&D-exp./turnover	1.057	0.153	0.903	0.64	72

Discrete change ( $\Delta$ ) or continuous growth rate (CGR) of mean values. <sup>*a*</sup> The value 0,101 means an 10.1 per cent increase. ATT<sub>DiD</sub>: difference between mean values in column 2 and 3. # number of observations. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01.

On the basis of these findings, we address the **degree of additionality** of public subsidies. *Full* additionality describes the optimal solution from the viewpoint of funding bodies and denotes an increase in R&D expenditure in total by the amount of public subsidies *and* additional private R&D efforts for the funded project. *Weak* additionality means that overall R&D expenditure rises by at least the extent of public subsidies. In this case, the public funding does not affect the private R&D expenditure significantly. Previous studies mostly addressed the latter form of additionality.

We find no evidence for crowding out on average for all funded firms. At the same time, we can identify a higher leverage effect of the LECC for small and medium-sized companies. A comparison to





companies that have been funded in other programs shows that the LECC leads to a higher increase in a few R&D related measures (e.g. external R&D as a share of turnover). This evidence further supports the view that there are structural changes towards R&D procurement for LECC funded firms. Our results indicate that the LECC has benefitted especially SMEs, which were able to profit from access to prior existent R&D networks.

When we compare the leverage effect of LECC program on total R&D, we can show that LECCfunded companies exhibit a significantly higher increase in external R&D as a share of turnover and R&D expenditures as a share of employees. LECC-funded SMEs only show a significantly higher growth of external R&D expenditures.

We then derive two main conclusions: First, the level of R&D activities of LECC-funded companies is higher than the level of companies that were funded otherwise, although the difference is slightly more pronounced for SMEs. One possible reason could be that many LECC-funded SMEs have not engaged in continuous R&D, which might imply an above-average leverage effect of promoting R&D activities by public subsidies. Second, there is evidence that LECC-funded companies prefer R&D procurement as a strategic option to a greater extent than firms that were funded otherwise. This can in principle imply different effects on innovation output and productivity (e.g. an increase in internal R&D, see Cassiman and Veugelers 2006).

These results are also consistent with expert interviews that we conducted with representatives from both large companies and SMEs in the ten clusters of the first and second round of the LECC. The interviews give further insights why the leverage effect differ between SMES and larger companies. As expected from the literature on factors influencing R&D financing in larger companies, the R&D budget is in the short-term only moderately flexible, and thus the increase in R&D expenditure in many cases amounted to the sum of the public subsidy. In companies – especially SMEs – with a small or no regular R&D budget at all, public subsidies also induced private co-financing from additionally mobilized internal or external financial sources.

The interviews further indicate that only few firms showed a high increase in R&D in addition to these patterns, at least in the short run. One firm started substantial R&D activities from scratch due to the program. However, one leverage effect that potentially results from public R&D funding is qualitative in nature: additional knowledge flows are induced, and also a substantial share of the projects investigates new ideas or gives impulses that are only possible in a very close cooperative framework as it exists within cluster initiatives. With respect to this topic Engel et al. (2013) detect some positive effects for successful participation in R&D programs of winner regions of the well-known BioRegio contest after the treatment period.

While in some large companies LECC funding partly replaced funds from other programs, we were able to see that a fraction of the SMEs had not been involved in public funding before participating in the program (in fact, some of the business companies had not performed R&D before). Especially for these companies, the effect of the program with respect to the amount of R&D funding has been larger than for other companies.

Based on these results, one could argue that it would be better for technology policy to focus funding more on SMEs in the future. However, there are also some observations that do not support such a change in future policy orientation. First of all, R&D funding in such strategy-oriented programs does not solely revolve around increasing the absolute amount of R&D, but also around aligning R&D more with the common goals of the cluster strategy. The underlying policy rationale is the hope that through knowledge flows and an increase in the application of common knowledge, these projects will benefit society to a larger extent. This mainly occurs through the projects that are carried out, regardless of the "additionality" of project funding. Secondly, R&D funding for SMEs in many industries is only effective if cooperation between SMEs and large companies is promoted.

Large companies are often the customers of SMEs. If SMEs want to sell their newly developed products on the market, large companies have to be involved in the R&D activities.

### 6. Clusters and innovation policy: findings and recommendations

The experiences from the LECC – as well as from other, similar funding programmes in Germany and other countries – can be used for the design and execution of future funding activities. This chapter tries to determine the prerequisites for the success of cluster initiatives. On this basis, recommendations are made for the remaining funding duration of the LECC until 2017, for future cluster and network funding, and for future innovation policies. Wherever possible, the findings of the accompanying evaluation were reflected against a background of existing cluster research and other evaluation studies. There was a high degree of correspondence in many points, as well as some new aspects that are not to be found in the literature (yet).

The "functioning" of technology-oriented cluster initiatives depends primarily on the following factors:

- Technology oriented clustered initiatives can only be successful if they have a critical mass of
  existing technological and innovation potential to build on already when the initiatives are
  constituted. If that is the case, the programme may be able to benefit from *windows of
  opportunity* that arise not just in early development stages of entirely new technologies, but also
  in established industries. This happens e.g. when comprehensive technological changes take
  place or when new challenges arise that require a reconfiguration of known technologies and
  production factors.
- For the success of cluster initiatives, an **assertive cluster organisation** represented by suitable cluster managers is indispensable. The cluster organisation and the CM at its core usually need some time in their constitution phase before they are fully functional. Like their corresponding industries, clusters are subject to medium and long-term structural changes. These changes force cluster initiatives to readjust their orientation from time to time and develop their organisations further. In the long run, these cluster institutions should therefore be seen as temporary intermediaries that may be replaced with new structures as this is appropriate.
- Cluster initiatives are based on **exploiting the benefits of geographic proximity**. For innovative clusters and in consideration of today's transportation and communication technologies, the word "proximity" can be interpreted pragmatically. The importance of geography varies considerably between the participants of the LECC. In some cases it provides a point of identification that contributes to the mobilisation of regional stakeholders and resources. In other cases it is the result of past developments and taken for granted. In yet other cases, geographic proximity does not play a significant role for joint R&D activities. A continuous exchange between R&D employees with different qualifications in one place can be helpful for developing innovations, but is it not a necessary prerequisite for collaboration within a cluster.
- On one hand, the success of cluster initiatives depends on **cluster-internal factors**. Within limits, cluster organisations are able to compensate for and actively respond to interference from the environment. They are successful especially when sufficient technological and innovation potential is available, when joint activities can be advanced within the cluster organisation, and when positive effects can be achieved by a close regional exchange between cluster stakeholders. On the other hand, **environmental factors** also play a role for cluster development, in particular international market events as well as framework conditions and their changes (e.g. when certain technological problems cannot be solved or when market constellations change). Such events may necessitate changes in the cluster strategy or, in extreme cases, render the





objectives of the cluster organisation obsolete, such that responsiveness and adaptability are required.

The funding of cluster and network initiatives is becoming an increasingly important instrument of innovation policy. Cluster funding addresses technology-political constellations which are characterised by the following factors:

- The development of technologies to be funded is marked by a **spatial agglomeration** of relevant companies and public research organisations.
- The addressed technologies are at a stage where a **technological breakthrough** is to be expected in the foreseeable future.
- The clusters to be funded exhibit a critical mass of relevant innovation capacities that may be
  expected to play a major role with regard to the development of the relevant technologies or
  industries in the future.
- The cluster initiative to be funded is supported by strong commitment of the stakeholders it represents.
- The technologies and industries in question have significant importance for the total economy.

If one or several of these prerequisites are not fulfilled, then cluster funding is not advisable, or at least not at the federal level. If from the perspective of the total economy there is still a need for funding, then this should be covered by other instruments of research and innovation policy, such as thematic technical programmes, network funding or funding for R&D cooperation. The instrument of cluster funding is therefore by no means a panacea to solve all conceivable problems of technology policy. Quite the contrary: Excessive or even indiscriminate use would necessarily result in a devaluation of the instrument. Regarding the funding of Leading-Edge Clusters, the concept of the LECC was designed in a way that the above prerequisites are all fulfilled. The findings of the accompanying evaluation also confirm that the basic concept of the competition has been implemented as intended.

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# The Business Model Prism: Managing and Innovating Business Models of arts and cultural organisations

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# **Structured Abstract**

**Purpose** - This paper introduces and analyses the Business Model Prism (BMP) for the arts and cultural organizations as multidimensional framework to map the "as is" structure and the logic of their business model as well as to drive the design of innovation initiatives, i.e. the "as should be" business model. The framework can be used both for descriptive and normative purposes and comprises seven facets organized and represented with a tri-dimensional prism which defines the key business components of arts and cultural organisations.

**Design/methodology/approach** – The research design and methodology are based on a literature review on the themes of business models and business models innovation with a focus on the characteristics and features of the arts and cultural organisations. This paper has a conceptual nature and it is based on a literature review. This includes also a desk research investigation of some key examples of arts and cultural organisations that have adopted innovations to transform the way how they work and deliver value to audience. The development of the novel framework builds the foundation for applying operatively and testing it in arts and cultural organisations and supports them in mapping and transforming effectively their business model.

**Originality/value** – Traditionally great attention the studies on business model innovation have been focused on businesses and public organisations, while rather limited attention has been paid to the

investigation of how arts and cultural organisations can develop and manage their business models. Most of the attempts in this direction are aimed at contextualising, in the cultural sector, frameworks that have been devised for the business sector. Although acknowledging the relevance of these contributions, they present weaknesses related to the capacity to take into account the specific characteristics and features of the arts and cultural organisations. The originality and the value of this paper resides, then, in the attempt to fill this gap, providing a new and industry-specific framework able to effectively support the management and the innovation of the business models in the arts and cultural sector.

**Practical implications** – The proposed framework can support arts and cultural managers to understand the key dimensions characterising the business model of their organizations. In addition, it provides guidelines to map and design managerial initiatives to develop and transform the business model of arts and cultural organisations.

**Keywords:** Business Model Innovation; Arts and Cultural Organisations; The Business Model Prism; Arts and Cultural Management

## 1. Introduction

Arts, creative and culture-driven industries and organizations are widely recognized as new key-players in the current scenarios for their economic and social role as well as for the relevant potential to lead further development and innovation in other industries (Schiuma, 2011; United Nations, 2008). However, the political and socio-economic changes of the last years have determined that public support for arts and culture have generally decreased dramatically with reduction of subsidies towards the arts and cultural organizations (Kea, 2006). This has increasingly encouraged arts and cultural institutions to explore new ways of managing and funding their artistic and cultural programs (Nesta, 2014)

In this scenario, the academic and management debate has largely argued about the relevance to enhance the cultural sector organisations' innovation capacity so that they can be more economic sustainable, they can become less dependent from public funding as well as capable of generating more significant and accountable impact for society at large (Arts Council England, 2011). In particular, arts and cultural organisations are increasingly called to explore the elaboration and the adoption of new business models (Munoz-Seca, 2011; Munoz-Seca and Riverola, 2010; TEH, 2015)

The business model innovation is actually one the main interests for most industrial sectors and organisations. However, arts and cultural organisations present some peculiarities that make the analysis of business model management and innovation very idiosyncratic. The specific characteristics of the sector makes very problematic the simple application of those framework that have been devised and applied traditionally in the business and public organisations. Despite a great "fad" in the current debate about how to analyse, shape and renew the orientations and the ways of doing in the arts and cultural sector, there is a general lack of data around this sector and specifically about the characteristics distinguishing the business models of the arts and cultural organisations as well as of the practices and





the results of business model innovation. This is further complicated by the evidences that even within the arts and cultural organisations it is possible to find great differences in missions and aims, orientation to the market and to the entrepreneurial approach, including ways of managing activities, resources, and stakeholders' relationships (Hume et al., 2006; Munoz-Seca and Riverola, 2008; TEH, 2015).

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In order to fill these gaps, this paper proposes a new framework aimed to support a better management and innovation of the business models of arts and cultural organisations. In particular, the Business Model Prism (BMP) is introduced and discussed as a multidimensional model to be used both for descriptive and normative purposes. It allows to analyse the "as is" structure and the logic of the business model of the arts and cultural organisation as well as to drive the design of innovation initiatives, i.e. the "as should be" business model. The framework comprises seven facets organized graphically around a tri-dimensional prism.

The paper is organized as follows. The second section briefly introduces the notions of business model and business model innovation. The third section discusses the strategic relevance of the business model management and innovation for the arts and cultural organisations. The fourth section introduces the Business Model Prism as a tri-dimensional model aimed to support both the analysis and the transformation of the business models of the arts and cultural organizations and presents the main managerial issues and questions it tries to answer.

## 2. Background

The arts, creative and cultural sector, with their relationships to be activated with the social entrepreneurship, the tourism and hospitality industries, and even with the agri-food business, are increasingly acknowledged as a new engine for stimulating and enhancing growth with an impact on well-being, new employment and society at large (United Nations, 2008).

Despite the relevance that arts and cultural organisations can potentially play to sustain local and global wealth creation dynamics, currently they are facing critical challenges for their growth and even survival. In particular, as a result of political and economic changes of the last decade, the allocation of financial resources, public supports and funds for arts and culture have decreased consistently. These radical changes are forcing arts and cultural organisations to identify new ways of managing and funding their activities (Cunningham, 2002; TEH, 2015; Thorsby, 2008). In this scenario, a relevant theme in the scientific and practitioners' debate is the challenge of enhancing the innovation capacity of arts and cultural organisations in order to improve their sustainability and ability to generate impact for society. For this reason a set of priorities have been identified and highlighted for the arts and cultural organisations, such as the development of new mindsets (Zomerdijk and Voss, 2010), the search of new funding and financing models (Nesta, 2014), the acquisition of managerial and business skills (Helmig et al., 2004), the understanding about how to exploit the digital transformation (Nesta, 2015), the creation of new forms of partnership (Ostrower, 2004; Schiuma, 2011; Schiuma and Lerro, 2013; Smagina and Lindemanis, 2012), the adoption of strategies for audience development (Bollo, 2013).

The above priorities point out that arts and cultural organisations need to undertake a development journey towards the capacity of managing and innovating the ways how they operate, interact with stakeholders, define their value objectives, acquire and deploy resources, and support economically their artistic, cultural and social programmes. This means to understand how to manage and innovate their business models.

## 2.1 The notion of Business Model (BM)

A working definition of Business Model (BM) is: "the synthesis and the integration of all the strategic, organizational, managerial and economic components that any organizations – explicitly or implicitly - design, implement, manage, assess and eventually change and radically transform to guarantee uniqueness, performance, value creation and sustainability" (Magretta, 2002; Osterwalder and Pigneur, 2010; Spieth et al., 2014; Teece, 2010; Timmers, 1998).

Historically, the BM notion has emerged in the late 1990s, with a particular attention to the Information and Communication Technologies and e-business companies (Afuah and Tucci, 2003). Since then, the notion has attracted a growing interest both in scientific and managerial debate (Casadesus-Masanell and Zhou, 2013; Enev and Liao, 2014; Frankenberger et al., 2013; Girotra and Netessine, 2014; Zott et al., 2011). Currently, it is possible to state that, from a scientific point of view, the notion of BM has become a mainstream topic in different research streams (Wirtz et al., 2016). And in the extant academic literature, the concept of business model has been conceptualized in accordance with different focuses and perspectives (Amit and Zott, 2001; Chesbrough and Rosenbloom, 2002; Magretta, 2002; Casadesus-Masanell and Ricart, 2007). Wirtz et al. (2016) group them according to four main foci: innovation; change and evolution; performance and controlling; and design. Moreover, Wirtz (2010) identifies three basic theoretical approaches to the interpretation of BM as follows: the Information Technology-oriented view (Afuah and Tucci, 2003; Hedman and Kallig, 2002; Timmers, 1998; Wirtz, 2000); the Organization-theory oriented standpoint (Linder and Cantrell, 2000; Tikkanen et al., 2005) and the Strategy-oriented approach (Magretta, 2002; Teece, 2010; Zott and Amit, 2008).

A number of definitions about business model have been provided in the academic literature. Among them, Osterwalder and Pigneur (2010, p. 14) state that "*a business model describes the rationale of how an organization creates, delivers and capture value*". Casadesus-Masanell and Zhu (2013, p. 465) argue that "*the business model can be defined as a unit of analysis to describe how the business of a firm works*". Zott et al. (2011, p. 1020) sustain that business model describes "*a logic story explaining who the firms' customers are, what they value, and how firms will make money providing them that value*". Other scholars, such as George and Bock (2011), Downing, (2005), Markides, (2013), Cohen and Winn (2007), instead, provide a different perspective. In particular, on the basis of a review of





prior research, they provide an interpretation of the business model according to an entrepreneurial lens. So, they see business model as a form of entrepreneurial opportunity creation, implicitly or explicitly initiated by market imperfections.

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However, George and Bock (2011, p. 83) underline that "while the term "business model" has gained widespread use in the practice community, the academic literature on this topic is fragmented and confounded by inconsistent definitions and construct boundaries". Moreover, the studies on business model have not yet reached a common opinion about which components exactly build up a business model (Spieth et al., 2014). It is revealed a gap to clearly distinguish the business model from other managerial constructs such as, for example, strategy, organizational design, revenue models, and operations management (DaSilva and Trkman, 2014).

## 2.2 The notion of Business Model Innovation (BMI)

The analysis of a business model is aimed at providing managers with an understanding of the key components characterising the working mechanisms and the value creation dynamics of an organisation, in order to propose adjustments, improvements or transformations. The definition of a new business model or the transformation of an existing one denote a process of business model innovation.

To define the notion of business model innovation, it seems relevant to begin with the contribution provided by Wirtz (2011, p. 72) who states that "BM management constitutes an instrument for the control of a company and comprises all target-oriented activities within the scope of design, implementation, modification and adaptation as well as the control of a business model in order to realize the overriding goal of generating and securing competitive advantage." (....) It "consists essentially in five macro-processes: the design of the business model, the implementation of the BM, the operation of the BM, the adaptation and the modification of the BM and finally the controlling of the BM". This view highlights that while business model management is traditionally concerned with firm-level value creation and capture, Business Model Innovation (BMI) poses in addition questions about novelty in customer value proposition and about the reframe and structural reconfiguration of firms (Schneider and Spieth, 2013). Consistently, the management literature has developed alternative interpretations of business model innovation such as: "the discovery of a fundamentally different business model in an existing business" (Markides, 2006, p. 20) or as "the search for new business logics of the firm and new ways to create and capture value for its stakeholders" (Casadesus-Masanell and Zhu, 2013, p. 464).

In fact, innovation is incorporated into a business model when two or more of its elements are reinvented. This can result in delivering value in a new way, to go beyond single-function strategies and to change use of technologies (Frankenberger et al., 2013). Accordingly, it is important to distinguish business model innovation from product, service or technological innovation (Baden-Fuller and Haefliger, 2013). Managers that confuse the latter for the former risk underestimating the requirements for a successful transformation of a business model. The main scope of the business model innovation is to identify approaches and methodologies to support change management as well as daily practices to better deliver

sustainable performance. Therefore, business model innovation goes beyond product and/or process innovation and continuous business performance improvement, and aims to understand how to transform the way organisations operate and create value (Enev and Liao, 2014).

Business model innovation is nowadays considered particularly valuable as a way to face instability. Indeed, it can provide companies a way to break out of intense competition. Through business model innovation companies can define new routes for sustainability and competitiveness. This means that organisations by analysing, managing and innovating business model can define their role and capacity for wealth creation and then identify the nature and scope of their value creation dynamics.

# 3. The role of business model innovation for the arts and cultural organizations

Multinationals and relevant corporations operating in the manufacturing or in the *e-business* context have been traditionally the object of investigation of the studies about the business models. In contrast, there was a notable lack of attention to the practices of small and medium-sized enterprises. In particular, there is still a significant missing of attention towards the organisations operating in the arts, creative and cultural industries (Munoz-Seca, 2011).

However, in the recent years, there has been a growing attention to the arts, creative and cultural sector. Different reasons contributed to this growing interest. They can be divided into two main categories: on the one hand, arts and cultural organisations are challenged to understand how they can achieve financial viability, without compromising their mission and/or not-for-profit values. On the other hand, the progressive evolution of the political, economic and socio-cultural scenarios put the arts and cultural organisations as players of cultural activities as well as providers of social innovation, of cultural and creative services, and catalysts for change for organisations operating in other traditional sectors (TEH, 2015).

Although business modelling is recognized as being fundamental to arts, creative and cultural organisations' success, the approaches, the techniques and the tools for elaborating, implementing and managing specific and tailor-made business models in arts and cultural sector are still crude and often inconsistent (Hume et al., 2006; Munoz-Seca, 2011; Munoz-Seca and Riverola, 2010, 2008; Zomerdijk and Voss, 2009).

One of the main obstacles to business model innovation in the cultural sector is the lack and/or misunderstanding of the language used in the sector. Indeed, many non-profits, government agencies, social enterprises, NGOs and cultural and arts organisations consistently proclaim that they are not businesses, and therefore business rules do not apply to them and accordingly they state that they do not really have a "business model". But, how underlined by Saul Kaplan (2011, p. 2) in his HBR article 'Business Models Aren't Just for Business': *"if an organisation has a viable way to create, deliver, and capture value, it has a business model. It does not matter whether an organization is in the public or private sector. It does not matter if it is a non-profit or a for-profit enterprise. All organisations have a* 





business model. Non-profit corporations may not be providing a financial return to investors or owners, but they still capture value to finance activities with contributions, grants, and service revenue. Social enterprises may be mission-driven, focused on delivering social impact versus a financial return on investment, but they still need a sustainable model to scale. (...). The idea that business models are just for business is just wrong. Any organisation that wants to be relevant, to deliver value at scale, and to sustain itself must clearly articulate and evolve its business model. (...). It may be, however, that the model is implicit rather than explicit"

Nowadays, an increasing number of creative, cultural and arts organisations are recognizing the importance to better understand manage and change their business model in order to make their value creation capacity more sustainable and impactful. The relevance of understanding and managing business models is recognized as one of the main challenges facing creative, cultural and arts organisations. In particular, great attention is paid on the identification of how to renew their capacity of existing working mechanisms as well as to enable them to effectively use and exploit technologies supporting digitalization processes. Cultural organisations are challenged to develop a more sustainable strategic and operational audience development, financial viability, resource and operations management, with the aim to enhance their value creation capacity as cultural agents in society.

This new strategic and operative perspectives need to be effectively understood and integrated with the current mindset of the arts and cultural organisations, considering that they are generally reluctant to consider themselves as business organisations or as organisations doing some form of business; and instead they see themselves as organisations primarily focused on the social issues. Accordingly, particular relevant are the insights provided by Ingrid Burkett in her publication "Using the Business Model Canvas for Social Enterprise Design (available at: <u>https://mbs.edu/.../Business-Model-for-SE-Design-Burkett.pdf</u>); she states that balancing a social or cultural mission "does not mean that a viable business model cannot be developed" (p. 6) – "It is just that we need to recognize that (cultural) organisations have business models that can be a little different from an ordinary business (...) and to build into the traditional modelling a clear picture of the social objectives (or the mission) of the organisation, in addition to all the dimensions of the actual business" (p. 7).

In order to address the business model innovation challenges of the arts and cultural organisations, different frameworks providing useful guidelines to design, manage and transform business models have been proposed more recently in the academic literature and practitioner-based publications. Combining these main contributions with the characteristics of the arts and cultural organisations a framework identifying the key specific dimensions of the business model distinguishing the cultural industry is proposed.

## 4. The Business Model Prism

## 4.1 Research design, data and methods

The research design has been primirily based on a systematic review of the literature about business model innovation in the cultural sector. Electronic search tools, keywords and search strings to identify relevant research constructs were used. The use of keywords is the most important building block of a systematic search. The underlying assumptions are that keywords capture the field under study and the electronic databases can identify the studies based on those keywords. Search strings are comprised of combinations of keywords. Thus, the success of the systematic literature review depends greatly on the choice of keywords and search strings used to conduct the search. The choice of the keywords and strings for the research constructs were defined on the basis of a consultation of a number of arts and cultural organsations as well as of a delphi group of experts in the field.

In addition the various dimensions and notions identified in the literature and related to "Business Model" and "Business Model Innovation" were identified and investigated by means of a review of the key outlets for scholarly research in the economic, strategic management and social science field (see MacMillan and Stern, 1987; MacMillan, 1989; 1991; 1994). Then, the collected research materials have been downloaded and imported into a reference manager database. Each research material was analysed. The results of this analysis were stored into the reference manager database in accordance with specific workform. In deciding on the electronic bibliographic databases to be used in the study, the search string were inputted into the most widely used web search engine, e.g. Google and Google Scholar. Moreover, a detailed identification and review of the most important existing strategic and managerial frameworks has been designed and implemented. In particular, the following key frameworks have been analysed: the *Strategy Map* and the *Success Map* (Kaplan and Norton, 2000), the *Balanced Scorecards* (Kaplan and Norton, 1996), the *Performance Prism* (Neely et al., 2001, 2002), the *Business Model CANVAS* (Osterwalder and Pigneur, 2010), the *Business Model Cube* (Lindgren and Rasmussen, 2012), the *Lean Canvas* (Maurya, 2015), the *Business Model Innovation Matrix* (Girotra and Netessine, 2013, 2014).

The analysis of the research constructs gained by the systematic literature review based on key-words and strings and of the different strategic and managerial frameworks has been then integrated with the results of a specific desk-research on a selected and relevant sample of world-wide arts and cultural organisations. This has been further integrated by the main insights collected from direct contacts and interviews with a selected sample of European arts and cultural organisations.

## 4.2 Research insights

The results of the investigation have provided the informative base for proposing a novel framework to interpret the business model of arts and cultural organisations. The Business Model Prism (BMP) is, then, proposed as a multidimensional framework to be used both for descriptive and normative purposes to



understand and transform the business models of the arts and cultural organisations. It is presented as a tri-dimensional prism comprising seven facets (Figure 1). The top and bottom facets of the prim denote the Social and Cultural Value & Impact, and the Funding and Financial Resilience, respectively. The other five facets of the prism correspond to the other key dimensions characterizing a business model of the arts and cultural organisations: Stakeholders, Strategies, Processes, Organizational Resources, and Partnerships.

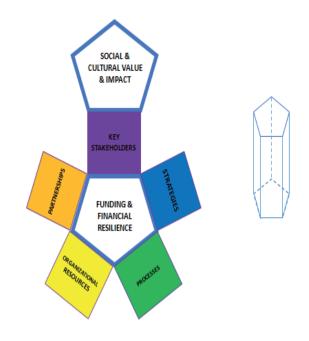


Figure 1. The Business Model Prism for ACOs

The Business Model Prism can support the identification and the mapping of the peculiarities of the business models of the arts and cultural organisations. It takes into account the specific features of the value creation focus and the operation mechanisms of such organisations. It allows to analyse the "as is" structure and logic of an arts and cultural organisation business model as well as to drive the design of innovation initiatives, i.e. the "as should be" business model. The seven distinct but inter-linked perspectives provide an ideal lens to understand the business model of an arts and cultural organization starting from addressing the following key questions:

- ✓ Social and Cultural Value & Impact Why do we exist? What impact do we want to have? Which values do we want to propose and offer? What are our mission and vision?
- ✓ Stakeholders Who are our key-stakeholders? What are their wants, needs, expectations and dreams?

- ✓ Strategies What are we doing to satisfy our stakeholders and deliver value for them? What are the main products and services we are doing? What is our legal structure? How is currently our organizational structure?
- Processes What are our existing processes? How do we manage our projects and programmes?
   What are the characteristics of our productions? How do we generate and sustain demand? How do we do Research & Development (R&D)?
- ✓ Organizational Resources What resources do we need to put in place, exploit and enhance to operate our processes?
- ✓ Partnerships What partnerships do we need to build and enhance to implement our strategy and guarantee social and cultural values and impact?
- ✓ Funding and Financial Resilience What are our current costs and incomes? What is our financial status?

The above key questions define the main issues to be addressed and managed to supporting the development of the fundamental theoretical pillars distinguishing the business model of an arts/culture organisation and provide a first step to understand the hypothesis grounding the "how", "why", "what" and "how much" of the working mechanisms, mission and vision of the investigated organisation. The above questions are then cascaded down for each perspective of the prism exploring further in detail the sub-dimensions components of the prism. Figure 2 illustrates the further subcomponents of the Business Model Prism.



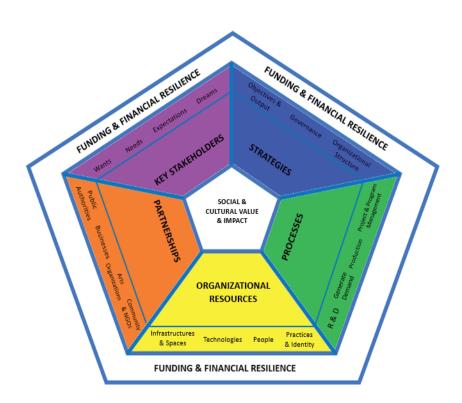


Figure 2. The Business Model Prism and related sub-components

The Business Model Prism reflects and applies a set of internal working mechanisms: the basic assumption of the business model prism application is that those arts and cultural organisations aiming to be sustainable and impactful in the long term must have a clear picture of their value creation dynamics. For this reason, they need, firstly, clearly define what value and impact they are going to deliver and for who, and consequently they have to define mission, visions and strategies. The key stakeholders have to be identified, and, in relation to them, the value propositions have to be defined. Then, the analysis of the processes allows clarifying the activities that have to be put in place in order to achieve the targeted strategic objectives for value creation. This has to be complemented with an understanding of the organisational resources available and needed. The key partners have to be identified and the relevance of the relational capital connected to such partnerships has to be defined. Finally, the business model analysis involves an understanding of the funding and financial resilience representing the economic and financial viability of the organisation. Figure 3 illustrates the stages through which to implement the framework in order to analyse a business model.

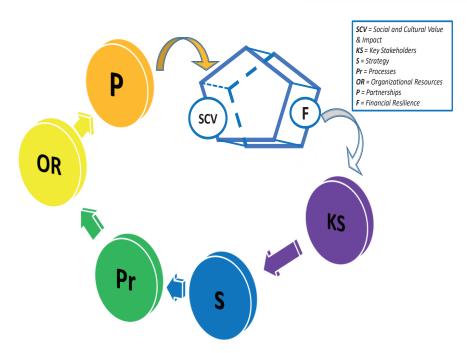


Figure 3. Implementing the Business Model Prism

# 5. Conclusions

The debate in policy, scientific and managerial circles have recently started to consider arts and cultural organisations as potential and relevant players in the paths of development, both at industrial and societal level. For this reason, it is of great relevance to understand how the arts and cultural organisations can manage and innovate their business models towards the capacity of shaping strategies and operations that can make them more sustainable and impactful.

The traditional models and tools devised to support public and private organisations to analyse and develop their business models, even if provide useful insights for the cultural sector, present limitations when applied to the arts and cultural organisations due to the specific characteristics of those organisations. In order to effectively balance the tension between the social and cultural values and the commercial values, the arts and cultural organisations need to design and apply business models, also in an implicit form, capable to identify and address their specific value propositions, resources requirements, activities delivering and economic and financial structures.

In order to fill the gap in the literature a novel framework is proposed: the Business Model Prism aims to support the mapping of a current business model as well to inspire and drive its transformation.

Future development of the research reside both at theoretical and empirical level. From conceptual point of view the hypothesis at the basis of the model need to be further developed in order to improve the granularity level of the different framework's dimensions. From empirical standpoint the model need to be tested into real cases both by action research projects and by developing surveys aimed at identifying the key traits of business model innovations of the arts and cultural organisations.





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# Connecting corporations and communities: Towards a theory of social inclusive open innovation

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#### Introduction:

Despite pervasiveness of the market forces and supplementary role of the state and in some cases, even civil society organisations, there are unmet social needs which remain unaddressed by the existing institutions. With industrial growth becoming jobless, the need for new models of social innovation is being felt all around the world to provide jobs to the youth, skills for the new economy and entrepreneurial opportunities for transforming resources and skills. The persistence of some of these unmet needs ( also referred as wicked problems sometimes) or unaddressed problems for a long time shows that the existing institutional arrangements are inadequate for the purpose. Innovations are imperative. A socio-ecological system that recognizes and rewards innovation can withstand many external shocks, provided it is agile and innovates quickly to remain responsive to emergent challenges (Anderies, Janssen, & Ostrom, 2004).

Whether corporations will follow an open innovation approach to blend grassroots ideas and innovations with their expertise in a reciprocal, responsible and respectful manner (Gupta et al,  $2016^3$ ) is still an open question. The design of appropriate manufacturing and frugal supply chain will then become closely linked with other innovation ecosystem features. This debate on the role of social innovation in multi-stakeholder context in European focused on how these innovations fostered trust among different actors and influenced policy (Defourny and Nyssens, 2008)<sup>4</sup>.

In this paper, we describe the market and social forces which influence the emergence of social innovations through various processes. We then look into the evolutionary pathways for social innovations (Mulgan,  $2006^5$ ), to avoid inertia and spur initiatives to bridge the social gap in an inclusive manner through mobilization of youth in particular. The ecosystem for social open innovations provides

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<sup>&</sup>lt;sup>4</sup> Defourny, J., & Nyssens, M. (2008). Social enterprise in Europe: recent trends and developments. *Social enterprise journal*, *4*(3), 202-228.

<sup>&</sup>lt;sup>5</sup> Mulgan, G. (2006). The process of social innovation. *innovations*, *1*(2), 145-162.





scope for connecting corporations and communities (Herrera, 2015; Gibson-Graham & Roelvink, 2013<sup>6</sup>). Following the theory of reciprocal and responsible open innovation systems ( Gupta et al, 2016), we explore the way barriers are overcome on the way to reach the base of economic pyramid [BOEP] customer. Technological adaptability and institutional or market adaptability are explored to understand how communities get empowered to deal with corporations through an open innovation platform. The corporations need to be empowered to understand the decision heuristics followed by grassroots and community frugal innovators( Gupta, 2006). Just as community need to be empowered to negotiate fair and just exchange relationship with corporations (Honey Bee Network, 1990-2017).

Finally, we conclude with the recommendations based on the experiences of grassroots innovators that can enrich both social innovations and social enterprises following commercial as well as social business models for meeting the unmet needs of the disadvantage section of the society.

### Part I Theory of social innovation

Social innovations emerge to meet the need unmet due to failure of markets, state and even civil society. Sometimes, technologies emerge which can be applied to deliver existing services better to meet the unmet or under-met needs of the disadvantaged section. Social innovations may involve several channels for serving the society such as social business/enterprise, social innovation based profit or non-profit enterprise, association, cooperative, groups or even individual social change agent. Sometimes, social innovations involve mobilizing people through new social movements. These movements may have a single or multiple locus of institutional core or anchor. The Honey Bee Network is a new social movement without any legal structure or boundary. But it has spawned several institutions such as Society for Research and Initiatives for Technologies and Institutions [SRISTI], Grassroots Innovation Augmentation Network [GIAN] and National Innovation Foundation [NIF] which provide institutional anchor to sustain the movement. It has also networked numerous other institutions, individuals and groups which may partly or wholly subscribe to the network philosophy in serving the society.

The social business can be defined as an economic activity addressing an unmet need of the disadvantaged people or making an existing delivery system more efficient, effective and accountable to different stakeholders including the people to be supported. Social business can have profit or non-profit purpose. In the case of profit-oriented enterprise, a large part of the profit goes back to the people. Amul Dairy Cooperative movement is able to give back more than 80 per cent of the value of the milk provided by the farmers to them as payment. In the 20% margin, it manages the entire supply chain, logistics and other manufacturing infrastructure. A business may share entire surplus with the people involved in the

<sup>&</sup>lt;sup>6</sup> Gibson-Graham, J. K., & Roelvink, G. (2013). 34. Social innovation for community economies: how. *The International Handbook on Social Innovation: Collective Action, Social Learning and Transdisciplinary Research*, 453.

provision of raw material and/or consumption of the final product and service, as is the case with many cooperatives. Such businesses may or may not grow very far depending upon the resources they set aside for replacing the infrastructure [depreciation], skill development and enhancement of capabilities of staff as well as customers and R&D, innovations for designing new products and services to expand market and serve existing clients more empathetically. Social business can be evaluated on the parameter of inclusiveness. There are five kinds of exclusion which a social business or an enterprise should try to overcome completely or substantially. Every social enterprise / innovation / business must serve the people in relatively inaccessible areas, engaged in neglected sectors, having skills for which market has come down or doesn't exist, suffer from seasonal or temporal exclusion and belong to social classes which have historically remained suppressed, bypassed, exploited and under-served. If social, sectoral, seasonal, spatial and skill-based exclusion is not overcome, then an enterprise is not inclusive or inclusive enough. Existing corporations may not have inclusivity in all their functions. They may not hire sufficient women or staff from neglected social classes. But, they may serve them better than others. It may not always possible to have inclusivity in all functions and all services and yet such inclusion is desirable. For example, a social health enterprise may not have medical doctors coming from tribal or scheduled caste background and yet it may serve the most neglected people in the most affordable and accessible manner.

The design of institutional platforms that reduce or eliminate the transaction costs of product and service providers and users in a given situation of social iniquity may depend on the degree of openness for mutual learning between formal and informal sectors. Higher the openness, greater may be the flexibility in designing open innovation platform. The conventional framework of open innovation has referred to corporate willingness to learn from outside or share its knowledge with outsiders. The central tenet of the Honey Bee Network has been openness in sharing, learning and valorizing people's knowledge through cross pollination and linkage with formal science and technology, business and financial sectors. Many farmers and artisans share their innovations openly without caring about the possible revenue they could have generated by keeping it confidential or restricted. A concept of technology commons was developed to ensure that despite IPR protection, people to people sharing is allowed and encouraged. However, the grassroots innovations can be accessed by a company only through license. This is a hybrid version of open and close system of innovation. Generally, most grassroots innovators benefit from the feedback they get from the community members including users and non-users of their innovations. In some of the open innovation communities in formal sector, similar values exist. There has been a long debate about the difference between social innovation, social enterprise and social The social innovation is a creative and compassionate solution for an unmet need of a business. disadvantaged social segment so far excluded from the benefits of development. The exclusion may have taken place because of spatial, sectoral, social, skill and seasonal / temporal reasons. It is not necessary that the solution may emerge only from the people who are affected by the problem. When it does, it becomes an example of social innovation from grassroots. When it is developed by outsiders such as a corporation or a public sector agency or a voluntary organisation, it becomes innovation for grassroots. One can also have social innovations emerging at grassroots though with or without involvement of people as designers and/or users or both. When such solutions have to be provided to several communities on an ongoing basis, one needs an operational, logistical supply chain. Such





manufacturing and supply of solutions may take place on commercial basis or not for profit basis. It can also happen that moderate profits are generated but not shared with the promoters as applicable in section 8 companies or what Prof. Yunus calls as social business. The programmed development and delivery of goods and services at the door of needy communities with or without full cost recovery is called social enterprise. The line between social innovation and enterprise is fuzzy. Once an activity acquires an entrepreneurial propulsion backed up by a budget and a revenue recovery system, it acquires an enterprise format. The cost of services or products may be met by third party or through CSR funds, through crowd funding or endogenously by the community itself [Fig 1].

DGIST

The emergence of social innovations in any society indicates that some of the unmet social needs have spurred experimentation for searching a solution. Market failure occurs when the cost at which solution is available is beyond the reach of majority of those who need the solution. The state failure takes place when public policy either does not target the most affected people or uses indicators which do not ensure that the most needy benefit from existing delivery systems. Civil society failure happens when even the voluntary organisations find it either infeasible or lack resources to reach the unreached social segments. In such a situation, some of the affected people or other individuals may develop an accessible, affordable, adaptable solution available to the most needy ones. If these initiatives are converted into innovation through open learning and open sharing, then social innovation also becomes an open innovation. Sustainability of such solutions depends upon the degree of reciprocity among provider, consumer and facilitator of the delivery systems. To illustrate, in many of the semi-arid regions with limited irrigation potential, high climatic fluctuation, markets are often weak because of poor infrastructure. Even the public systems are weak because often the state uses such locations as punishment postings for laggard officials. Since neither the bureaucratic system nor the political system is much inclined to serve the interests of such people, the instances of apathy and inadequacy are rampant. In one such case, during our learning walks, Shodhyatra, we came across a practice for pest control which are very sustainable and extremely affordable. The problem of termite attack in wheat in drylands is quite pervasive. Most farmers being poor, cannot afford chemical pesticides which are also not very effective in such cases. The private sector agencies and public sector scientists have not paid adequate attention. A farmer shared a very interesting and extremely affordable solution. He mentioned that while irrigating the wheat crop, they put cut pieces of cactus like euphorbia or opuntia in the irrigation channel. The latex of these cacti dissolves in the water and spreads in the field to help control termites. This is an open innovation socially extremely useful and affordable by the poorest people and developed also by the poor people. There are many such examples in the Honey Bee Network [honeybee.org, Sristi.org]. Harbhajan Singh, a small farmer from Hisar decided to irrigate cotton field in alternate rows. The water requirement went down by half. The pests attack also got reduced because of less succulence in the plant. The pesticide cost and its adverse environmental effects also got reduced. The challenge in diffusing such social innovations really is that the user cannot be expected to pay for such open source information. Therefore, third party agency has to bear the cost of diffusion. When social entrepreneurs and innovators fail to mobilise resources either through crowd funding or subsidies / grants, such extremely affordable and democratic sustainable innovations fail to diffuse. The process of development then does not become inclusive enough.

Insistence on full or partial payment by users for such knowledge, practices or sometimes even tangible solutions [such as low cost devices for physically challenged people] may lead to exclusion of the most needy and the poorest ones. In this paper, we have argued for a framework that reduces transaction costs on supply and demand side and make such intermediation possible that needs of the most disadvantaged people don't remain unmet. The way institutions are designed and monitored, it is becoming more and more difficult even by public institutions to serve the extreme cases of public interest. Limits of market, state and civil society are seldom brought to the heart of popular discourse.

#### Taxonomy of Social Innovation approaches (six Bs of basic design approaches):

• **Bridging function:** Bridging function implies meeting need gaps by linking the available actors supplying innovative solutions with needy communities. The existing suppliers may even design new solutions after bridges are formed if the need be, with or without participation of users.

There are several ways in which bridges are formed among different actors meeting the unmet social needs. Bringing actors together, creating platforms for sharing information and generating mutuality of interest and help in forging bridges. Many online match making platforms provide information of various actors who can on their own form association or partnership. Enabling a two-way flow of information may not be sufficient for forming bridges in every case but it increases the possibility given the willingness among the actors. A platform of voluntary organisations working for the blind and various agencies providing content, technologies, funding, etc., may trigger partnerships. Bridge function is one of the weakest process but a very popular one.

• **Broker**: Broker reduces the ex-ante and ex-poste transaction costs of the social innovators/entrepreneurs & meets the unmet social needs at mutually agreed terms.

Brokers not only bring the actors together but also mediate the deals. Thus, in the above case the agencies working for the blind may not be able to develop proposals, fulfil all the guidelines or generate enough funds to avail of innovative solutions or other support system. Social innovators involved in brokering will reduce transaction cost and create mutuality of interest. Generally, brokers also take responsibility for due diligence which the bridge function may not do.

• **Benevolence:** A philanthropic or charitable operation under which uniform solutions are offered to the affected people presumably meeting their similar unmet needs. The fit between supply and demand may be optimal or suboptimal depending upon the inherent nature of diversity and variability among users.

The charitable organisations may provide uniform solutions or in some cases may agree to adaptation of the solutions for meeting the needs of the user organisations. The benevolent





organisations provide bridge and broker the deal and fund it to make sure that needs are met. Sustainability of such platforms or processes may depend upon the continued willingness of benevolent social innovators to underwrite the costs of meeting the unmet needs.

DONST

• Social Business: Where a commercial and/or not-for-profit organisation provides a business opportunity to people to meet their own needs or through third party enterprise with or without recovery of full cost of doing so. Social business enterprise can meet partly or fully the unmet needs of the users. There can also be differential pricing of products/services, which may enable their cross subsidization to the consumers.

In this model of social innovation, the mediating organisations enable entrepreneurial approaches for meeting the unmet needs. The social entrepreneurs may cover fully or partly the costs of providing products and services. Whether such a system will sustain depends upon the viability of the business plan or ability of the user organisation to cross subsidize different classes of users to run the activity. There are cases when the intermediating organisations provide business solutions but the costs are met by some philanthropists till such an organisation becomes self-reliant.

• **Bonding:** Social innovation may bring about evolution of common property/pool institutions and/or organisations by bonding communities & harnessing their social capital to meet their needs. Bonding can have implications for the way companies or institutional resources are mobilized or generated locally. These institutions can be autopoeitic that self-design and self-governed; or hetropoeitic or PPPP (Public-Private- People-Partnership) in nature.

Social innovators in such cases invest their energy in creating community organisations or fostering social contracts so that with or without outside support, the needs of the disadvantaged sections are met. When differently abled children attend the regular schools, the intervening agencies or social innovators try to make the sighted students take responsibility of the blind ones. The differently abled children learn to share their strengths and seek help when necessary without feeling obliged or patronized. One can have a variety of institutional arrangements for creating social bonds to empower committees to meet their needs autopoeitically or hetropoeitically.

• Bundling & Blending: *Bundling* approach to social innovation implies creating a bundle or a combination package of existing component solutions or sourcing additional components available locally or externally or both to meet the unmet social need. The users have a choice in some cases to make or modify their own bundle to suit their needs with in their affordability constraints. *Blending* approach to social innovation implies re-configuring different components in a manner that the user cannot separate one component from the other. In this case the user has to take all of it or leave it. It cannot modify the blend except through appeal to the provider of blended solution to modify its offering in due course.

Both in product and service innovations, a wide scope exists for bundling and blending the variety of solutions so as to suit the needs of users. The bundling approach in the case of blind students would mean access to braille books, audio books, various devices for navigation and other services. Depending upon individual preferences one can choose to have all or a combination of some of them to improve affordability and flexibility. In the case of blending, one cannot separate different functions or features. Even if one is likely to use only two out of five features, one has to pay for all five. The re-configuration may not be possible either due to technological constraints or institutional ones.

It is not necessary that all these approaches occur in mutually exclusive manner. Either over time, i.e., sequentially or over space the functional integration can be facilitated to meet the unmet user needs. Empowerment of the communities meeting their needs through external provisioning may require institution building by the social innovators. This is one area where even corporations or communities are unable to invest long term resources to create capacity among the user community for negotiating appropriate terms of exchange under various functions described here. The reciprocity and mutual accountability in social innovations requires reliance on open innovation so that all the parties share and seek ideas without reservation or restrictions.

Source:

Gupta, Anil K., 1987, Own compilation, adapted from <u>http://anilg.sristi.org/banking-on-the-unbankable-poor/</u>

Gupta Anil K., 1987, Being Bridges, Brokers or Benevolent Banias, CMA, IIM., Ahmedabad,

Gupta Anil K., 1987, Banking in Backward Regions: Banks-NGO-Poor Interface -Alternatives for Action, IIM Working Paper No.675, in Indian Journal of Public Administration, Vol.XXXIII (3) Nos. 662-679, July-September 1987.

#### **Emergence of social innovation:**

There are several reasons why needs of some of the social segments remain either unnoticed / unsensed or if noted, remain unmet. The failure of markets, state or even civil society may cause such gaps in meeting the needs persist for a long time. The transaction costs of meeting such needs may be high due to terrain, basic infrastructure, lack of local demand or a combination of other technological, cultural or institutional factors. There are five A's which explain why needs may remain unmet even if some of the transaction costs are met. The solutions may not be affordable or accessible or even acceptable. It is not enough to have acceptable solutions because needs may change over time and the change may not be uniform for different community members. In such cases, the adaptability of solution and its availability becomes important parameter for supply chain management. What use an affordable, acceptable and accessible solution is, if it is not available. Certain needs therefore remain unmet for long time though policy makers or corporations may claim that they have solutions for the same. There are several ways in which the community members try to articulate their need. They may protest through violent or non-





violent means and if policy doesn't change, the inertia may follow. This may aggravate the frustration and in extreme cases, may give rise to insurgency. The non-violent constructive Gandhian approach may lead to co-creation of solutions through joint action between people and the formal institutions. People learn to be helpless sometimes. Their self-esteem goes down and the downward spiral of low esteem, low aspirations and low expectation leads to other adjustment with whatever problem exists or may trigger exit through migration or abandonment of the enterprise.

The most hopeful scenario which has been the foundation of the Honey Bee Network is innovation at the grassroots level. These innovations may be supported endogenously by individual innovator or his community, through crowd funding of private or public grants and in rare cases through corporate social responsibility. The open innovation framework may trigger institutionalization of social innovation if the needs are met adequately and the communities and / or individuals try to improve the ideas on their own. Grassroots innovations provide an opportunity for engagement to not only corporations but also high net worth individuals and any other person who wishes to contribute small amounts through crowd funding.

In the figure two, evolutionary path ways for social innovation are described. Either through some extreme event, accident or otherwise, one may sense the unmet need. Deliberate attempt to study the reasons for unmet needs may also uncover them. If the institutions responsible for meeting the needs are overawed by the scale of the problem, limited scope of their mandate, inadequate resources or inability of users to use what is available, the inertia may follow. But, if either some individuals or community feels impatient, empathetic, or has prior experience of solving problems, it may take initiative. Availability of resources, mentors and ecosystem support may also reinforce the willingness to take initiative. The initiatives may emerge endogenously or exogenously [Fig1]. They may or may not evolve into an innovative solution. Various facilitative or inhibitory factorsmay influence this transition. Sustainability of social innovations may depend upon the openness of the learning and exchange platform. Product and process innovations may be accompanied by service and system support by third party agencies or individuals. In a dynamic social situation, neither need remain constant nor the design or delivery system. Continuous derivative innovations are necessary including the bypassed communities.

The interplay between inertia and initiative may lead to innovation in product, process, service and system including the excluded regions, communities, sectors, skills or other factors. Continuous improvements and inclusivity may contribute to sustainability in bridging social gap. Whether the solutions so generated require repurposing available institutions or technologies, redesigning them, recalibrating them or rejuvenating them depends upon how institutions transform themselves for bridging the social gap. The corporations may also develop inertia and thus may not take initiative to generate social innovations. Small enterprises, communities may also remain timid and limited in their vision without exploring open innovation to learn and share their approach to solving problem. It is true that grassroots innovators follow open innovation far more than large corporations. For every one Tesla which opened all its patents, there are tens of thousands of farmers, mechanics, labourers, artisans, etc., who share their solutions to meet the social gap openly. The ecosystem for social innovation may however need both the community level initiatives but also corporate contributions beside public policy support. Both closed loop innovations and open collaborative innovation have a role to play in

institutional transformation. The design of a mobile phone is a closed loop innovation backed by hundreds of patents. But it also provides open platforms on which different factors can design participative and open access knowledge base and communities. Institutional transformation may involve repurposing the existing institutions or sometimes redesigning. When that is not easy to accomplish recalibrating the monitoring indicators and success factors may become necessary to rejuvenate the institutions. The ecosystem of social innovation does not grow only through transformation of existing institutions. There are situations in which disruption of established norms and values become necessary to achieve the larger social good so long as the core values of reaching the unreached remain intact. The classical banking model, trying to serve rural communities through branch network left almost forty percent people of our country unbanked. New payment gateways and channels have made banking accessible to the most remote corners of the country which had not been reached through conventional model. More innovations are called for to incorporate the barter economy still prevalent in tribal areas. The strength of the ecosystem lies in constant recalibration of indicators of performance. More and more difficult problems must occupy the agenda for action with change in social norms of sensitivity and accountability

#### Corporations and communities: mutual empowerment (fig 3)

Corporations have been trying to reach the base of the economic pyramid<sup>7</sup> by providing flexibility at institutional or market level or in the design of technological solutions. Corporations have succeeded in delivering small sachets of cosmetics, tea or coffee to millions of villages. And yet, the open source multimedia multilingual content for educating children has not reached even a few thousands village schools. The supply change efficiency in delivering consumption goods fails to mimic similar efficiency in overcoming anemia among 60 per cent women. Several factors have been discussed earlier responsible for neglect of unmet needs. Corporations need to be empowered to bring in flexibility and adaptability in their technological and institutional functioning. Their ability to develop frugal designs would increase when corporate designers will work with grassroots innovators to learn from their heuristics. Not all designs are modifiable or are climate resilient, environment friendly or gender neutral. But greater connect with the community might develop empathy and a reciprocal and responsible innovation system may evolve. Amul cooperative model has demonstrated that scale need not prevent close affinity with client's interest. Amul transfers more than 80 per cent of the value of marketed milk products to the milk producers. With almost 30000 Cr worth brand, it has shown that a completely inclusive service model can be built to provide comprehensive care for household livestock enterprises.

The open innovation platform bringing corporations and communities together to generate, adapt and deliver social innovations can have four possible approaches. Openness is measured here in terms of willingness to share one's knowledge and resources with others that is inside out; and the opposite that is desire to learn from others i.e. outside in. The most indifferent and pessimistic situation is (cell1) when oth inside out and outside in are low [fig 3]. Such organizations do not want to share with other

<sup>&</sup>lt;sup>7</sup> There are several pyramids. People at the bottom of the economic pyramid may not be at the base of ethical or innovation pyramid.





organizations or the communities what they are good at. Nor do they want to learn from them. It is ostrich kind of behavior which will not lead to much reciprocity or responsibility between corporations and communities. In the second case, the inside out is high and outside in is low. Such ecosystems of organizations encourage pollination of ideas, open sharing of their knowledge as done by Tesla. This pioneering company in electrical cars opened all its patents to encourage competition and installation of more charging stations for customer convenience. Those who have high outside in and low inside out [cell 3] behave like a sponge seeking ideas from others but not sharing much with them. Many large corporations crowd source ideas from outside for frugal and/or social innovations with or without payment. They seldom give feedback to the idea providers as to what did they do with the ideas received and value generated. If they will let idea providers know, how valuable those ideas were, their confidence in their own innovative potential could increase manifold.

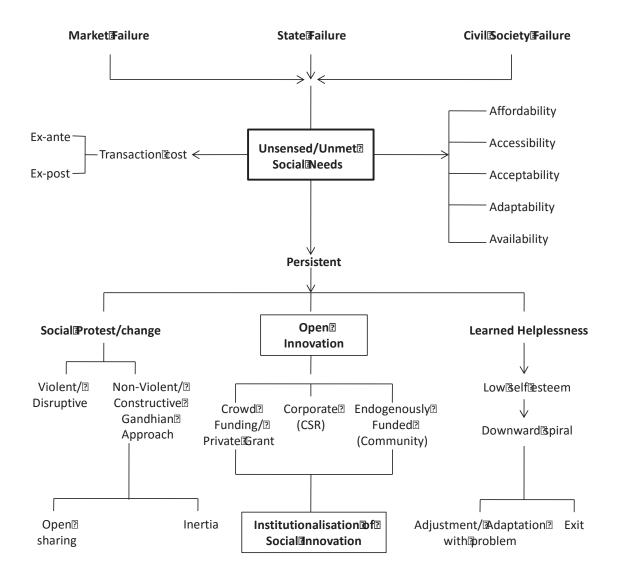
DGÁST

The reciprocities between corporations and communities can be pursued through several mechanisms with or without intermediation of third party.

- a. While sourcing ideas, even if corporations don't use these ideas as such but these ideas trigger further investigation, they should acknowledge the idea provider and share some benefits with them. Without their initial trigger, the corporations may not have reached the point they actually reached. A very large industrial house and a national research lab jointly found a lead of developing graphene kind of material from natural resource very useful and interesting. Their representatives even visited the tribal community which provided the original lead. Eventually, through R&D they developed a process which could make a graphene compound providing a lot of potential for commercial advantage. They refused to acknowledge either the community or National Innovation Foundation [NIF] which mediated in the exchange and facilitated their visit in good faith. The patent was filed without any attribution to the Foundation and the tribal community, the question of sharing benefits didn't arise. The Foundation is opposing the patent on various grounds and deeply regrets an unethical behavior on the part of the formal institutions in this regard.
- b the mutual capacity building among corporation, community and civil society organizations.
- c) The corporations learn the art of frugal innovations from grassroots innovators and youth and share the art of frugal supply chain with the communities.
- d) The generosity of communities may sometime motivate the corporate executives to take time off and extend their personal social capital in aid of social innovators.

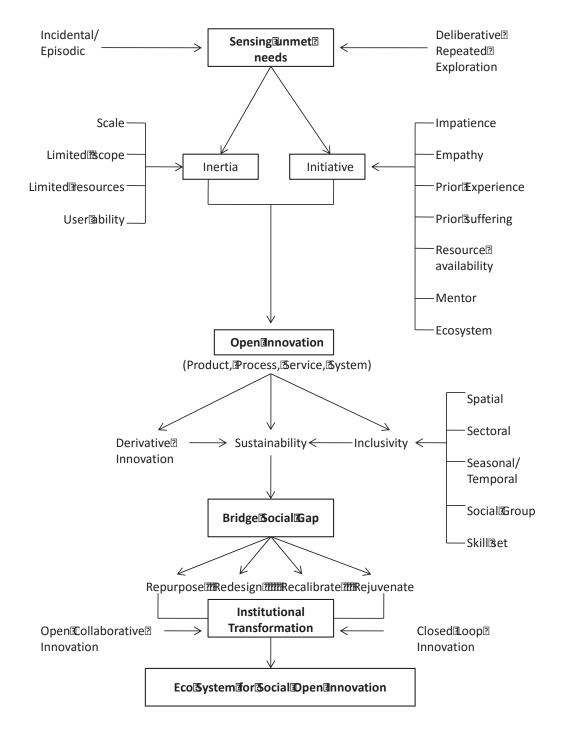
There are numerous ways in which social innovations are nurtured and mutually rewarding relationships can be forged among corporations, communities and civils society organizations. What matters is not only the mutual reciprocity and responsibility but also willingness to learn from each other.

# EmergenceIbfIsocialInnovationI(Fig.II)



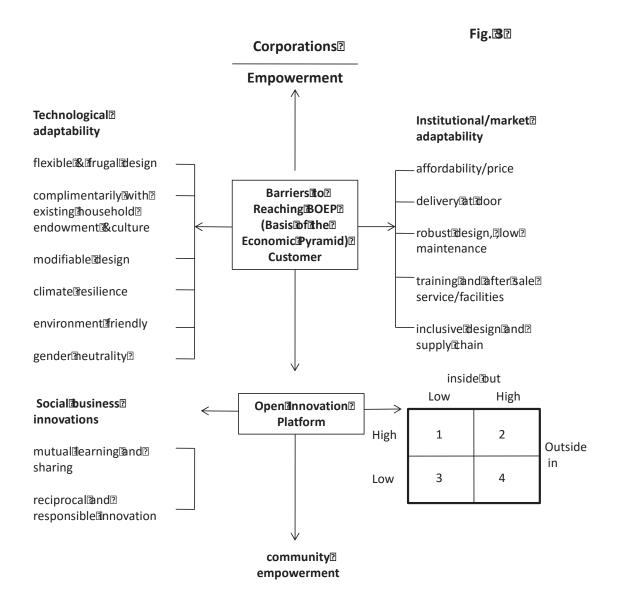






#### Evolutionary Pathways for Social Innovation [Fig. 2)

June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia







UNIVERSITY

# Capitalism as a Complex, Adaptive System

### **Ulrich Witt**

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## **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 16 (Friday)

# Session-16-#301-1(SS8 & SS22)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 08:00~09:30)

### "Innovation diversity for emerging economies"

- Chair: Natalja Lace(RTU, Latvia)
- Paper 1: "Internet of Things as a framework for company digitalization" by Deniss Sceulovs, Vladimir Shatrevich & Iveta Ozolina-Ozola
- Paper 2: "Managing Competence Based Synergy in Acquisition Processes: Empirical Evidences from Information and Communication Technologies Industry" by Andrejs Čirjevskis
- Paper 3: "Relevance analysis of factors enhancing coaching in organizations" by Angelina Rosha & Natalja Lace
- Paper 4: "Efficiency Analysis of Retail Chain Stores in Korea" by Kyungwan Ko, Meehyang Chang), Eun-Song Bae & Daecheol Kim
- Paper 5: "The Efficiency Analysis and Service Quality for Chinese Commercial Banks Using DEA" by Meehyang Chang & Hanbyeol Jang

# Session-16-#303-1(SS7 & SS15)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 08:00~09:30)

### "Open Innovation, New Combination, and Schumpeter"

- Chair: JinHyo Joseph Yun(DGIST, Korea)
- Honor Discusser: Philip Cooke
- Paper 1: "Effect of Distance on Open Innovation: Differences among Institutions according to Patent Citation and Reference" by JinHyo Joseph Yun, EuiSeob Jeong, ChangHwan Lee, JinSeu Park) & Xiaofei Zhao
- Paper 2: "Harnessing the value of open innovation: Change in the moderating role of absorptive capability in the South Korean Manufacturing Sector" by JinHyo Joseph Yun, Xiaofei Zhao & Sung Deuk Hahm
- Paper 3: "Benefits and Costs of Closed Innovation Strategy: Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal" by JinHyo Joseph Yun, KyungBae Park, Jeonghwan Jeon & XiaoFei Zhao
- Paper 4: "Innovation of the Management Systems in Medium-Sized Enterprises Problems and Solutions" by Maris Miller & Elina Gaile-Sarkane
- Paper 5: "Assessment of sustainability at higher education institutions" by Jana Erina & Ingars
   Erins







# **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 16 (Friday)

# Session-16-#309-1(SS6 & SS14)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 309, Time: 08:00~09:30)

### "Social innovation for sustainable development"

- Chair: Karine Oganisjana(RTU, Latvia)
- Paper 1: "The model of involvement of the society in social innovation processes in Latvia" by Karine Oganisjana, Svetlana Surikova, Konstantins Kozlovskis, Nicolás Monge-Iriarte & Anna Svirina
- Paper 2: "Grassroots social innovation development: the main trends" by Anna Svirina, Alfia
   Zabbarova & Karine Oganisjana
- Paper 3: "The social entrepreneurship concept as a subject of social innovation" by Lasma
   Dobele & Gunta Grinberga-Zalite
- Paper 4: "A food industry trend analysis of Gangwon-province in Korea based on Patent Information" by Taehoon Kwon, EuiSeob Jeong, Eui Soo Kim, Joon Woo Lee & Hyang Ho Son
- Paper 5: "Startup trend analysis of global listed companies Focusing on growth engine industry in Korea" by Lee-Nam Kwon, Jun-Hwan Park, Yeong-Ho Moon & Bang-Rae Lee

# Session-16-#321-1(SS3 & SS12)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 08:00~09:30)

### "Entrepreneurship, and Knowledge and action sharing among industries, higher educations & research institutions, and science and technology parks"

Chairs: Jaehoon Rhee(Yeungnam University, Korea), Junghyun Yoon(Dongguk University, Korea)

- Paper 1: "Entrepreneurial Behaviors, Technology Transfer, and Performance: Focused on Network among Industries-Higher education & Research Institutions, and Technopark" Junghyun Yoon, Jaehoon Rhee & Sanghyun Sung
- Paper 2: "The Effects of Entrepreneurial Business Process on New Firm Creation: An Empirical Study Based on PSED Data" by Sanghyun Sung, Seunghoon Lee & Junghyun Yoon
- Paper 3: "Communication-Flow oriented Organizational Redesign Methodology by Analyzing
  Unstructured Business Process Executions" by Seunghoon Lee, Jinyoun Lee & Injun Choi
- Paper 4: "Socio-spatial dynamics of e-services and e-commerce potential" by Maria Merisalo & Tommi Inkinen
- Paper 5: "Cost aggregation in export logistics chain" by Esa Hämäläinen & Elen Twrdy

Session-16-#301-1(SS8 & SS22)

SOltmC & RTU 2017

# Internet of Things as a framework for company digitalisation

#### Deniss Sceulovs<sup>1</sup>, Vladimir Shatrevich<sup>2</sup>, Iveta Ozolina-Ozola<sup>3</sup>

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#### Abstract

Contemporary advantages are coming from the technological evolution from embedded systems to cyber-physical systems. Digitalisation through Internet of Things as a framework creates new the vision of an entirely networked production, its efficiently provide a considerable competitive advantage. These trends are more focused on intangible assets (associated with IC) managing company data flow, plant specific software and the "hardware" of manufacturing technology.

The authors perform empirical research of digitalisation using Internet of Things advantages in erecruitment methods, transferring knowledge for job seeker through automated processes creating the ability to accomplish these processes in a shorter time. Technology breakthrough is allowing to increase the level of automation for interaction with job-seekers and labour cost decreased.

The electronic environment is used for various needs – for trade, marketing, advertisement, studies, communication, training, etc. Simultaneously, there is an opinion claiming that in future, the majority of businesses will be performed on the electronic market, hence advancing the dominant position of the e-environment in achieving entrepreneurship competitiveness (Nistor et.al., 2010). In recent years, companies' intellectual capital (IC) has gained increased attention due to globalisation and integration of capital markets, greater mobility of monetary and actual goods, tougher competition, new dominating industries, and developments in information and communication technology (ICT).

Scientists (Beattie & Pratt, 2001; Eustace, 2000; Lev, 2000; Upton, 2001) have argued that demand for in-formation (external communication) on knowledge-based resources is growing as companies increasingly base their competitive strength in the value of know-how, patents, skilled employees and other intangibles. The electronic environment already now offers companies practically all the necessary marketing and communication tools for ensuring company development by creating competitive advantages, nevertheless, not all companies can employ the opportunities rendered by the e-environment, in order to increase company competitiveness and productivity.

The importance of knowledge is found in information processing studies, which have demonstrated that prior knowledge of product characteristics greatly affects the way in which consumers investigate, process, and organize product related information (Alba & Hutchinson, 1987).

The advance of modern ICT has launched the Industry 4.0, to take up a leader role in industrial IT which is currently revolutionizing the manufacturing engineering sector (Germany Trade and Invest, 2014).

Technology breakthrough is allowing to increase the level of automation for cost efficiency (Ashraf & Habaebi, 2015). These trends will is more focused on intangible assets (associated with IC) managing





company data flow, plant specific software and the "hardware" of manufacturing technology. Since ICT is only one part of the Industry 4.0, the other is its use in the industrial sector and the utilization of the benefits that it brings to the value chain.

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"Industry 4.0" (sometime referred as Smart industry) advantages are coming from the technological evolution from embedded systems to cyber-physical systems. Industry 4.0 connects embedded system production technologies and smart production processes associated with the new technological age advantages. De-centralized intelligence helps create intelligent object networking and independent process management, with the interaction of the real and virtual worlds representing a significant new aspect of the manufacturing and production process. Industry 4.0 creates the vision of an entirely networked production, in which orders man-aged automatically throughout entire value chains, order processing machines and material and organize their delivery to the customer (Berger, 2014).

Using these data efficiently provides a considerable competitive advantage (reducing downtimes, accurate planning, reducing unit costs and etc.). New Industrial revolution (Industry 4.0) is also called Internet of Things, Data and Services. Cyber-physical systems provide the basis for the creation of an Internet of Things, which combines with the Internet of Services to make Industry 4.0 possible. The widespread adoption by e-recruitment automatic operations of ICT is increasingly blurring the boundaries between the real world and the virtual world in what are known as cyber-physical production systems (CPPSs) (Federal Ministry of Education and Research, 2013).

#### Acknowledgments

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- Keywords: e-recruitment, Internet of Things, e-business, digitalisation, innovation, information and communication technology.





Session-16-#301-1(SS8 & SS22)

# Managing Competence Based Synergy in Acquisition Processes: Empirical Evidences from Information and Communication Technologies Industry

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#### Abstract

#### Purpose/ Research Question

Acquisitions remain one of the most intriguing and controversial issues in contemporary management science. The process of a new venture birth from combination of different resources and competences in acquisition is very intriguing in terms of synergy. In situation, where one or both companies change business process after acquisition, prediction of synergy and estimation of economic gains from this change has crucial important. This research looks for interdependence between synergy gain in acquisition process and core competences used in it from both sides. The aim of this research paper is to develop an integrative and more holistic research model *which would help to estimate possible competence-based synergy in acquisition process*. In order to reach the aim, the research question has been pondered: *how core competences should be evaluated as sources of synergy in acquisition*?

#### **Key Literature Reviews**

Synergy effect has been named as a major motive to initiate the process of M&A. This effect is commonly described as 2+2=5 or according to Rappaport (1998) synergy increasing in competitiveness and resulting cash flows beyond what the two companies are expected to accomplish independently. Recently a valuable piece of study was provided by Bauer and Matzler (2014) in those researches on antecedents of M&A success. Seth (1990), Homburg and Bucerius (2006), King, Slotegraaf and Kesner (2008) identified and resume in their prominent research stream in strategic management literature that the *strategic fit* as decisive for M&A success. The central argument of Cartwright and Schoenberg (2006) is that a high fit enlarges market power and productivity. Researchers Pehrsson (2006) as well as Stimpert and Duhaime (1997) using the resource based perspective operationalized the construct of fit with product market, resource, and/or supply chain-related similarity. Meyer and Altenborg (2008) argue that strategic fit is an indicator for the *synergy potential* of a transaction. According to Cartwright and Schoenberg, (2006), Bijlsma-Frankema (2001), Lodorfos and Boateng (2006), Nguyen and Kleiner (2003) one more important factor is *cultural* incompatibility or *misfit*, this is one of the most cited reasons for the low success rates of M&As. Although it seems obvious that cultural similarity fosters

integration and success, there is empirical evidence that *cultural differences* have a strong positive impact on *synergy* and potential realization and, therefore, on value creation as pointed out Cartwright and Cooper (2001), Schraeder and Self (2003), Teerikangas and Very (2006).

The post-merger integration phase is often cited to be decisive for M&A according to Haspeslagh and Jemison (1991) and Stahl and Voigt (2008). In the post-merger integration phase, well-established operational sequences and patterns are partially or completely changed and, throughout the new company, harmonized as revealed by Haspeslagh and Jemison (1991) and Bueno and Bowditch (2003). Therefore, this phase is due to employee resistance and a cultural clash, would be very risky. But acquisitions without any integration, resource redeployment and exploitation, as well as the elimination of redundant resources, are not feasible, it has been found by Homburg and Bucerius (2006); Cording. Christmann and King (2008); Karim (2006) and Pablo (1994). The study of Angwin (2004) also revealed that speed of integration can lead to faster exploitation of synergies and to faster returns on investment. What's more, Angwin (2004) and Bauer and Matzler (2014) argue that speed leads to a faster exploitation of synergies and returns on investment, reduces uncertainty among employees, minimizes time spent in a suboptimal condition, and takes advantage of the momentum in the direct aftermath of a deal. Thus, synergies in acquisition are a function of strategic similarity which foster internal advantages and relatedness to external settings, cultural fit, and the degree and speed of integration. In absence of one or more elements, the process will go wrong from the very beginning. What's more, Devers at al. (2013) argue that CEOs will make acquisitions when they obtain information suggesting that the combination of their firm and a target firm offers a firm-specific synergistic opportunity to create value by exploiting one or more common or complementary resources or capabilities.

Capabilities and competencies of an enterprise should be classified and valued in terms of potential benefits they can bring. Hamel and Prahalad (1990) have created a framework for establishing core competence agenda. One more evaluation model has to be mentioned, which probably is the most important one in terms of this study. This is Barney (1996) VRIO framework for resource and capability analysis. Barney evaluates each competence of a company in terms of its value, rareness, imitability and organization. According to Barney, each competence can be a source of sustained competitive advantage only if it creates value, is unique, is hard to imitate or substitute and enterprise has structure, which allows to exploit this competence. Although this model is initially used by the author for evaluation of key strengths of the company, he also outlines the potential benefits of core competence usage in M&A.

There is not only one way to visualize core competence overlap in M&A process. For example, interesting contributions to the literature on technological acquisitions has been recently provided by Sears and Hoetker (2014). Firstly, authors offer a conceptually and empirically more accurate and nuanced measure of technological overlap in M&A process. Secondly, they show that target and acquirer overlap have distinct, but interrelated, impacts on the value created from each firm's technological capabilities. Although Porter's model is not originally designed for this purpose, his methodology fits very well to see, how different resources (not only technological one), capabilities and thus core competences can be combined in the process of M&A. Barney recommends searching for valuable and rare synergies in acquisitions for core competence implication. Barney (1996) states that core competence should be analyzed in terms of their ability to produce valuable and rare *synergies* and





therefore bring competitive advantage to the company. The author believes, that it is not enough to outline the core competences of merging companies, they have to be investigated and a question should always be asked, *if they work together*? In order to answer this research question and based on literature review outcomes, we have developed an ARCTIC model for core competence evaluation in M&A.

#### Design/ Methodology/ Approach

The research model consists of 4 stages. They used a theoretical example of company "A" acquiring company "B". *First*, all core competences of both companies are identified using the *VRIO framework*. On the *second stage*, type of acquisition is defined and future structure is drawn, using the *value chain* of Michael Porter. Then, future positions of all core competences to be transferred are shown on this structure. The *third stage* is competence transferability analysis. *ARCTIC (A –* Advantage, R – Relatedness, C – Complexity of Competence, T – Time, I – Implementation Plan, C – Culture compliance) model is developed by the authors to evaluate, if core competences can be transferred in M&A process. Use of the model is very similar to VRIO network. First three factors concern potential *compatibilities and similarities of core competence* in new organization. Another three factors are more on *implementation process*. To be implemented in the new structure successfully, core competence has to satisfy all six criteria. Of course, each factor has to be explained in more detail.

Advantage – is *value* that core competence usage can bring to the company and *rareness* of this value. If the competence is useless, because it does not satisfy any important needs in the new market, then there is no rationale behind the merger.

Relatedness – ability to bring value strongly depends on relatedness *of the environment*, in which the competence will be applied. By this, the author means not external market environment, but company business as well. If the competence is valuable, but it should be implemented in a really different *perspective*, chances of success fall.

Complexity – every competence has a degree of complexity, which hinders its transfer, as to the competitors, so as to the partners. If a competence is based on some special technology, know-how, if it is highly vulnerable and developed upon a great *piece of time*, its usage gets harder.

Time – it empirically tested, that the longer integration process takes before operations start running in a normal way, the less chances of being successful the acquisition has. Time scale (or speed of integration) can be a very important factor in acquisitions where valuable core competence *takes so much time to transfer, that it becomes useless*.

Implementation plan – by the time top management evaluates potential acquisition, at least some steps of practical implementation should be developed. When a company enters M&A process *without a strict plan to follow*, chances again go down.

Culture compliance – at last, it should be tested, how core competences fit other company culture. Cultures are the subject of main importance in acquisition, but as this framework is competence related, management should see, if cultures of both companies *accept use of selected competencies*. Therefore, ARCTIC framework uses 6 success factors for future acquisition, but apart from VRIO model it does not

mean, that a case, lacking at least one of those factors would definitely fail. The authors believe that in cases where 3 or more factors are missing in the model, competence-based M&A is unlikely to succeed.

ARCTIC methodology is designed not for predicting, whether M&A will fail or succeed. It is impossible, because some acquisitions bring value by absolutely other means, then originally planned. This model, of course, needs some empirical testing to assure its effectiveness.

Finally, the *fourth stage* is a final decision whether to acquire or ally according to Dyer, Kale and Singh (2004).

#### Findings/Results:

Based on literature review in depth, an ARCTIC model has been developed and tested. We have selected Facebook acquisition of Instagram in 2012 and WhatsApp in 2014 year as well as current Microsoft acquisition of LinkedIn (a deal expected to be completed by the end of 2016) to test empirically developed methodology.

#### **Research limitations/ Implications:**

Illustrative case studies involved explore empirically the competence transfer as main drivers of successful acquisition process. The author suggests further empirical testing on illustrative case studies and possible development of methodology for evaluation of all six factors. Research identified four steps to investigate whether core competence transfer in an acquisition process is an important source of synergy and whether is better to acquire or ally for competence transfer. The ARCTIC model can be used effectively in evaluating core competencies as a means of synergy creation in the M&A context. The authors believe that six factors of ARCTIC models allow to make preliminary evaluation of core competences as sources of synergy in acquisitions and new ARCTIC model should be helpful to mangers facing mergers and acquisitions, as well as to management academic specialists, studying this area.

Keywords: synergy, core competence, value chain, M&A process, ARCTIC model.





Session-16-#301-1(SS8 & SS22)

# Relevance Analysis of Factors Enhancing Coaching Interactions in Organizations

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#### Abstract

**Purpose/** Research Question: Nowadays coaching is increasingly placed among facilitated activities in a wide range of contexts. Coaching can have a real practical impact and provides desirable and sustainable change for the benefit of both individuals and organisations (Cox *et al.*, 2011). While there is a general consensus among scholars and practitioners that coaching is an effective tool to improve organisational performance, coaching is still a relatively new facilitating practice in organizational context in Latvia and Lithuania. Considering the peculiar issues of the use of coaching in Latvia and Lithuania, the paper aims to study the relevance of factors that are likely to enhance coaching interactions in organizations.

**Key Literature Reviews**: A literature review is undertaken to gather together the facts, discussion, frameworks and models relevant to the exploration of the essence of coaching in the context of organization. Although coaching has become incredibly popular, there is still a lot of uncertainty and vagueness around what coaching is really about. Coaching is generally defined as a support structure based on a close interpersonal relationship leading to learning and the development of potential, often within a context of change (Audet, Couteret, 2012). In literature, coaching is considered as a management development activity that promotes organisational change and leads to sustainability (Bozer et al., 2013).

Haan and Culpin (2011) summarize the latest on the coaching outcomes research, their study is dedicated to the investigation of helpfulness of coaching interventions. They tried to explore what clients tend to experience as truly helpful in coaching. Their conclusion is that clients perceive the helpfulness of their coach almost indiscriminately across all possible coaching behaviors. They defined the common factors in coaching such as: the ability of coach to employ many techniques, to use them well and at the right moment; the quality of the relationship or "working alliance" between coach and client; the support system of the client; the personality of the coach; client expectations of a positive outcome. In this perspective it is suggested that general factors common to all good coaching predict helpfulness of coaching.

Audet, Couteret (2012) consider that coaching plays a vital role during startup development period of organization. Coaching encourage entrepreneurs to implement their strategic vision into practice. They suggest that coaching is increasingly popular among support tools available to entrepreneurs. The purpose of Audet, Couteret research (2012) is to examine the effectiveness of coaching as a support measure for young entrepreneurs and to identify the factors likely to have an impact on the success of coaching initiatives. The success of coaching relationship have resulted from a set of 'winning conditions', among them client's positive attitude to change, receptiveness to outside help and willingness to learn and change. Being receptive to coaching and especially being open to change seem to be the main conditions for coaching success. However, yet most small business owner-managers know very little about coaching, probably because its effectiveness has not yet been proven (Audet, Couteret, 2012). Many individuals refuse all outside help on the basis that they prefer to remain absolutely independent. This is explained by the natural resistance to outside help. Audet and Couteret (2012) proved that the relationship of trust established between the coach and the client can neutralize the resistance to change.

Bozer, Sarros research (2013) provides greater insights about the type of individual outcomes executive coaching should achieve, and under which conditions coaching is likely to be more beneficial for participants. Commitment to the relationship appears to be a major success factor. Bozer et.al. (2013) explored the role of coachee characteristics in executive coaching for effective sustainability. They concluded that the coachee characteristics of learning goal orientation, pre-training motivation, feedback receptivity, and developmental self-efficacy are recognized as important predictors of coaching effectiveness.

Smith and Brummel study (2013) examined the impact of executive involvement in the development process, the influence of perceptions of competency developablity and the effects of creating a formal individual development plan.

**Design/ Methodology/ Approach**: The questionnaire is designed to investigate the relevance of conditions that are likely to enhance coaching interactions in organisations. The questionnaire consists of two sections. The aim of the first section is to gather the information to create the profiles of respondents of two target groups: coaches and coaching clients. The second part of the questionnaire consists of closed-ended questions and aims to rate the importance of the conditions that are likely to facilitate the promotion of coaching in organisations and thus, enhance coaching interaction. A list of conditions is greatly extracted from the literature review; they include external indirect conditions, external direct conditions, internal conditions at the level of organisation, internal conditions at the level of groups and internal conditions at individual (client's) level.

External indirect conditions can indirectly affect the promotion of coaching in organisation. They include:

- Reference to coaching in the context of EU documents.
- Recommendations to integrate coaching in training programmes.

• Innovations in business, psychology, education, etc. that facilitate developing coaching theory. The choice of these conditions is stipulated by the following facts. A number of EU initiatives have drawn attention to coaching. Coaching is proposed to apply together with management training and networking to support organizations in crucial phases of their lifecycle and help them grow. It is





expected that the mention of coaching in EU initiatives draws attention to it and promotes coaching in organisations. Innovations in business, psychology, education triggers the development of new approaches, techniques and models in coaching. These technologies are aimed at improving the effectiveness of coaching focusing on the reliability and sustainability of coaching outcomes. Effective coaching outcomes, which are the result of the innovative ideas in different areas, provide a strong argument in promotion of coaching in organisations.

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The below mentioned variables constitute external direct conditions:

- Disseminating best practices in coaching.
- Establishing professional standards for coaches.
- Providing coaching industry research.
- Cooperation of coaching professional associations with other professional and government organizations.
- The system of professional supervision to oversee the work of the coach.
- Education and continuing training for coaches.
- Coach's ability to employ the skills related to the core coaching competences.
- Coach's awareness of business processes.

The following arguments are taken into account in selection of external direct conditions. Professionalization of coaching is a complex and sensitive topic. It is a fact that only well-educated, skilled, credentialed coaches can ensure the environment that will forward coaching in organisations. However, coach training programs vary considerably, from short online courses and weekend workshops, to a three-year academic masters-level program. Establishing professional standards for coaches will allow having clearer picture of the service provided by coaches. Much work is done by the professional bodies to recognize coaching as a self-regulated profession. However, some scholars (Bachkirova, 2014) suggest that coaching presently is a market-regulated practice. It is important to develop science-based coaching practices conducting research studies in the field of coaching. Partnership between coaching professional associations and other professional organizations and government agencies expands consensus and supports community building and networking. The system of professional supervision provides constructive feedback. The ability to employ various techniques effectively and at the right moment may be considered as one of the components of quality.

Internal conditions are presented at three levels: organisational, group and individual respectively. Internal conditions at the level of organisation:

- Goal-oriented organisational culture.
- Top management support for learning and development.
- Motivation to learn and acquire new skills.
- Requiring new skills acquisition because of organisational change.
- The opportunity to apply the knowledge and skills acquired in the training to the job.
- Relationship of trust and openness among the members of organisation.

Internal conditions at the level of organisation are related to the features of organisational culture such as goals orientation, support orientation, learning culture, relationship of mutual trust and openness, a culture of effective feedback. These components of culture create a favorable environment for the development of coaching culture within the organisation.

Internal conditions at the level of groups:

- High cohesion and good communication within team.
- Collaborative planning.
- Making decision in groups / teams.
- Employees learning and development within the groups / teams.

The conditions at the level of groups are likely to have significant impact on the promotion of coaching in the groups in particular and in organization in general. Team coaching is distinct from individual coaching because in team coaching, the team as a whole is the client and collective performance is the goal, versus the individual focus of one-on-one coaching (Peters, Carr, 2013). The aim of team coaching is to support team members to structure their work and conversations to communicate well, make decisions and ensure the achievement of the optimal result through a joint effort of the group. Therefore, the conditions that were selected for the questionnaire have collaborative focus.

Internal conditions at individual (client's) level:

- Client's positive attitude to change.
- Being receptive to help.
- Client's willingness to learn and change.
- Client's feedback receptivity.
- Client's willingness to invest time and energy in coaching process.
- Client's involvement in the coaching process.

Internal conditions at individual level are focused on the client. Client engagement plays significant role in the success of coaching and extends coaching implementation in organisation. Client involvement is an important prerequisite for promotion and successful implementation of coaching. The client is often considered ready when they are willing to invest time and energy in the process, do the work of development even when it becomes difficult and take personal responsibility for transferring what is learned into action for change on the job. These three components of involvement are critical to the success of an executive's development. (Smith, Brummel, 2013).

**Expected Findings/Results**: The pilot test was conducted in August 2014 with a limited sample. The survey was conducted among coaches and coaching clients in Latvia and Lithuania from December 2014 to August 2015. 75 coaches and coaching clients from Latvia and Lithuania took part in the survey. The obtained data were analyzed by using the Statistical Package for the Social Sciences (SPSS) and conducting correspondence analysis to extract the most important factors.

The most coaches who did respond to the survey reported that they have graduated from the International Coach Federation approved or accredited coach training programs, and positioned themselves as executive coaches. Almost a half of coaches have practiced in coaching for more than 3 years.

The respondents consider that innovative ideas in other related fields such as business, psychology, education, etc. are the most important external indirect conditions. The reference to coaching in the context of EU documents is not mentioned as the important condition. Disseminating best practices is essential for building an effective coaching environment. Education and continuing training of coaching practitioners as well as the ability to employ various techniques effectively and at the right moment are the first steps in continuous improvement of the quality of coaching work. Coaching needs to have senior management support, it should be also visibly adopted at the highest levels. Coaching can be a





tremendous support in work-related learning - enhancing it. Client involvement is an important prerequisite for promotion and successful implementation of coaching.

**Research limitations**/ **Implications**: The findings of the survey are important for the further development of the topic. The findings will fuel thinking on how to enhance the coaching interactions in organizations. The survey is based on a limited number of respondents and therefore has statistical limitation.

Keywords: coaching, relevance analysis, organizational change

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# Efficiency Analysis of Retail Chain Stores in Korea

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#### Abstract

In today's low-growth business environment, efficiency management is becoming more important to improve corporate sustainability. In a chain store, the efficiency of individual stores must be well managed to improve the efficiency of the entire enterprise. To do this, it is important to measure the efficiency of individual stores and to find factors that affect efficiency. The main purpose of this study is to find out the factors affecting the efficiency of the chain store and to analyze the results to find out the implications that contribute to the efficiency improvement. We measured the relative efficiency of individual stores using DEAand analyzed the factors that affect the efficiency with the Tobit regression model. As a result, we found that the number of items and competitive environment influence the efficiency of stores. Excessive number of items may cause efficiency to be lowered. Therefore, it is necessary to manage the lifecycle of the item considering the trade-off between assortment and efficiency. Competition helps to improve efficiency to some extent, but too much competition can reduce efficiency.

Keywords: efficiency analysis; chain stores; data envelopment analysis (DEA); Tobit regression

#### 1. Introduction

The Korean retail market has grown at a slower pace, with growth of 1% in the last two years since 2013.In particular, traditional distribution channels such as department stores, supermarkets, and specialty stores recorded negative growth in 2014.This is due to factors such as the prolonged recession





in the domestic market, the maturity of the retail industry, changes in consumer trends, growth of online and mobile shopping, and strengthening government regulations [1]. The slow growth of the Korean retail market is expected to continue for the time being, and it is difficult to expect the high growth rate of the past. In such a business environment, it is difficult to expand sales, so pursuing profitability through cost reduction is a common way to improve the sustainability of a company. Therefore, the importance of efficiency management is emphasized.

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In the chain store, one of the representative forms of retailing, it is essential to improve the efficiency of individual stores in order to improve the efficiency of the entire enterprise. To do this, we first measure the efficiency of individual stores, and if there are differences in efficiency between stores, we need to figure out what is the cause. Since chain stores are based on standardized processes, IT systems, and employee training programs, theoretically, there should be little or no difference in efficiency between stores. However, if there is a difference in efficiency between stores, it means that other factors are affecting the efficiency, and understanding these factors will be a starting point for improving efficiency.

Therefore, this study aims to analyze the factors affecting the efficiency of individual retail stores and to provide managerial implications for improvement of efficiency.

The research questions of this study are as follows: (1) What is the efficiency of individual stores in a chain store, taking into account multiple inputs and outputs? (2) Is the efficiency of the store different depending on the local characteristics? (3) What are the factors that affect the efficiency of retail stores?

#### 2. Literature Reviews

In the early stage studies, the efficiency of the retailers was measured using DEA (Data Envelopment Analysis) and the results were analyzed.Donthu and Yoo [2] measured the relative efficiency of 24 the US restaurant chains.Thomas et al. [3] analyzed the efficiency of 520 retail outlets and examined 16 variables used as input variables to determine the variables affecting efficiency.Keh and Chu [4] compared the efficiency of inputs, intermediate output, and final output for 13 the US grocery chain stores.Barros and Alves [5] measured the relative efficiency of 47 chain stores in Portuguese hypermarkets.There is also an efficiency study for retailers in Spain, the US and India [6-9].Table 1 shows the efficiency studies for retailers using DEA.

Subsequent studies have been extended to factors affecting efficiency, mainly using the Tobit regression model. Barros [10] measured the efficiency of 22 hypermarkets in Portugal by DEA model, and then analyzed the factors affecting the efficiency by Tobit regression model. The independent variables examined in the Tobit regression model are the market share of the retailers, the number of outlets, ownership, regulation and location. As a result, the efficiency scores are positively related and statistically significant with all variables, with the exception of the regulation variables, signifying that the market share, number of outlets, national ownership and market coverage contribute to the efficiency of retailers. Perrigot and Barros [11] used the DEA model to analyze the efficiency of 11 French retailers and identify the factors that affect their efficiency. As a result of the analysis, the efficiency was higher as the period increased, and the efficiency of stock market-quoted retailers, companies involved in mergers and acquisitions, retailers belonging to an economic group, and retailers with an international expansion strategy were high. Yu and Ramanathan [12] used the DEA model to examine the economic efficiencies

of 41 retailer companies in the UK and analyzed the determinants of efficiency.As a result, it was found that the factors influencing the efficiency are the type of ownership, legal form and retail characteristic.Foreign retail companies, private retail companies, and food retail companiesseem to be more efficient. Yu and Ramanathan [13], which applied the DEA model to 61 Chinese retailers, also analyzed the determinants as well as the efficiency values, and found that the only factors influencing efficiency were the retail characteristic and the department stores were the most efficient. Uyar et al. [14]assessedoperational efficiency of 79 bookshops within a bookshop chain in Turkey and identified efficiency, whereas manager experience, staff experience, and education level of the shop manager do not.Gandhi and Shankar [15] studied the determinants of efficiency in 18 Indian retailers.The results shows that number of retail outlets and mergers and acquisitions can be considered as the driving forces influencing efficiency. Table 2 shows prior studies that include an analysis of the determinants of efficiency for retailers.

There have been many studies on efficiency of retailers, however, most of the studies have the unit of analysis as the entire company, so it is still not enough to study individual retail stores.

#### 3. Methodology

This study consists of two stages: measuring the relative efficiency of individual stores and determining the factors that affect the efficiency.First, DEA model, which is widely used in this study, was used to measure relative efficiency.The Tobit regression model was used to analyze the factors affecting the efficiency.This is because the efficiency calculated by DEA has a limited range of values between 0 and 1.



## Table1. List of studies on retail efficiency using DEA

Studies	Units	Inputs	Outputs
Donthu and Yoo (1998)	24 outlets of a USA fast food restaurant chain	Store size, Store manager experience, Store location, Promotion expenses	Sales, Customer satisfaction
Thomas et al. (1998)	520 outlets of a USA multi-store, multi- market retailer	Full-time employees, Full-to-part-time employees, Salaries, Employee tenure, Store manager tenure, Store age, Occupancy expenses, Population, Household income, Households, Proximity, Inventory, Transactions, Employee turnover, Shrinkage	Sales, Profits
Keh and Chu (2003)	13 outlets of a USA chain of grocery stores	Labor (floor staff and management wages and benefits), Capital (occupancy, utilities, maintenance and general expenses)	Distribution services (accessibility, assortment, assurance of product delivery, availability of information, and ambience), Sales revenue
Barros and Alves (2003)	47 outlets of a Portuguese hypermarket retail company	Full-time employees, Part-time employees, Cost of labor, Absenteeism, Area of outlets, Number of points of sale (POS), Age of the outlet, Inventory, Other costs	Sales, Operational results
Sellers-Rubio and Mas-Ruiz (2006)	100 supermarket chains in Spain	Employees, Outlets, Capital	Sales, Profits
Mostafa (2009)	45 USA retailers	Employees, Assets	Revenue, Market value, Earn share
Gupta and Mittal (2010)	43 outlets of a Indian grocery retailer	Area of outlets, Number of SKUs, Number of POS machines, Labor cost of employees, Number of employees, Working hours of employees	Sales, Customer conversion ratio
Sharma and Choudhary (2010)	200 Indian retail stores	Size of retail store, Manager's experience, Location of retail store	Sales, Customer satisfaction

Studies	Units	Inputs	Outputs
Barros (2006)	22 hypermarket and supermarket firms in Portugal	Labor, Capital <i>Tobit regression model variables:</i> Share, Outlets, Ownership, Regulation, Location	Sales, Operational results
Perrigot and Barros (2008)	11 French generalist retailers	Labor, Capital, Total costs <i>Tobit regression model variables:</i> Trend, Square trend, Quoted, M&A, Group, International	Turnover, Profits
Yu and Ramanathan (2008)	41 retail companies in the UK	Total assets, Shareholders funds, Employees <i>Tobit regression model variables:</i> Head office location, Types of ownership, Years of incorporation, Legal form, Retail characteristic	Turnover, Profit before taxation
Yu and Ramanathan (2009)	61 retail firms in China	Total selling floor space, Employees <i>Tobit regression model variables:</i> Head office location, Firm nationality, Years of incorporation, Ownership type, Retail characteristic	Sales, Profit before taxation
Uyar et al. (2013)	79 bookshops within a bookshop chain in Turkey	<ul> <li>Area, Population, Inventory, Employee, Salaries, Other costs</li> <li><i>Tobit regression model variables:</i></li> <li>Education of manager, Experience of manager, Experience of staff, Age of bookshop</li> </ul>	Sales, Profit
Gandhi and Shankar (2014)	18 Indian retailers	Cost of labor, Capital employed <i>Tobit regression model variables:</i> Number of outlets, Ownership, Age since incorporation, Mergers and acquisition	Sales, Profit

Table2. List of studies on determinants of retailer's efficiency using Tobit regression model

#### 3.1 DEA

Data Envelopment Analysis (DEA) was developed by Charnes et al. [16] as a methodology primarily used to determine the relative efficiency when there are a large number of input and output factors.DEA uses the distance function concept (Shephard [17]) centered on the efficient DMU among the decision making units (DMUs) to obtain the relative efficiency value of each DMU.

There are several types of models used in DEA, but they can be largely classified into a CRS (Constant Returns to Scale) model and a VRS (Variable Returns to Scale) model depending on the size variability. The CRS model is based on the assumption that the input and output ratios do not change with size, and is called the CCR model after the first letters of Charnes, Cooper, and Rhodes (see equation (1)). The VRS model is a model that applies when the ratio of input and output varies with size, also called the BCC model in the name of Banker et al. [18].



The DEA model can be broadly divided into two models: an input-oriented model and an outputoriented model for the purpose of efficiency improvement. The input-oriented model is aimed at minimizing the input amount in the direction of efficiency improvement, and the output-oriented model tries to maximize the output in order to improve the efficiency.

Equation (1) shows the output-oriented CCR model. Assuming that there are a total of n DMUs, m inputs  $x_{ij}$  (i = 1, ..., m), and s outputs  $y_{rj}$  (r = 1, ..., s),

$$\max \phi_{k} + \epsilon \left( \sum_{i=1}^{m} s_{i}^{-} + \sum_{r=1}^{s} s_{r}^{+} \right)$$

$$s. t. \sum_{j=1}^{n} x_{ij} \lambda_{j} + s_{i}^{-} = x_{ik}, \quad i = 1, ..., m$$

$$\sum_{j=1}^{n} y_{rj} \lambda_{j} - s_{i}^{+} = \phi_{k} y_{ik}, \quad r = 1, ..., s$$

$$\lambda_{j}, s_{i}^{-}, s_{i}^{+} \ge 0, \quad \forall i, j, r$$

$$(1)$$

Here,  $\phi_k (k = 1, ..., n)$  is the efficiency value of the kth DMU<sub>k</sub>, and  $s_i^-$  and  $s_i^+$  represent input and output slack variables, respectively.

Equation (2) shows the output-oriented BCC model. This equation has a constraint on the sum of  $\lambda$  in the CCR model of Equation (1) to have convexity constraints.

$$max \phi_{k} + \epsilon \left( \sum_{i=1}^{m} s_{i}^{-} + \sum_{r=1}^{s} s_{r}^{+} \right)$$

$$s. t. \sum_{j=1}^{n} x_{ij} \lambda_{j} + s_{i}^{-} = x_{ik}, \quad i = 1, ..., m$$

$$\sum_{j=1}^{n} y_{rj} \lambda_{j} - s_{i}^{+} = \phi_{k} y_{ik}, \quad r = 1, ..., s$$

$$\sum_{j=1}^{n} \lambda_{j} = 1$$

$$\lambda_{j}, s_{i}^{-}, s_{i}^{+} \ge 0, \quad \forall i, j, r$$

$$(2)$$

#### 3.2 Data

In this study, DMU is the individual store of retailers operating the largest household goods retailers in Korea.In DEA, the homogeneity of DMU should be assumed. Therefore, first, it was restricted to stores located in Seoul area.In addition, since new stores require a certain period of time to stabilize their operations, only those stores with more than one year of operation period are considered.Finally, 32 stores in the Seoul area with a store operation period of more than one year were identified as the DMU of this study.

#### 3.3 Input/output measures

In order to apply DEA successfully, selection of inputs and output variables is important. Input and output variables for DEA should be chosen such that they accurately reflect the retail firm's goals, objectives, and sales situation. The choice of the input and output variables is critical to the successful application of this technique [2]. In this study, the input and output variables were selected in consideration of the variables used in the precedent study and the key performance indicators used by the target company. This is intended to include variables that are commonly used in retailers' efficiency analysis, as well as variables that reflect the target company's strategic goals, salessituation, and performance management system.

Through this process, four variables were selected as the input variables: store size, number of items, number of employees, and rental cost. The store size and the number of employees are used as input variables in most of the previous studies [2,3,5-8,19] and the target company also manage them as management indicators. The store size used in this study was only the area used for sales excluding the warehouse area. The number of employees is the sum of the number of full-time employees and the number of part-time employees. The number of part-time employees was calculated to be 0.7 times the number of full-time employees in the same way as in the target company. The number of items, which are important indicators of the target company, means the total number of items including both products displayed on the store floor and products stored in the warehouse. This was used as an input variable in the study by Gupta and Mittal [8]. The rentalcost was used as input variable in the study of Thomas et al. [3]. Since rental cost vary according to the terms of the contract, we used the average rental cost in the area where the store is located.

In our study, we selected sales and number of customers as output variables. Sales is used as an output variable in almost all previous studies [2-10,13-15] and is a key performance indicator for most companies. In this study, daily average sales was used. In addition, the number of customers was selected as the output variable in order to compensate the efficiency result when the number of customers is high even if the sales amount is low.

#### 3.4 DEA Models

The DEA model is divided into the CCR model and the BCC model based on the assumption of economies of scale. In this study, the BCC model was used. In addition, in the selection of inputs-oriented or output-oriented models, the output-oriented model was applied according to the general criteria proposed by Barros and Alves [5]. They argue that it is desirable to apply the output-oriented DEA model because private firms operating in a competitive market environment maximize output rather than minimizing inputs [5].

#### 3.5 Tobit regression model

To analyze the factors that affect some outcomes, we generally use a regression model. However, the general regression model cannot be used to analyze the factors that affect the efficiency calculated throughDEA. Since the efficiency value calculated through DEA has a limited range of values between 0 and 1, the OLS (ordinary least squares) results in biased estimates or invalid inferences. The Tobit regression model proposed by Tobin [20] is suitable for the case where the dependent variable of the



regression model is limited to a certain range of values [14].Equation (3) shows the Tobit regression model used in this study.

$$y_{i} = \beta_{0} + \beta_{1}x_{1i} + \beta_{2}x_{2i} + \dots + \beta_{5}x_{5i} + \varepsilon_{i}$$
  
if  $y_{i}^{*} \leq 0$ , then  $y_{i} = 0$   
if  $y_{i}^{*} \geq 1$ , then  $y_{i} = 1$   
if  $0 < y_{i}^{*} < 1$ , then  $y_{i} = y_{i}^{*}$ 
(3)

Here,  $y_i$  is the efficiency value of DMU<sub>i</sub> calculated by DEA, and the determinants are the store age  $(x_1)$ , number of items per unit area  $(x_2)$ , number of items per employee  $(x_2)$ , trade area index  $(x_4)$ , and number of competitors  $(x_5)$  were examined.

The selection of independent variable is the most important process in regression model design. In this study, the variables were selected by combining the results of the previous studies and the opinions of the managers of the target companies, which includes experience and knowledge of stores, operational capability, and external environment factors.

Typical variables that indicate store's experience and knowledge are the store age and the employee's working period. The store age is an indicator of accumulated experience and knowledge of stores, reputation in the area and consumer's awareness. Thomas et al. [3] found that the store age affects efficiency and Uyar et al. [14] also found similar results. Also, in the study of Assaf et al. [21] for supermarket chain stores, age of the firm was found to affect the efficiency. Therefore, this study considers the store age as a factor in order to determine whether the experience and knowledge of stores are influencing on efficiency. Another variable that can represent the experience of a store is the manager's and staff's working period, but this is excluded because the company has job rotation system. In this study, two variables - number of items per unit area and number of items per employee were defined to compare the operating capabilities of stores. The number of items per unit area represents the ability to display a variety of items in a limited space and effectively display them. In the case of a large number of items to be handled like the target company of this study, the capacity to utilize the store space is considered to have an important effect on the efficiency, so it is included in the independent variable. The number of items per employee represents the ability to manage the appropriate number of items compared to the number of employees. One of the most important operational capabilities is how many items can be managed by the staff in charge of item display and customer response in the store.

External environmental factors are also important factors affecting the efficiency of stores. The environmental variables mainly used in previous studies are demographic variables such as population, population density, number of households, income level, and the location of the store and the distance from other stores. In this study, trade area index and the number of competitors were selected as variables representing external environmental factors. The trade area index is a numerical representation of the store. Some examples of facilities and buildings affecting sales within a radius of 500meters from the store. Some examples of facilities and buildings are subway stations, schools, offices, hospitals, hotels, etc. The larger the value of a trade area index, the larger the size of the trade area. We included a trade area index as an independent variable to determine whether the size of a trade area affects efficiency as well. Competition is also an important external environmental variable to consider in terms of store efficiency. Dubelaar et al. [22] found that competition had a significant impact on productivity and that competition-related factors should be included in the assessment of productivity. This study also used the

number of competitors located within a radius of 500 meters from the store to consider the competitive strength of stores.

#### 4. Discussion of Results

#### 4.1 Efficiency scores

Mean overall efficiency for all stores is 0.8366 and standard deviation is 0.1569. The efficiency score of the lowest efficient store was 0.5113 and the number of efficient stores with efficiency score 1.0 was 8, which was 25% of the total stores.

#### 4.2 Comparison of efficiency

Is the efficiency of the store different depending on the local characteristics? To answer this question, we compared the efficiency scores of the 4 stores in the residential area and the 27 stores in the residential and commercial area (One store is classified as other areas and excluded from the analysis).Since the efficiency scoresobtained using DEA are calculated values, we cannot use a test method that assumes a normal distribution like t-test. Therefore, we used the non-parametric Wilcoxon Rank Sum Test to test the efficiency difference between the two groups.As a result of the test, the p-value was 0.04793, indicating that there was a difference in efficiency between the two groups at significance level 0.05.The average efficiency of the stores located in the residential area is 0.8639, indicating that the efficiency of the stores located in the residential areas is 0.8639, indicating that the efficiency of the stores located in residential and commercial areas is higher.

#### 4.3 Tobit regression model

The results of the Tobit regression model are shown in Table 3. The number of items per employeeand the number of competitors statistically significant at the significance level of 1%. Also, it was confirmed that the number of items per employee affects the negative direction and the number of competitors affects the positive direction.

Variables	Estimate	Std. Error	z value	<i>p</i> -values
Store age	0.0011525	0.0015299	0.753	0.45128
Items per area	0.0014730	0.0007993	1.843	0.06536
Items per employee	- 0.0004210	0.0001429	-2.945	0.00322 **
Trade area index	- 0.3490104	0.3113706	-1.121	0.26234
Competitors	0.0067086	0.0025178	2.664	0.00771 **
R-Squared=0.6469811,	Adjusted R-Squar	ed=0.5790929		

Table 3. The results of the Tobit regression model

Note: *p*-values followed by \*\* are significant at a level of 1%





The number of items per employee affects efficiency in the negative direction. It can be understood that managing the appropriate number of items that can be afforded by store staff helps improve efficiency. For customer satisfaction, it is important to have various item assortment. However, efficiency may be deteriorated if item displays or customer service are not performed properly due to excessive items.

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The fact that the number of competitors affects efficiency in a positive way means that some competition can have a positive impact on efficiency. It can be understood that the more intense the competitive environment such as the store located in the central commercial district of the big city, the higher the work tensions of the employees, which can improve the efficiency.

#### 4.4 In-depth analysis of significant variables

The analysis of the determinants leads to a more detailed analysis of the two variables found to have a significant effect on efficiency.

#### 4.4.1 Number of items per employee

The stores were divided into two groups based on average of efficiency and average of sales, and the average of items per employee of each group was compared.Regardless of the size of the sales, the more efficient the group has fewer items per employee, and the higher the sales, the lower the number of items per employee.This shows the regression results that the number of items per employee affects the efficiency negatively.It is necessary to pay attention to the difference in the number of items per employee between the high efficiency group and the low efficiency group is larger in the low sales group.Similar results can be obtained by using store size instead of sales in the same way.That is, the difference in the number of items per employee between the high efficiency store size instead of sales in the same way.That is, the difference in the number of items per employee between the high efficiency store size instead of sales in the same way.That is, the difference in the number of items per employee between the high efficiency store size instead of sales in the same way.That is, the difference in the number of items per employee between the high efficiency group and the low efficiency group and the low efficiency group is larger in small stores.Figure 1 shows this relationship.

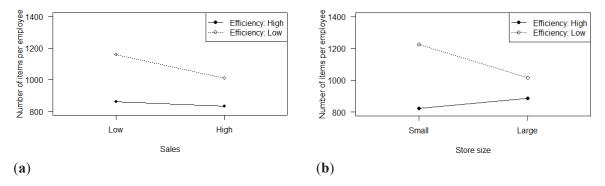


Figure 1. Changes in the number of items per employee in high-efficiency and low-efficiency groups. (a) Comparison of high-sales stores and low-sales stores; (b) Comparison of large-sized stores and small-sized stores

In sum, it can be deduced that the number of items per employee is high in stores where sales are low and stores are small in size. This is because, even if a small-scale store has a certain number of items assortments, the number of items increases, but the increase in the number of employees is relatively limited. We can derive two important implications from these results. First, in estimating the appropriate number of employees, it is necessary to consider the number of items, not just the size of the store.Currently, this company estimates the number of employees considering the sales and external characteristics of the store.However, there is a need to consider the number of items.The second is the importance of product life cycle management.As the sourcing of new items continues, the number of items will continue to increase and this problem is expected to become more and more intense.Managing the life cycle of anitem and discontinuing it at the right time can eventually be a way to improve efficiency.

#### 4.4.2Number of competitors

Regression analysis shows that the number of competitors has a positive effect on efficiency. If so, does the efficiency continue to improve as the intensity of competition increases? To answer this question, the squared value of the number of competitors was added to the model, and the results of Table 4 were obtained.

Variables	Estimate	Std. Error	z value	<i>p</i> -values
Store age	0.000812 7	0.001431 5	0.568	0.57024
Items per area	0.001402 6	0.000752 2	1.865	0.06224
Items per employee	- 0.0004082	0.000134 5	-3.036	0.00240 **
Trade area index	- 0.3134973	0.290405 8	-1.080	0.28036
Competitors	0.032540 3	0.012631 0	2.576	0.00999 **
Square competitors	- 0.0003695	0.000176 7	-2.091	0.03655 *

#### Table 4. The results of the Tobit regression

R-Squared=0.6916738, Adjusted R-Squared=0.6176755

Note: *p*-values followed by \*\* are significant at a level of 1% and those followed by \* are significant at a level of 5%

As with the previous results, the number of items per employee and the number of competitors are significant, and the number of items per employee is negative and the number of competitors has a positive effect. In addition, the squared value of the number of competitors was also significant and the sign was negative. In other words, the number of competitors appears as an inverted "U" shape, which means that efficiency increases when the intensity of competition increases to a certain level, but that



efficiency decreases if the threshold is exceeded.In the regression equation of this model, the remaining variables excluding the number of competitors are fixed as an average, and the graph is shown in Figure 2 and it can be confirmed that it is an inverted "U" shape.

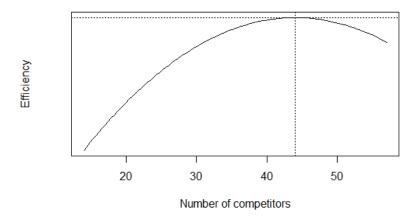


Figure 2. Changes in efficiency scores as the number of competitors changes

This result implies that it is necessary to consider the competitive environment of the store when evaluating the performance of the store. It can also be used when evaluating the location to open a new store.

#### 5. Conclusion

In this study, we measured the efficiency of individual stores and found that 75% of the stores are inefficient, which means that there is room for improvement in performance without additional resources. In addition, the efficiency of the lowest-efficient stores is only 0.5113, so it is necessary to analyze what difference these individual stores have under the standardized process and the IT system.

To identify the cause of this difference in efficiency, we used the Tobit regression model. As a result, we found that the number of items and competitive environment influence the efficiency of stores. A variety of items are required for customer satisfaction, but the excessive number of items may lead to lower efficiency. Therefore, it is necessary to manage the lifecycle of the item considering the trade-off between assortment and efficiency. In particular, these issues are clearly seen in low-sales and small-sized stores, so it is necessary to focus on these stores in order to improve the efficiency of the entire enterprise.

Understanding the impact of competitive environment on efficiency is also important.Competition affects efficiency with an inverted "U" shape. In other words, competition helps to improve efficiency to some extent, but too much competition can reduce efficiency.Therefore, it is necessary to consider the influence of this competitive environment in making decisions such as evaluating the performance of a store or opening a new store.

However, this study is limited to one household goods retailer, so the results may not be applied to other industries. In addition, it is the analysis of the data at a specific point in time, so it would be meaningful to conduct a longitudinal study in future studies.

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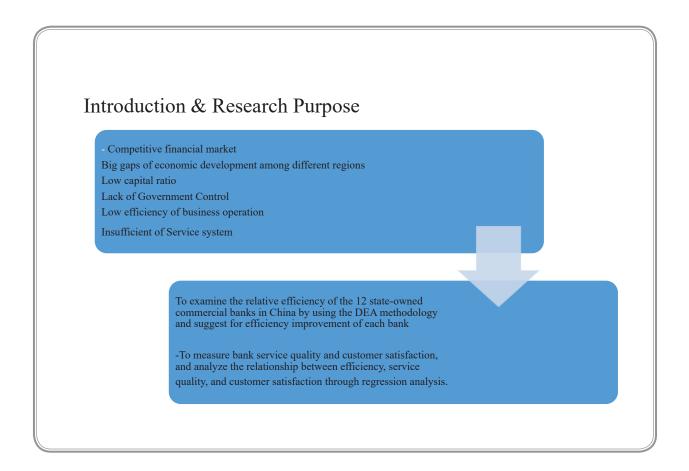
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Session-16-#301-1(SS8 & SS22)

# The Efficiency Analysis and Service Qualityfor Chinese Commercial Banks Using DEA

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Hanbyeol Jang







### Literature Review

- Farrell (1957) presented the concept of nonparametric efficiency measurement for the first time
- Charnes, Cooper and Rhoders (1978) then presented a constant invariant profit model and a CCR model (or CRS model) in terms of inputs.
- Banker, Charnes and Cooper (1984) developed a variable profit model, ie, BCC model (or VRS model), in terms of output.

-----These two models are among the most commonly used evaluation models for measuring efficiency with DEA.

## Literature Review

- A Study on Bank Efficiency Measurement Using DEA Model & Bank Service Quality and Customer Satisfaction Using SERVQUAL Model
- Sherman and Gold (1985) ;to evaluate the relative efficiency of banks.

- Weiyi and Wangli (2000) measured the technological efficiency, pure technology efficiency and scale efficiency of banks using the statistical data of 1997 for Chinese four - state commercial banks and eight commercial banks.

- Huangqing (2004) analyzed the efficiency of Chinese commercial banks from 15 commercial banks and 11 commercial banks in four state
- Cowling and Newman (1995) found that the SERVQUAL model was the most reliable, responsive, and empathic in evaluating the service quality of banks.
- Kim, Moon Hee (2005) used SERVQUAL model to evaluate the service quality of banks in Korea and China and compare the factors affecting customer satisfaction

			Input variable		Output variable			
Types of bank	Decision-making units	# of employees(person)	Fixed assets (one-hundred million)	Deposits (one-hundred million)	Loans (one-hundred million)	Net profit (one-hundred million		
de la destrict en d	DMU1	14553	12899.63	10698.35	5246.59	151.95		
Commercial Bank of China	DMU2	17791	4395.06	4063.74	2563.4	54.51		
(ICBC)	DMU3	16038	23900	21748.49	4205.24	340.51		
	DMU4	24574	11057.35	3763.77	1392.89	53.25		
the <u>Agricultural Bank of</u> China (ABC),	DMU5	23886	7230.86	8013.96	5321.53	155.94		
	DMU6	20019	4417.16	4199.79	1988.19	81.76		
	DMU7	8424	5385.69	4194.9	3126.88	77.09		
the <u>Bank of China</u> (BOC)	DMU8	9561	2239.76	2058.51	1309.68	30.17		
	DMU9	9738	10152.29	5116.75	1907.18	65.06		
	DMU10	10355	9241.66	7567.2	3702.94	103.21		
the Industrial and mmercial Bank of China (ICBC) he Agricultural Bank of <u>China</u> (ABC),	DMU11	12739	3896.02	4231.97	2401.81	66		
	DMU12	11831	12243.82	9046.9	3576.98	110.18		

#### Data Collection China's state-owned Commercial banks in 2014

## Data collection

• Index for Quality and Satisfaction of Service (total 286 out of 318 from April 1<sup>st</sup> to April 30 in 2016)

Decision-making units	Tangibles	Reliability	Responsiveness	Assurance	Empathy	Service Quality	Service Satisfaction
DMU1	3.41	3.45	2.91	3.30	3.14	3.24	3.51
DMU2	3.31	3.45	3.32	2.99	3.28	3.26	3.30
DMU3	3.81	3.78	3.59	3.83	3.57	3.71	3.89
DMU4	3.04	3.08	2.71	3.38	2.94	3.04	2.96
DMU5	3.78	3.65	3.12	3.73	3.23	3.50	3.54
DMU6	3.55	3.32	2.80	3.52	3.13	3.28	3.37
DMU7	3.62	3.68	3.35	3.87	3.47	3.60	3.75
DMU8	3.55	3.61	3.33	3.67	3.47	3.53	3.56
DMU9	3.26	3.18	2.89	3.43	3.12	3.19	3.36
DMU10	3.98	3.91	3.67	3.90	3.70	3.83	3.87
DMU11	3.46	3.50	3.11	3.43	3.16	3.33	3.52
DMU12	3.98	3.73	3.09	3.68	3.38	3.58	3.68





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# $Results \ \textbf{-} Relative \ efficiency \ through \ DEA \ analysis$

CCR

DMU	DMU CRS		SE	RTS
DMU1	1	1	1	CRS
DMU2	0.898	0.924	0.972	IRS
DMU3	1	1	1	CRS
DMU4	0.727	0.801	0.907	IRS
DMU5	1	1	1	CRS
DMU6	1	1	1	CRS
DMU7	1	1	1	CRS
DMU8	0.904	1	0.904	IRS
DMU9	0.700	0.865	0.810	IRS
DMU10	0.985	0.986	0.999	IRS
DMU11	0.850	0.991	0.857	IRS
DMU12	0.850	0.851	0.999	IRS

<b>SCC-References</b> to		Shortfal	l in output	W	hether or not to inp	ut		
inefficient bank branches in the	Decision-making units	Loan	Net Profit	#of Employees	Fixed Asset	Deposits	Reference groups and weights	
	DMU1	0	0	0	0	0	1	
BCC model and improvement goals	DMU2	0	12.003	4645.495	0	0	5(0.179) 7(0.295) 8(0.526)	
	DMU3	0	0	0	0	0	1	
	DMU4	220.337	0.000	5455.125	5648.008	0	6(0.447) 8(0.553)	
	DMU5	0	0	0	0	0	1	
	DMU6	0	0	0	0	0	1	
	DMU7	0	0	0	0	0	1	
	DMU8	0	0	0	0	0	1	
	DMU9	1219.700	12.030	0	3396.698	231.420	7(1)	
	DMU10	0	0	0	1303.399	1130.067	1(0.260) 3(0.025) 7(0.715)	
	DMU11	100.890	0	0	0.000	453.607	5(0.227) 7(0.156) 8(0.617)	
	DMU12	0	0	0	2317.570	1036.345	1(0.174) 3(0.076) 7(0.750)	

# Efficiency Cause Analysis

H1: The bank's service quality will have a positive (+) impact on efficiency.

Result of the Analysis of Efficiency by Regression Analysis (service quality)

	Estimate	Std.Error	t value	$\Pr(\geq  t )$
(intercept)	-0.02215	0.40654	-0.054	0.9576
Servqual	0.27208	0.11847	2.297	0.0445 **

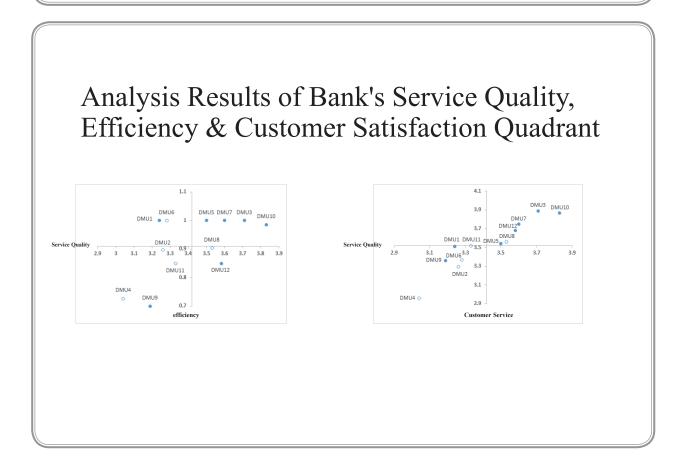
P-value: at 1% level, \*\*\* at 5% level, \*\* at 10% level,

H2: The bank's service quality will have a positive impact on customer satisfaction. H3: Bank efficiency will have a positive impact on customer satisfaction

Result of the analysis of Customer Satisfaction by Regression Analysis

	Estimate	Std. Error	t value	Pr(> t )
(intercept)	-0.008181	0.435172	-0.019	0.985
Servqual	1.03208	0.126813	8.139	1.01e-05 ***
Efficiency	1.4995	0.5891	2.545	0.02910 **

P-value: at 1% level, \*\*\* at 5% level, \*\* at 10% level,







# Conclusions

- The overall average technological efficiency was .909, the bank with the relative technical efficiency of 1 showed an efficient management with 5 banks accounting for 42% of the total.
- The loan amount is insufficient compared to the amount of money received by the bank, or the amount of assets is large and the number of employees is inefficient.
- To improve ineffective banks, efficiency may be improved by reducing input variables such as excessive manpower reduction.
- Users are increasingly demanding the stability of personal information. It is important for banks to establish a more reliable information security system.
- It is also necessary to supplement the credit rating system or the service reporting system
- it is also important to consider the customers who use the bank

Session-16-#303-1(SS7 & SS15)

# Effect of Distance on Open Innovation: Differences among Institutions according to Patent Citation and Reference

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Abstract: We have two research questions, as follows:

Is there any relation between the distance between technology and the market, and open innovation? If there is, what differences are there in the relation among Fortune 500 and non–Fortune 500 companies, laboratories, universities, and start-ups?

First, this study measured the distance between technology and the market of a patent by the size of its list of references and citations. Second, the OI network among patent application subjects was described based on patent similarity. From these, network and regression analyses were used to answer the research questions. The first result was that there were differences in the distance and OI among Fortune 500 firms, Fortune non 500 firms, laboratories, universities, and start-ups. The second result was that the distance between technology and market was found to moderate the open innovation effect in Fortune 500 firms and laboratories.

Keywords: distance between technology and market, open innovation, moderating,





Session-16-#303-1(SS7 & SS15)

# Harnessing the value of open innovation: Change in the moderating role of absorptive capability in the South Korean Manufacturing Sector

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#### Introduction

Since South Korea's investment in research and development (R&D) reached 2.63% of its gross domestic product (GDP) in 2005, the figure has been steadily rising (4.29% in 2014 and 4.23% in 2015) even after the global financial crisis in 2008 as shown in **Figure** 1. In fact, South Korea has one of the highest levels of R&D investment, taking into consideration its GDP. While South Korea's economic growth rate has fluctuated from 3.9% in 2005 to 6.5% in 2010, it has stayed below 3% for the past four years, showing no signs of change. Taking into consideration the inflation rates of the period, the actual economic growth rate has dropped even further. In other words, despite the significant increase in the amount and ratio of R&D investment, slow economic growth since the global financial crisis has continued and South Korea has had only 2-4 percent economic growth. Indeed, South Korea has settled into a low growth trajectory.

In this regard, we want to answer the following questions. Has there been any change in the moderating effects of R&D between open innovation (OI) and firm performance of small and medium enterprises (SMEs) in the South Korean manufacturing sector since the global financial crisis? If so, do they include changes in the OI effect, the R&D effect, and the R&D open-moderating effect?

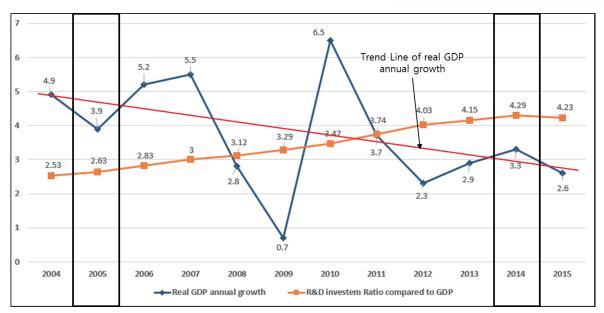


Figure 1. Changes in GDP and R&D investment of South Korea from 2004 to 2015 Source: Korean Government Statistic Office

By analyzing the empirical changes in the effects of OI, R&D investment, and the moderation of R&D investment on the South Korean manufacturing sector before and after the global financial crisis, the purpose of this study was to understand why South Korea's economic growth has stalled or fluctuated despite the high R&D investment. Big corporations were excluded from our empirical analysis because the international macroeconomic environment largely affects their performance in certain industries. In addition, OI is an analytical tool for us to understand the industrial innovation of more traditional and mature industries in SMEs rather than that of the high level technology of big corporations, such as Lucent, 3Com, IBM, Intel, and Millennium Pharmaceuticals (Chesbrough and Crowther, 2006). The service sector was also excluded from our empirical analysis because the effects of OI and R&D investment on the service industry are often empirical analysis because the OI effect on SMEs in the United Kingdom and in the Netherlands, respectively.

Following the OECD Frascati Manual, we conducted an empirical analysis based on data obtained from the South Korean SMEs Innovation Survey Results including the 2005 manufacturing industry and the 2014 manufacturing industry (OECD, 2015). We also employed additional empirical methods, such as intensive interviews with representatives of the South Korean manufacturing sector. In fact, we provide the related parts of the "Innovation Survey Questionnaire" in an attachment for reference. We also provide descriptive statistics on South Korea's macroeconomic environment and its SMEs before and after the global financial crisis in 2008.





Session-16-#303-1(SS7 & SS15)

## **Benefits and Costs of Closed Innovation Strategy:**

#### Analysis of Samsung's Galaxy Note 7 Explosion and Withdrawal Scandal

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#### Abstracts

Samsung Galaxy Note 7 has been withdrawn from the market after occurrences of its explosion after launch in 2016. Our research wants to answer three questions as follows.

How did the Samsung Galaxy Note 7 withdrawal occur?

What caused this event to take place?

How should we understand the causes and processes of this event?

From among the qualitative inquiry methods, this study used case study research.

From this research, we found out three implications.

First is the benefits and costs of closed innovation strategy in Samsung Electronics.

Second is the internal impact of the Galaxy Note 7 explosion on Samsung Electronics.

Three is that the success in open innovation strategy requires much investment and effects.

**Keyword:** Samsung Galaxy Note 7 explosion, closed innovation. Benefits of closed innovation, Cost of closed innovation, not invented here syndrome

Session-16-#303-1(SS7 & SS15)

# Innovation of the Management Systems in Medium-Sized Enterprises – Problems and Solutions

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#### Abstract

#### **Purpose/ Research Question:**

Small and medium-sized enterprises (SMEs) are the backbone economy. In Europe SMEs represents up to 99% of all businesses and provide two-thirds of the total private sector employment. In a private sector, large proportion of enterprises is owned by individuals or by families and at the same time managed by founders or owners. Despite of significance of the SME sector to economy, business literature as well as training programmes tend to use large companies and corporations as a best practice and management approach examples.

This paper review existing literature on management system development in small and medium enterprises and compare theoretical findings with several owner-managed medium-sized company cases from different European countries. Cases will be compared to find possible similarities and differences across different companies and different business environments. Purpose of this paper is to enlighten challenges SMEs are facing and possible solutions that will contribute to improving their management and sustainability.

#### Key Literature Reviews.

Literature review will include recent theoretical and empiric findings in the small and medium business area, with particular focus on management system development and owner-managed companies, as well as concepts of innovation and open innovation.

Management system, according to Kaplan and Norton (Kaplan & Norton, 2008) is the integrated set of processes and tools that a company uses to develop it strategy, translate into operational terms and monitor and improve effectiveness of both.

Literature still mainly focuses upon large organizations, and many questions on how management system can be developed in small and medium enterprises still remains unanswered. Empirical large-scale postal survey of owner-managed small and medium sized enterprises (SMEs) was conducted in the UK (Wang & Poutziouris, 2010) drawing evidence and exploring the association of small business managerial style and performance. It reveals that the managerial style of entrepreneurs is influenced by a series of





demographic and situational factors. Moreover, according to this research, owner-managed businesses characterized by delegation of authority appear to achieve higher growth in sales and operationalize in a more professional way.

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Implementation of the management system itself can be described as a process. Garengo and Biazzo (Garengo & Biazzo, 2013) suggest the framework process for implementation of Integrated Management system (IMS) in SME. Their framework is based on changeover from the adoption of ISO quality standards to the implementation of an IMS.

For an owner-managed company, entrepreneurial behaviour of owner-manager is affected by their personal values and views. Jaouen & Lasch suggest a new typology of owner-managers (Jaouen & Lasch, 2013) exploring the extent to which the views of owner-managers regarding growth and lifestyle issues affect their entrepreneurial behaviour. Typology suggested consists of four owner-manager views associated with success, subsistence, hedonism and paternalism, and investigates the differences in the behaviours associated with these four profiles.

Open innovation has been defined as the use of purposive inflows and outflows of knowledge

to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough, 2006). Small and medium enterprises have limited internal resources and internal knowledge and shall use external knowledge; however, diversity in the SME sector is high. Chesbrough et.al ((Gassmann, Enkel, & Chesbrough, 2010), identified several trends how open innovation develops. One of trend is that innovation goes from large companies to SMEs. Other trend is that industry is starting to professionalize the internal processes to manage open innovation more effectively and efficiently. Nevertheless, it is currently still more trial and error than a professionality managed process.

This research will analyze innovation in the management system of the small and medium enterprises linking both system and process aspects with the owner-manager personality traits.

#### Design/ Methodology/ Approach:

Research starts with a literature review using the state-of-the-art method to understand previous research on management system development in small and medium enterprises and owner-managed companies in particular. Then structured interviews with owners-managers of small-medium sized companies are conduced to identify underlying factors and particularities of management system is developed in case companies. This is followed by comparison of findings from literature review and case companies and drawing conclusions.

#### **Expected Findings/Results**:

This paper will enlighten challenges that SMEs are facing in context of current business environment and contribute to discussion on possible solutions that improve the SMEs management and sustainability.

#### **Research limitations/ Implications:**

This paper focuses on a Management system as a general set of tools and processes in a company, and not specifically on IT solutions used for enterprise resource planning (ERP systems), performance management or other management processes. Conclusions from field research are relevant to those particular medium-sized companies analyzed in this research, and shall not be generalized without additional research and validation. Keywords: Small and medium enterprises. Management system. Management processes. Ownermanager.

#### Literature

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Session-16-#303-1(SS7 & SS15)

## Assessment of sustainability at higher education institutions

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#### Abstract

*Introduction.* Along with the growing social role of higher education institutions (HEIs), the issue of their sustainable development potential is becoming more and more topical. The Talloires Declaration signed in 1990 can be mentioned as one of the main documents that initiated discussion on the sustainable development at HEIs (The Association of University Leaders for a Sustainable Future, 2016). Since the signing of the declaration, HEIs have devoted a lot of attention to sustainable development and its role not only as a factor influencing the universities as such, but also their external shareholders. These efforts have become even more concentrated in the recent years. Research on the internal stakeholders (students, academic personnel, etc.) and their contribution to sustainable development at HEIs has also intensified (Pittman, 2004; Barth, & Timm, 2011 and other authors).

*Literature Review.* There is a wide range of research on sustainable development and development potential of HEIs. For example, Lidgren et al. (2006) analyze university curricula, knowledge transfer opportunities, production of educated students, production of research results and potential barriers to the university goals in the context of sustainable development. Moore (2005) in her study analyzes the main factors influencing sustainable development of HEIs, such as research, service and teaching, study programs, students and other. Buissink-Smith (2011) reflects on such sustainable development should be based on three main pillars: economic, social and environmental. Analyzing the performance of the University of Amsterdam in the context of sustainable development, Van Weenen (2000) focuses on social and environmental indicators, and Velazquez et al. (2005) concentrate on organizational structure, financial factors, research, regulations, performance indicators, time, data access, communication, sustainability on campus and other indicators.

Purpose. The purpose of the present paper is to assess sustainability of higher education institutions.

*Methodology.* In order to achieve the results of the present research, the qualitative overview of the scientific literature on sustainability at higher education institutions and its contributing factors has been performed. Based on literature analysis, the authors have developed theoretical sustainability model for higher education institutions. To gain the required data and test the theoretically developed sustainability model, the authors of the present paper have analyzed the top universities in the world that already realize sustainability principles, as well as the largest higher education intuitions in Latvia and their

correspondence to the principles of sustainable development.

Various research methods have been applied in the course of development of the present research paper, such as qualitative, quantitative and mixed economic research methods and qualitative and quantitative data processing methods including statistical and comparative methods, as well as content analysis.

**Results.** Assessing sustainability of higher education institutions, the authors have come to the conclusion that the factors that ensure sustainability include academic and research excellence, qualified academic personnel, flexibility of curricula as well as conformity to other important principles of sustainable development.

Based on the analysis of good practice of foreign HEIs in the field of sustainable development, the authors provide recommendations to improve sustainability of the Latvian HEIs.

*Practical implications*. Research results obtained by the authors can be used by sustainable development planners and decision makers at HEIs; they may also help develop better understanding of the factors contributing to sustainability, sustainability assessment options and transition to sustainable development principles.

*Value/originality.* Taking into consideration the role of sustainability, especially in the education system, HEIs should change the present strategy to constantly improve their sustainability.

The authors consider that in the context of sustainable development it is necessary to conduct additional research that would allow developing a deeper understanding of the role of all stakeholders in promoting sustainability at higher education institutions.

Keywords: Sustainability, Higher Education Institutions, Model

*Paper type*: Research paper

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# The model of involvement of the society in social innovation processes in Latvia

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#### Abstract

The paper is to present the results of the research which is being conducted within the project "Involvement of the Society in Social Innovation for Providing Sustainable Development of Latvia" as part of the National Research Program 5.2. "Economic Transformation, Smart Growth, Governance and Legal Framework for the State and Society for Sustainable Development – a New Approach to the Creation of a Sustainable Learning Community (EKOSOC-LV)".

The purpose of the research is to elaborate the model of involvement of the society in social innovation processes in Latvia based on the levels of inclusion of the stakeholders with financial, organizational and informative support.

Key Literature Reviews (About 3~5 papers):

In the European Commission's "Guide to social innovation", it is argued that social innovation typically goes through stages starting as ideas, which may then be piloted or prototyped for being implemented as a new venture or as a new policy within an existing institution and scaled up in the final stage, making a

real impact and becoming part of the norm (European Commission, 2013). The spiral model of social innovation shows its four stages:

- 1) ideas;
- 2) prototyping or piloting;
- 3) implementation;
- 4) scaling (European Commission, 2013: 9)

Based on the literature analysis, the project team have come to the conclusion that the starting point of social innovation is not just an idea but an urgent social problem which either hasn't been solved yet or is solved partly or not very effectively (Phills, Deiglmeier & Miller, 2008; OECD, 2010; Dover, 2011; Minks, 2011; Mahmuda, Baskaran & Pancholi, 2014; Howaldt et al., 2014, etc.). The research team defines social innovation as better, more efficient and effective solutions of social problems (Phills, Deiglmeier & Miller, 2008; Howaldt & Schwarz, 2010; Minks, 2011; Cajaiba-Santana, 2013; Klievink & Janssen, 2014). In the result of social innovation, new sustainable social practices and culture including new organizations, new policy, new technological solutions, value system, mentality, etc. could be created (Howaldt & Schwarz, 2010, The Young Foundation, 2012a; Lundstrom & Zhou, 2011; Davies, 2014; Howaldt et al., 2014).

The specific aspect about social innovation is co-organization and co-thinking of the stakeholders for diagnosing the social problems in the local community or in the country with further prioritization for finalizing the problem to be solved (The Young Foundation, 2012a, 2012b; Davies & Simon, 2012). The process of social innovation has been pursued at three levels:

- delegating the role of generating social innovation to individual entrepreneur (micro),
- through the public/private partnerships (meso),
- innovating the patterns of social interaction by governments and institutions for generating social value through policies, laws, and institutional reforms (macro) (Bonifacio, 2014).

In the stage of the solution of the social problem the parties involved co-create best solutions via ideation, prototyping and piloting. In the course of implementation, the solution is improved or pivoted for achieving self-sustainability. Then the new practice is expanded and developed on sometimes being replicated in one or more locations involving more people in social innovation processes (Murray, Caulier-Grice, & Mulgan, 2010; The Young Foundation, 2012a, 2012b). Therefore, the research logic used in this project is based on the following four stages:

- 1) community diagnosis of social problems and prioritization of the most urgent problem;
- 2) co-creation including ideation and prototyping of the most effective solution for the social problem;
- 3) implementation of the project;
- 4) scaling up of the new social practice and involving broader society in the social innovation processes.

#### Design/ Methodology/ Approach:

The research is based on face-to-face or online interviews of social innovation projects in Latvia which may be in different phases of their development. The content of the interview is elaborated according to



the four stages analyzed above. Interviewees are to evaluate in 10-point system (10 - very much and 0 - none) the input in the project given by each of the stakeholders who may be: the target group for whom the social problem is to be solved, municipalities, public institutions, entrepreneurs, families and friends, NGOs, other individuals and/or educational institutions. Three aspects of that input: financial support, informative support and organizational support are to be evaluated as shown in table 1.

The input of the stakeholders in social innovation project										
	Target group	Municipalities	Public institutions	Entrepreneurs	Family & friends	NGOs	Other individuals	Educational institutions	EU institutions	Other
Financial support										
Informative support										
Organizational support										

Table 1The input of the stakeholders in social innovation project

The matrix constructed on the basis of the quantitative data obtained in the interviews will be used for creating the mathematical and logical model of the involvement of the society in social innovation processes. The logic of the mathematical model is based on the approach of calculating different macroeconomic indicators such as: Purchasing Managers' Index represented by the Institute for Supply Management (Institute for Supply Management, 2016) and German Ifo Business Climate Index introduced by Center for Economic Studies of Leibniz Institute for Economic Research at the University of Munich (CESifo Group Munich, 2016). To simplify the evaluation of the involvement of each stakeholder in social innovation processes in Latvia and the interpretation of the results, the model will be based on average values calculated in each matrix column and row; the general aggregated index will be calculated as the average of averages. The evaluation conducted in the 10-point system will significantly simplify the interpretation of the results.

The qualitative content analysis of the text will reveal: the character of the social problems solved, the barriers overcome and challenges faced by the social innovation projects, the specific aspects observed in the course of the social innovation projects, the social impact and mechanisms of the achievement of financial sustainability of the projects, etc.

(Expected) Findings/Results: At this moment the research team is organizing interviews of social innovation projects all over Latvia. According to the project schedule, 2017 is its final year. That means that by the end of May 2017 all the data are to be collected, analyzed, processed and interpreted with the elaboration of the model which will give insight into the levels of financial, informational and organizational involvement of different stakeholders into social innovation processes in Latvia. In its turn, the qualitative content analysis of the texts of the interviews will shed light on the issues related to the four stages of social innovation started from community diagnosis till the scaling up of the new social

practice.

**Research limitations/ Implications**: Even after piloting and making the material of the interview much shorter and more focused, it sometimes causes certain inconveniences for the interviewees who, as a rule are very busy and do not always wish to devote their time to research. Today people from the world of business are offered to answer different questionnaires more and more often; that has made them irritated. In the result, the response rate of online written interviews has decreased. That may have a negative impact on the reliability of the results. To ensure high reliability and validity, the research team will have to organize mainly face-to-face interviews in order to communicate with the interviewees directly and to explain things in cases when necessary. This will make the work of the research team more time-consuming and expensive.

Keywords: Social innovation, involvement in social innovation, model of involvement in social innovation

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Session-16-#309-1(SS6 & SS14)

### Grassroots social innovation development: the main trends

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#### Abstract

#### Purpose/ Research Question:

The management and economic literature at the beginning of the 21st century proposed numerous ideas regarding perspectives on capitalism in general and the efficiency of governance frameworks introduced under capitalism in particular. These contributions include critical works addressing issues such as the following:

- the importance of institutions that have been taken for granted under capitalism and their influence on economic development (de Soto, 2000),
- the limitations of "pure capitalism" with respect to value creation (Porter & Cramer, 2011),
- capitalism's inability to overcome poverty (Yunus, 2008),
- capitalism's inability to regulate the distribution of wealth and address the unequal distribution of income across societies (Piketty, 2014),
- new trends in capitalism arising from the network economy (Benkler, 2006).

Thus, social entrepreneurship that is based on social innovation becomes one of the possible key solutions to existing problems.

The role of institutions in social entrepreneurship development had been discussed widely in literature (Dacin et al., 2010; Estrin et al., 2013, Mair&Marti, 2009, Sud et al., 2009) which defines the importance of institutional setting for its development – from outlining that social business models are bound to work in the institutional settings they were created for (Dacin et al., 2010) to questioning the ability of social entrepreneurs to "provide comprehensive answers to most pressing social ills" (Sud et al., 2009).

For the purposes of this paper we agree with Sud et al, (2009) and see social business as just one of the ways of both social and economic development (as outlined in the suggested definition), based on the opportunity which was overlooked by "regular" entrepreneurs (Yunus, 2008). We also base our suggestion on findings of Dacin et al. (2010), who states that "social entrepreneurship is more likely to occur where there are significant socioeconomic, cultural and environmental problems". Same is suggested within empirical research: "social entrepreneurship in some developing countries is likely to be shaped by the political context and the heritage of weak governments" (Terjesen et al., 2009), where social market failure creates an opportunity for a social entrepreneur (Austin et al., 2006) and henceforth new social values are created (Urbano et al, 2010) – and still, these thesis, though seem perfectly logical, is not supported by some empirical testing. For example, Stephan et al. (2014) had found that revenue-generating social business development is strongly associated only with government activism and rule of low – and these two features can rarely be found in economies with weak institutions. GEM report also finds, that equally high level of social entrepreneurship activity can be find in the US, Iceland, Finland (the countries associated with high level of institutional development) and in Argentina, Colombia or Uganda (associated with underdeveloped institutions).

The importance of institutions indicates the following: in case of low institutional development the problem that is not solved by the institutions would be addressed by social entrepreneurs who use grassroot innovation to solve the problems which remain unsolved in traditional ways.

#### Key Literature Reviews:

1. de Soto, H. 2000. The Mystery of Capital: Why Capitalism Triumphs In the West and Fails Everywhere Else, New York, NY: Basic Books.

2. Porter, M., Cramer, M. 2011. Creating Shared Value. Harvard Business Review, January, 2011.

3. Yunus, M. 2008. Creating a World without Poverty: Social Business and the Future of Capitalism; Public Affairs

#### Design/ Methodology/ Approach:

The paper uses both qualitative and quantitative analysis – the first one is used to address the appearance of grassroot innovation, while qualitative GEM-based analysis is used to justify the qualitative propositions The main tool of qualitative analysis is the case method, while the main instrument in quantitative analysis is cluster analysis.

#### (Expected) Findings/Results:

To solve this contradiction, we suggest the following approach to define how institutions influence organizations with social mission: (1) the type of such organization is influenced by the type of institutions that are prevailing in a field where social entrepreneur see an opportunity – it can be either formal or informal institutions; (2) the type of organization is defined by the inter-country average level of regulatory control and rule reinforcement that can be found in a country (in case of highly polarized countries regional level should be taken into consideration as a moderator).

Thus, social enterprises emerge in case of prevailing informal institutions and relatively low level of regulation and control (which can occur both from laissez-faire or weak state practices). Low level of





regulation in this matrix is underlining governmental attitude to market failure: if the regulatory control is high, the government indicates that only the solutions that involve state can be implemented in case of market failure (the examples of such approach are Belarus, Democratic Republic of Korea, Russian Federation that offer strict regulations for any emerging social activities); low regulation level indicates the government agrees to have state-free solutions to social problems (an example of such approach can be Bangladesh, Uganda or Argentina). Quantitative analysis run on the data on Economic Freedom Index (used to measure the level of state regulation, Heritage foundation) and SEA rate (Terjesen et al., 2009) indicated that there is a positive Spearman correlation between these parameters (.318, significant at 0.05), which supports the idea of mapping social entrepreneurship using the level of regulation scale. The second parameter, prevalence of formal institutions indicates there are paths for solving a social problem, and these are used by either non-profits or socially responsible companies; social enterprises emerge to close the gap that arises from underdeveloped formal institutions. If regulation is high, but formal institutions are underdeveloped, literature suggests (de Soto, 2000) that informal enterprises will emerge – and this happens in case of enterprises with social mission as well.

#### Limitations:

The present study has certain limitations, the most important of which is the lack of a quantitative analysis to verify the significance of the proposed models and matrixes, which are derived from a logical analysis of the existing literature and cases on social entrepreneurship based on social grassroot innovation.

Keywords: social innovation, grassroot innovation, social enterpreneurship.

Session-16-#309-1(SS6 & SS14)

# The social entrepreneurship concept as a subject of social innovation

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#### Abstract

**Purpose/ Research Question**: In the last years, in the international academic debate a discussion is evolving around a number of interconnected concepts which intrinsically include two apparently contradictory dimensions: social and economic. Among them, the most visible are the concepts of social entrepreneurship and social innovation which are often used as synonyms. The purpose of the research paper is to clarify the relation between the concepts of social innovation and social entrepreneurship.

**Key Literature Reviews (About 3~5 papers)**: The research is based on the theoretical analysis of both the concepts using the works of Mulgan, 2007; Phills et al., 2008 Schöning, 2013.

**Design/ Methodology/ Approach**: In the research, the authors used the following methods: monographic method (to create a theoretical discussion and interpret research results on the social innovation and social entrepreneurship concepts, which are based on the findings of scientific literature); the methods of analysis and synthesis to separately explore elements of the problem and build interrelationships; the method of scientific induction – to create scientific assumptions and similarities based on separate elements; scientific deduction method – to logically systematize and explain empirical data. In scope of the research, the authors used scientific literature on social entrepreneurship and social innovation.

(Expected) Findings/Results: Social entrepreneurship and social innovation are interrelated, since social entrepreneurship often creates and promotes social innovation. Social innovation is a mechanism in actual innovation but a social entrepreneur is a driving force for social change.

**Research limitations/ Implications:** Social innovation and social entrepreneurship have several meanings, thus information related to these two subjects is widely dispersed in the scientific literature. Consequently, this research cannot be considered as an in-depth exploratory study. Another potential limitation was the subjectivity in the analysis of the social innovation and social entrepreneurship concepts.

Keywords: social innovation, social entrepreneurship, social change.

#### Acknowledgement





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DOVIST

Session-16-#309-1(SS6 & SS14)

# A food industry trend analysis of Gangwon-province in Korea based on Patent Information

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#### Abstract

The technology is the important factor to develop the competitiveness of the product. For example, the advanced technology can reduce the cost of production and increase the quality of products. Therefore, the technology affects the competitive power of the trade product.

The patent analysis is one of the popular approaches to observe the technology trend. We can see good reasons for exploring this approach. First, the patents can provide us with information about the development of the technology itself because they hold the technological know-how. Second, they can infer an insight on the potential of a technology to be commercialized; the possibility of commercialization with the technology is one of the preconditions of patentability. Third, data on patent applications (with an ex-post-perspective the annual number of applications of granted patents) also can give us information about the technology life cycle (TLC) before life cycles of different products, which are related with the technology, take place. Lastly, patent applications can be measured easily and objectively by using data banks. A lot of advantages referred above may provide good reasons for our taking up patent application data for recognizing TLC, over accumulated sales data generated by products that comes from the new technology.

In this paper, we investigate the relationship between the technology and the competitive power of the trade product based on the patent analysis and the trade data of the food products at Gangwon-province in Korea, where the food industry is actively supported by the government.

For this purpose, first, we investigate the patent statistical information on the food industry at





Gangwon-province in Korea. Next, we design the model for the competitiveness of the product based on trade amount and the cost per unit weight based on the food custom statistical information at Gangwon-province in Korea. Lastly, we investigate the relationship between the patent statistical information and the competitiveness of the food product.

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#### Purpose/ Research Question:

How does the patent activity affect the food industry trend? **Key Literature Reviews (About 3~5 papers)**: 1.http://www.kosis.kr, Korean Statistical Information Services Homepage. 2.http://kipris.or.kr, Korea Institute of Patent Information Homepage 3.http://unipass.customs.go.kr, Korea Customs Service Homepage

#### Design/ Methodology/ Approach:

- 1. Investigate the patent statistical information on food at Gangwon-province in Korea.
- 2. We design the model for the competitiveness of the product based on trade amount and the cost per unit weight based on the food custom statistical information at Gangwon-province in Korea.
- 3. Investigate the relation between t 1. And 2.

#### (Expected) Findings/Results:

If the activity factor of patent is high, the related item has more competitiveness.

#### **Research limitations/ Implications:**

-The data of Gangwon-province in Korea is only investigated. We need to expand the range of investigation to get more definite generalization.

- We need to expand the research to the high-tech items.

Keywords: Patent, Food Industry, the competitiveness comparison model

Session-16-#309-1(SS6 & SS14)

# Startup trend analysis of global listed companies - Focusing on growth engine industry in Korea -

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## Abstract

Today's enterprises are exposed to frequently changing business environments, and only to adapt to change, it is in a very difficult situation to create new business and lead. The Davos Forum in Switzerland in 2016 predicted that the global economy will continue to maintain low growth, the risk of expansion of the Chinese economy, low oil prices, declining global productivity and the competitive composition of the industry will become serious. As an alternative to solve this problem, it was necessary to master the 4th industrial revolution.

Among them, "shared economy" was selected to be one of the core business of the tertiary industrial revolution, but in 2016, not only in Korea, "shared economy" has a great impact on the industry worldwide It can be seen as the year.

In accordance with the development of ICT technology so that the economic term "Uberization" is defined, new industries have evolved new changes in existing industries, not changes that were born. Uberization is to make existing services a shared economy, and consumers and providers meet directly with the Internet without a separate intermediary to make a direct transaction.

Uberization is rapidly progressing in various industrial fields, and in 2015 Newsweek in the US predicted that all services will go on uberization.

In addition to increasing the variety of services and business models that utilize the platform based on ICT technology, we expect that the industry's competitive composition will intensify.

While the circumstances surrounding the manufacturing industry are changing suddenly, the importance





of the manufacturing industry, which is an existing industry, is being re-lighted.

Global advanced companies not only make efforts to adapt to these changes in the 4th industrial revolution but also prepare business items that will become new growth power and opportunities in the future and are investing for that .

Governments of various countries also have selected investment plans to select future strategic industrial fields for their economic growth and employment creation and support them and promote it.

In this research, as a measure to find industries that will grow in the future, we are trying to analyze the trend of the establishment of recently listed global companies, and through analysis of the type of industry and the number of businesses of the new startup enterprises, And to see the linkage between the growth of the industry and the life cycle of the industry.

According to a previous study on the analysis of the number of global newcomers (2016, Leenam Kwon), although the number of founded companies tended to decline (-12%) from 2013 compared with the previous year in 2014, the G7 countries , It was confirmed that a marked increase trend in specific industries was revealed.

We would like to confirm the relevance of the industrial life cycle by analyzing the data of longer periods to analyze whether the global listed companies mainly concentrate on which industry in each year.

The ILC(Industry Life Cycle) can interpret industry structure, development and forecast in diverse aspects so that it can suggest practical guidelines for target strategies and policies to the government or investors by the industrial life cycle stage as well as important implications needed in developing market response strategies.

Since the ILC is influenced by diverse market environments such as technology development, market demand, business factors, competition structure, marketing and government policies, however, there should be meticulous analysis and efforts to find a life cycle for certain industry.

According to the ILC theory, it is forecasted that the ILC is at a certain stage depending on the product sales, shipment volume and market distribution rates to measure the industrial life cycle.

As an empirical study to measure an ILC, Steven Klepper and Elizabeth Graddy (1990) insisted that in general industry, the number of businesses dramatically increases during a growth stage and starts to decline entering a maturity stage. The total number of businesses in the same industry is the most fundamental indicator which divides the market into monopolistic, oligopolistic and competitive market because as the number of businesses increases, competition becomes more intense while influence on market price diminishes. They wanted to tell that increase in the number of businesses would be applicable to the development of new industries under the same rules. In today's rapidly changing market environments, it is time to perform a study on the indicators and models which can be applied in a more empirical and fast manner, instead of using conventional sales & shipment volume-dependent indicators.

In addition, we analyze existing existing industrial areas where existing global companies are expanding and try to confirm new movements in existing industries such as "Uberization". By doing this, we will try to present government guidelines not only for companies that are concerned about the direction of future business, but also for establishing support policies for industry.

The most hot technical fields in "The 10 biggest startup opportunities in 2016" selected by CIO magazine are as follows. 1. Wearables in the enterprise, 2. Consumer IoT and 'smart home', 3. Consumer privacy protection, 4. Counterterrorism technologies, 5. Cybersecurity services to protect enterprises, 6. Financial tech in emerging markets, 7. Digital health and Big Data, 8. The 'Uberization' of manufacturing, 9.

Autonomous cars, 10. Space exploration

This is a technical industry area which is in substantial part agreement with the growth engine industry field selected by the Korean government.

We will first extract global listing companies established by developing global listed companies and branch offices, centering on 17 growth power industry fields selected by the Korean government for analysis. And analyze the industries and the number of newly-emerging businesses and analyze the change by industry.

Analyze using the U. S SIC code mapped to the KSIC (Korean Standard Industry Classification) industry type code by Korea's growth power industry, and exclude classifications where mapping does not exist or are missing.

We would like to extract and analyze the data corresponding to the global listing company in the past 5 years at the ORBIS database that provides global company information (total of 154 million) to analyze the trend of the start of global listed companies.

Keywords: Startup trend, global listed companies, growth engine industry, Industry life cycle, Industry analysis





Session-16-#321-1(SS3 & SS12)

# Entrepreneurial Behaviors, Technology Transfer, and Innovative Performance: Focused on Networks among Industries-Higher education & Research Institutions, and Technoparks

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## Abstract

**Purpose/ Research Question**: In general, networks have played roles in improving innovation, as well as early-stage companies carry out entrepreneurial behaviors for securing technological competitiveness. In other words, the companies would like to get technology transfer by carrying out the entrepreneurial behaviors, and hence can increase innovative performance. In addition, by utilizing the networks, the companies would like to improve their innovative performance. Nevertheless, relatively few studies have been devoted to investigating empirical relationships among entrepreneurial behaviors, technology transfer, networks, and innovative performance. Especially, technology-based firms in technoparks are one of the best samples. Therefore, this study aims to explore characteristics of the firms and then investigate comprehensive and empirical relationships among entrepreneurial behaviors, technology transfer, networks, and innovative performance, based on technology-based firms that are occupied in South Korean Technoparks.

## Key Literature Reviews (About 3~5 papers)

- 1) Soriano, D. R., & Huarng, K. H. (2013). Innovation and entrepreneurship in knowledge industries. *Journal of Business Research*, 66(10), 1964-1969.
- 2) Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, 43(7), 1097-1108.
- 3) Mowery, D., Nelson, R., Sampat, B., & Ziedonis, A. (2015). *Ivory tower and industrial innovation: University-industry technology transfer before and after the Bayh-Dole Act.* Stanford University Press.

SOltmC & RTU 2017

- 4) Grimpe, C., & Hussinger, K. (2013). Formal and informal knowledge and technology transfer from academia to industry: Complementarity effects and innovation performance. *Industry and innovation*, 20(8), 683-700.
- 5) Leydesdorff, L., & Ivanova, I. (2016). "Open innovation" and "triple helix" models of innovation: can synergy in innovation systems be measured?. *Journal of Open Innovation: Technology, Market, and Complexity*, 2(11), 1-12.
- 6) Cooke, P. (2016). The virtues of variety in regional innovation systems and entrepreneurial ecosystems. *Journal of Open Innovation: Technology, Market, and Complexity*, 2(13), 1-19.
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**Design/ Methodology/ Approach**: The study analyzes data from technology-based small and mediumsized enterprises (SMEs) in South Korean technoparks, by using structural equation modeling (SEM). It assumes that networks will play moderating roles in the relationships between entrepreneurial behaviors and innovation performance. That is to say, we would like to carry out the survey after making interviews with CEOs in the enterprises.

(Expected) Findings/Results: Technology-based SMEs will transfer useful technologies by carrying out entrepreneurial behaviors. Moreover, the stronger networks with other stakeholders such as universities, industries, and technoparks SMEs have, the higher innovative performance they have. With the stronger networks, tech-based SMEs will have useful technologies more easily and hence better innovative performance.

**Research limitations/ Implications**: There are some limitations in this study. First of all, this study relied heavily on just quantitative methods such as surveys. This approach is inadequate for considering individuals' in-depth opinions. Therefore, future research utilizing both qualitative and quantitative measures needs to be carried out. Second, this study has some academic limitations. Actually, this study considered restricted factors on innovation and networks, so it is necessary to evaluate other variables such as environmental factors (e.g., regulations or support policies) that might be significantly associated with networks and innovation hereafter. Finally, due to the fact that this study was focused on SMEs that are occupied in South Korean technoparks, it is difficult to generalize the above results. However, this study implies that a greater stronger network ties improve innovative performance, so SMEs must establish and reinforce networks to improve the performance.

**Keywords**: entrepreneurial behaviors, technology transfer, networks, innovative performance, technology-based small and medium-sized enterprises





Session-16-#321-1(SS3 & SS12)

# The Effects of Entrepreneurial Business Process on New Firm Creation : An Empirical Study Based on PSED Data

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## Abstract

## **Purpose/ Research Question**

: This study proposes the entrepreneurial business process (EBP) that reflects how to search and manage the necessary activities, resources, and stakeholders for managing startups from the viewpoints of Know-Why, Know-What, Know-Who, and Know-How. In this study, using resource management, organization theory, stakeholder theory and business process management, we focus on role of resource and stakeholder of startup firms on their survival.

## Key Literature Reviews (About 3~5 papers)

: Most entrepreneurship studies have concluded that startup companies fail due to the lack of resources and the absence of network with external stakeholders (Dahl and Nesheim, 1998). Early-phase startups face difficulty in obtaining the knowledge and information about how to systematically secure and manage insufficient resources. The three important factors that directly affect the performance of new venture creation are team, resource, and opportunity (Song et al., 2008). Startup companies should maintain consistent relations with external stakeholders or partners who have the complementary ability and resources required for different entrepreneurial activities in the growth process (Gulati and Gargiulo, 1999). Entrepreneurial processes have a close relation with entrepreneurship and may be regarded as a series of processes of creating value, searching for business opportunities for development into a business idea, and commercializing it for practical business through management of resources and organization (Tötterman, 2008; Moroz and Hindle, 2012).

## **Design/ Methodology/ Approach**

: More specifically, we argue that resource availability and stakeholder mentors outside the organization have an effects on failure of startup companies in the next five years. Using nascent entrepreneurs during the startup process with data from US Panel Study of Entrepreneurial Dynamics (PSED), we analyze whether they are actually reaching the new firm creation stage, disengagement stage, or startup active stage depending on resource and stakeholder management.

## (Expected) Findings/Results

: We identify individual characteristics, environment and policy factors that affect the entrepreneurial activity of the entrepreneurs. We conduct the latent growth model analysis using structural equation modeling to measure changes in factors over time, and verify the effectiveness of the defined factors in the entrepreneurial business process. This is the first research of analyzing relationships among business process and organizational characteristics from the perspective of startup companies considering the limitations of startup companies.

## **Research limitations/ Implications**

: Our results suggested that entrepreneurs can increase the chances of survival of their startup firms with external resource and stakeholder. We will contribute to more effectively model entrepreneurial business process and manage factors affecting the success and growth of startups.

## Keywords

: Entrepreneurial Business Process, Business Process Management, Startup Process, Resource and Stakeholder Management, Latent Growth Model

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Session-16-#321-1(SS3 & SS12)

# Communication-Flow oriented Organizational Redesign Methodology by Analyzing Unstructured Business Process Executions

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## Abstract

Due to the globalization and frequently changing environment, organizations should change themselves in order to adapt to these environments. Especially, business process, the structured path to deliver the value of their organization to their customer, is utmost component to be changed in these environments. Organizational structure, the formal communication channel among the organization, affects the business process performances when business process executions have been varied by their confronted environments.

Unstructured business process executions that is not executed as designed business process are more likely to occur than structured executions because the business process is varied by recent complex environments. During the business process execution, various communication flows can occur including task reporting, task approval, task assignment, task coordination, task-related knowledge sharing. Communication flows which means a directed communication from the performer to other performer on the business process executions. Although process performers should have followed the organizational structure as formal communication channel in principle, they may not communicate on their formal channel in some situation. If communication flows that don't conform their organizational structure have been occurred frequently, it is necessary to redesign the organizational structure to support their communication flows well. However, the organizational structure has not been considered as the affecting factor in most studies.

Numerous efforts and research for successful Business Process Innovation(BPI) have already been

conducted in many academic and industrial area. Most existing approaches such as Business Process Reengineering(BPR) and Process Innovation(PI), however, didn't yield desired result since the business processes were analyzed without considering other organizational factors, for example, organizational structure and their communication channel which significantly affects the process performance in these fluctuating environment. On these reason, it is required that both business process and organizational structure should be adapted comprehensively to their environment to promote their organizational performances effectively.

While it is also very important how organizational factors that affects the business process as well as their performance can be stored and managed in the information system, none of existing studies have been conducted. Although process mining, data-driven approach to analyze business process from the extracted event log, have been actively studied recently, how to manage the relationship between business processes and other organizational factor in data perspective also have not been considered at all. To overcome these limitations, the extended process log that incorporates the unstructured business process execution with the organizational data is defined in this paper.

This paper proposes a methodology for suggesting communication flow-oriented organizational structure by analyzing their unstructured business process execution from suggested process log. It first extends existing business process execution log to Business Process - Organizational Structure Data Model (BP-OS DM) which means data requirements to analyze the business process execution and the organizational structure comprehensively. Even though process log is reported in different types according to their enterprise information systems (ERP, CRM, BPMS), it consists of basic business process information such as process instance identifier, task identifier, performer identifier and timestamp while relatively little attention has been placed on how to consider the organizational structure. They are considered as a basic data set for business process analysis because most research only has focused on the discovery of the business process model. Organizational data requirement such as performer related information (department / role / organizational hierarchy) and their communication log between their task executions should be included in the suggested data model. The data model (BP-OS DM) will be designed as Entity - Relationship Diagram(ERD) and can be useful for designing an enterprise information system and analyzing business process. Then, it is derived how well existing organizational structure supports their unstructured business process executions and their communication flows by analyzing their process execution log accumulated based on the suggested data model. We extend the Process and Organization Fitness Index(POFI) developed by our team to develop various Business Process - Organization evaluation indexes. By analyzing the communication log, the type, shared knowledge and frequency of communication flows between performers can be derived. Alternative organizational structures will be derived based on characteristics of their communication. We will develop a method to analyze the communication between performers using relatively simple natural language processing technology in this study. The organizational redesign taxonomy is suggested to classify the suitable alternatives which is promoting communication flows. The application of the proposed methodology will be illustrated by a running example. The analysis tool will be implemented using Python, an open source programming language with many libraries, such as data analysis and natural language processing, allowing researchers to freely develop and extend methodology and related





research.

This study has academic contributions in two respects. First, while there are only limited and narrow approach of business process analysis in existing process related researches, this study considers business processes and organizational structures in an integrated manner. Second, it contributes academically to analyzing and improving the communications that occur frequently during the execution of unstructured business processes. In particular, this methodology has an important academic contribution in that it utilizes a communication log analysis that is not widely used in BPM research.

**Keywords**: organizational structure, unstructured business process, organizational redesign, communication orientation, business process log

Session-16-#321-1(SS3 & SS12)

# Socio-spatial dynamics of e-services and e-commerce potential

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## Abstract

#### Purpose:

During the last decades, companies and public bodies have initiated e-business and egovernment projects in order to achieve benefits such as improved effectiveness, productivity and business processes (e.g. Wielicki & Arendt 2010; Linnefell et al. 2014; Nam 2014). E-commerce developed alongside the massive adoption of Internet (Lee et al. 2005) by private companies that aimed to sell and buy goods and services online (Rust & Kannan 2003). Public e-services, that have "mirrored the development of e-commerce" (Lee et al. 2005: 99), are results of e-government projects, that utilize information and communication technologies for delivering (public) information and/or services for citizens (and other stakeholders) and empower them to participate in public governance and decision making (Almarabeh & AbuAli 2010; Lindgren & Jansson 2013; Joseph 2013). This development has produced myriad collection of e-services that have become common practices for people to conduct their daily routines such as shop clothes or fill electronic tax form. The citizen perspective on e-services is fundamental since without extensive use of eservices the developers (whether public or private) cannot gain the benefits they gain (e.g. Colesca & Dobrica 2008).

The use of (private and public) e-services is closely connected to the adoption of ICTs that have unevenly diffused globally as well as locally during the last decades (Chen & Wellman 2004; Graham 2011; van Deursen & van Dijk 2013). Geography has significantly defined this development and especially cities have become digitally advanced (e.g. Inkinen 2010; Graham et al. 2013; Graham 2013). Socio-spatial and economic factors explain this development on the national scale but there are clear and distinct spatial diversities. This paper focuses on the citizens' use of (public and private) e-services in the Helsinki Metropolitan Area (HMA). The study examines urban socio-spatial and economic differences and the use of e-services. The specific

The research questions are:





1. How different e-services are diffused; and how does the use of them differ between the city centre and suburban areas in the HMA? (RQ1)

2. How are dependent variables (gender, age, education and income levels and spatial categorization) connected to the residents' willingness to prioritize e-services over other service forms in the HMA? (RQ2)

3. How are socio-economic dependent variables (sex, age, education and income levels and willingness to prioritize e-services) connected to the probability to use e-services between the city center and suburban areas in the HMA? (RQ3)

#### **Key Literature Reviews**

Quite often the economic effects of technology on commerce and customer behaviour are discussed from an engineering and technology-driven viewpoint. A concept of technological determinism is commonly used to point out the assumption that technology will inevitably lead behaviour towards a predetermined destination. In this deterministic discourse, it is also claimed that ICTs, and the digitalization they enable, might provide content regardless of socio-spatial conditions. That is not the case (Lyon 1988; Graham 1998; Staehli et al. 2002; Merisalo et al. 2013). The internet modifies people's purchasing patterns, thus consumption and the selection of applied services. The empirical research question inquires how respondents use and perceive their online e-service usage in relation to their socio-economic situation. The question concerns the redesign and change of retailing and service use through digitalization, which depends on spatial context. Studies concerning e-commerce and e-governance recognize the significance of representation: How are the products presented, how reliable is the supply-chain from the provider to customer, and what customer rights are supported in the case of cancelling the deals? The internet is currently becoming the dominant purchasing medium also for physical products. Digital services are products created in physical environments and they are used in physical realities and contextual situations (cf. Graham 2005; Kellerman 2016). In this process, the issue of assessing product quality, information reliability concerning services and the ability to understand service properties becomes paramount.

Economic implications and the diversification of the global trade and the role of the internet entail questions of consumer rights (law), taxation and the return process. Technological solutions often aim to enhance and support these functions. Electronic service platforms and product delivery management are perhaps the best-known examples of areas of study that concern the e-commerce. The notion of globalization is essential in our understanding of the "time-space compression", as discussed decades ago in analyses of information networks and their societal implications (Kellerman 2002; West 2005; Hudson-Smith et al. 2005; Wilson 2005). The question focuses on enabling direct or indirect knowledge transfer and flows of material or immaterial resources. Stimulating business solutions have emerged in terms product comparisons. Thus metaplatforms comparing e-service providers help to compare various service providers in relation to

their price, conditions and reliability. There have been numerous studies indicating the digital divide (e.g. James 2008) that injects a socio-economic structure into information-based consumerism.

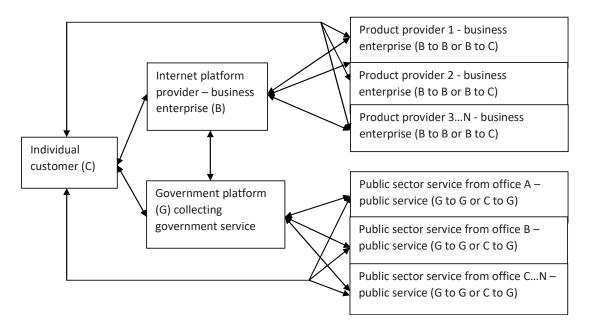
Digital services refer to a complex package of products and services that include 1) public sector services both to citizens and businesses; 2) business-to-business products; and 3) free-of-charge end-user services such as social media applications and cloud services. The paper applies triangulation approach that focuses particularly on interaction and development of public and commercial services. The paper also considers e-services as sectoral entities (public, private, end-user). Producer and user analysis of digitalization has been deemed as one of the great game changers in economy and behaviour for a long time now. This paper applies an extensive empirical data (survey) with focus group segmentation (business, citizens, public administration). The use of multidimensional approach enables answering to the question of digitalization and use of electronic services. The research adds to knowledge on the practices of technology use and gives an opportunity to reflect on the major future developments and service potentials.

Developments in wireless information technologies have affected information distribution on all geographical scales from global satellite transmission to local indoor networks. Cities, whether thought as physical spaces or administrative structures, have been influenced by the growing demands, and also potential, brought about by technological progress. Emergent new solutions to providing location-based services (LBS) have been seen as one of the major market potentials for software and service developers. Therefore, this research will have three focus groups under which e-service adoption and use (extent, process and future potential) are assessed.

When studying digital services and their societal implications and impacts it is a necessity to consider aspects of technological possibilities, economic feasibility and social consequences that these services entail. Sector relations are needed to be considered with respect to analysis. Key dimensions for public electronic services are proposed here to include transparency, interactivity between the customer and service provider. Inclusion is an example of social impacts emerging from the technological development.

The empirical data concerns both private and public electronic services. In order to systematize the approach the paper applies the following schematic (Figure 1).





*Figure 1. Thematic classification of the service provision logic between customers (end-users), government and businesses.* 

Figure 1 indicates that electronic service use is bound to the premises of classic divisions and functions of a contemporary society. The aspect of national and international trade is an interesting venue for studies. A significant amount of internet trade is conducted regardless of national boundaries and the issues of tolls and fees in imports has gained a significant amount of attention particularly concerning items that have traditionally been regulated by the public authorities. These include e.g. sales of alcohol, motor vehicles, medicines and education. Figure 1 indicates also the layered structure commonly applied in e-service provision. Meta-platforms collecting numerous service providers under a single service helps and enables the price and property comparisons between similar items. The transaction flow includes therefore several interconnections between the sectors and their conceptual treatment is not straightforward. This layering also may cause interpretations concerning the liabilities between the service provision chains as the used broker is the contact interface for the customer. The changes in services (e.g. cancelled flights or cancellations to use the service) and the costs or reimbursements liabilities may be disputed.

**Methodology**: The paper utilizes (postal) survey data that was collected in the Helsinki Metropolitan Area in 2010. The survey was stratified into three different case region types to get a representative sample from different residential areas: 1) the city center of Helsinki (region type, RG1), 2) higher socioeconomic suburban areas (region type 2, i.e. RG2/HSAs) and 3) lower

socioeconomic suburban areas (region type 3, i.e. RG3/LSAs). Total sample size was 2 500 that resulted 971 responses (response rate 39 %): 468 from the city center, 220 from the HSAs and 283 from the LSAs (see more (author) 2016). Overall schematic for applying survey data and methods is presented in Figure 2. It shows that practically all used variables are categorical and thus directing our selected toolbox towards categorical methods. The data provides qualitative information treatable as quantified categories.

Applied methods include standard statistical testing including crosstabulations, chi square tests and logistic regression analysis used to examine the three identified research questions (Figure 2). Crosstabs were used to examine how the use of the eight e-services have diffused in the HMA and chi-square tests were used to analyse how the use of them differ between the city center and suburban areas (research question 1). Logistic regression analysis indicated how independent variables and willingness to prioritize e-services are connected to the probability to use e-services in the city center and in the suburban areas (research question 2). Finally, chi square tests were used to examine how socio-spatial variables are connected to the residents' willingness to prioritize e-service delivery forms. The applied methods are suitable to analyse nominal and ordinal scale variables (Bailey, 1987; Weisberg et al., 1989; Pampel, 2000).

#### Results:

Table 1. Results of chi square tests considering the use of e-services between the city center and suburban areas.

Proportions (%) and amo	Chi square statistics									
Total amount of the resp from the proportions an	City center - suburban Subur areas (RG1 - RG2/3) RG3)			reas (RG2 -						
	RG1 (%)	Ν	RG2 (%)	Ν	RG3 (%)	Ν	χ2	sig.	χ2	sig.
Electronic tax form	58.2	260	49.0	102	43.8	116	13.428	0.000	1.300	0.266
E-employment office <sup>1</sup>	52.5	234	37.7	78	56.8	151	1.431	0.235	16.979	0.000
E-services by KELA <sup>2</sup>	44.1	197	30.9	64	35.4	93	11.000	0.001	1.028	0.326
E-notice of removal <sup>3</sup>	55.5	248	32.9	68	35.4	93	41.259	0.000	0.324	0.625
Mobile ticket <sup>4</sup>	63.0	281	18.4	38	23.5	62	164.599	0.000	1.824	0.212
WLAN in public space	51.9	233	34.4	72	30.6	81	36.461	0.000	0.806	0.375
E-commerce	91.3	410	84.7	177	82.6	219	12.663	0.000	0.356	0.618
Online auction	52.1	234	45.9	94	45.9	94	5.996	0.015	0.436	0.513

<sup>1</sup>Service provided by Ministry of Employment and the Economy, <sup>2</sup>KELA= the Social Insurance Institution of Finland, <sup>3</sup>Service provided by Population Register Center and Postal Service. <sup>4</sup>Single SMS ticket for public transport provided by Helsinki Region Transport.



Table 2. Results of logistic regression analysis considering the connection between the use of public e-services and socio-economic characters in the Helsinki Metropolitan Area. <sup>1</sup>Service provided by Ministry of Employment and the Economy, <sup>2</sup>KELA= the Social Insurance Institution of Finland, <sup>3</sup>Service provided by Population Register Center and Postal Service.

Exp(B)	Electronic tax form			E-employment office <sup>1</sup>			E-services by KELA <sup>2</sup>				E-notice of removal <sup>3</sup>					
RG=Region type	ALL	RG1	RG2	RG3	ALL	RG1	RG2	RG3	ALL	RG1	RG2	RG3	ALL	RG1	RG2	RG3
Sex					_											
Women	1.000	1.000	1.000	1.000	1.000	1.000***	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Man	1.163	1.650*	0.579	0.987	0.446***	0.343***	0.624	0.437*	0.613**	0.749	0.379*	0.541*	0.964	1.008	0.963	0.955
Age																
18 - 29	2.401***	3.112**	0.225	3.571**	8.752***	13,626***	11.725**	"8.880***	3.820***	5.682***	4.115	1.720	7.540***	11.494**	* 1.941	2.534*
30 - 40	2.465*	2.997**	1.185	2.964**	3.728***	4,588***	2.124	10.494***	2.159**	2.550**	3.539*	1.215	4.443***	4.454***	21.195***	2.059
41 - 50	2.163*	3.572**	1.142	2.130	1.408	4,017**	0.856	0.892	1.369	1.266	1.295	1.633	2.494***	2.861*	7,047**	1.126
51 - 60	1.000***	1.000**	1.000	1.000**	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000*	1.000	1.000***	1.000***	1.000***	1.000
Education																-
No higher education	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Higher educated	1.213	1.454	0.911	0.602	0.812	0.997	1.539	0.431*	1.580**	1.997*	1.311	1.058	1.786**	1.522	1.192	1.490
Household incomes	s,¤/year															
Below 20 000	1.000***	1.000**	1.000	1.000	1.000***	1.000***	1.000	1.000*	1.000**	1.000*	1.000	1.000	1.000	1.000	1.000**	1.000*
20 000 - 59 999	2,005*	2.368**	8E+08	1.672	0.446*	0.573	0.226	0.146*	0,472**	0.438*	1.824	0.374	0.939	1.768	0.189	0.452
60 000 - 99 999	2.069*	1.964	2E+09	2.147	0.321**	0.37*	0.275	0.082*	0.334***	0.349*	2.714	0.198*	0.612	1.346	0.620	0.212**
More than 99 999	3.534***	3.450**	3E+09	3.800	0.148***	0.150***	0.171	0.042**	0,319***	0.299*	2.708	0.262	0.961	1.391	1.992	0.185*
Willingness to prior	itise e-se	rvices			_											
Disagree	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Agree	3.031***	3.199**	4.622**	4,114**	1.351	2.099*	0.814	1.225	2.264***	2.111	1.388	3.643**	2.609***	4.342***	1.673	1.380
Nagelkerke R2	0.131	0.151	0.222	0.145	0.313	0.364	0.170	0.423	0.180	0.233	0.160	0.155	0.222	0.249	0.396	0.151

Statistical significance level:  $p \le 0.05$ ,  $p \le 0.01$ ,  $p \le 0.001$ .

Table 3. Results of logistic regression analysis considering the connection between the use of public e-services and socio-economic characters in the Helsinki Metropolitan Area. <sup>4</sup>Single SMS ticket for public transport provided by Helsinki Region Transport.

Exp(B)	Mobile ticket <sup>4</sup>			WLAN in public space			E-commerce				Online auction					
RG=Region type	ALL	RG1	RG2	RG3	ALL	RG1	RG2	RG3	ALL	RG1	RG2	RG3	ALL	RG1	RG2	RG3
Sex																
Women	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Man	0.886	0.855	0.715	0.598	3.030***	2.989***	2.891*	3.388***	0.975	1.641	0.819	0.578	1.467*	1.508	1.924	1.428
Age																
18 - 29	3.940	3.211**	0.430	6.947**	3.396***	3.956***	1.750	3.136*	4.017***	3.839*	2.286	3.220*	2.191**	2.593*	0.423	2.489*
30 - 40	5.326***	5.979***	2.652	12,004***	2.230***	2.929*	1.359	2.271	6.526***	19.719**	2.865	4.290*	2.643***	2.362*	7.433***	2.555*
41 - 50	1,764*	1.146	1.288	8.366**	1.998**	3.179*	1.245	2.236	2.041*	1.643	1.826	2.170	1.508	1.545	1.703	1.830
51 - 60	1.000***	1.000***	1.000	1.000**	1.000***	1.000*	1.000	1.000	1.000***	1.000*	1.000	1.000	1.000***	1.000*	1.000*	1.000
Education																
No higher education	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Higher educated	1.714**	1.076	1.367	1.181	1.732***	1.670*	0.916	1.618	1.060	0.744	0.555	1.355	1.480*	1.359	1.334	1.233
Household incomes	3												-			
Below 20 000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
20 000 - 59 999	1.088	1.824	7E+07	0.760	0.741	0.890	4E+08	0.507	1.480	2.261	2.728	1.133	0.961	1.377	0.074	0.626
60 000 - 99 999	0.799	2.034	3E+08	0.320	0.819	1.035	8E+08	0.398	2.188	5.797*	5.444	1.712	1.108	1.377	0.093	1.012
More than 99 999	0.100	1.818	3E+08	0.451	1.029	1.011	1E+09	1.080	3.173*	3.302	7.632	4E+08	1.003	1.184	0.060	1.251
Willingness to prior	itise e-se	ervices														
Disagree	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Agree	1.931***	1.674	8.353	2.151	2.548***	3.496*	1.593	3.100*	4.269***	3.758**	5.023**	4.664**	1.837**	2.538*	0.764	2.512
Nagelkerke R2	0.186	0.164	0.187	0.209	0.188	0.185	0.153	0.226	0.187	0.208	0.203	0.216	0.093	0.092	0.200	0.121

Statistical significance level: \*p≤0.05, \*\*p≤0.01, \*\*\*p≤0.001.

#### Implications:

The study results clearly indicate that the e-service use has still statistically differentiated user profiles, particularly if considered in spatial setting. The regional approach selected for research design provided significant results in terms of socio-economic variables. There are number of recommendations both for policy making and academic research. First, the information society policy should still give focus on providing egalitarian possibilities for all socio-economic groups to make benefit of new emerging e-services. This diminishes some of the economic gains of efficiency obtainable trough service digitalization. In the case of private service use the regional differences are smaller and more customer segment focused: people tend to use those services that they experience the most benefit from.

For the future research there are several interesting and important research questions identifiable. For example, the applying of new regional classifications and particularly GIS data in the analysis of e-service use provides an interesting platform for studies till years to come. Additionally, comprehensive international comparisons are still very few in terms of regional impacts of eservice use. These include both producer and end-user analyses. Second, the impacts of digitalization in the work efficiency still need addressing. Practically all surveyed respondents who are employed in management positions experienced intra- and Internet services as fundamental tools for their work. Digitalization has been considered as one of the major game changers in working life since the emergence of the Internet since the mid-1990s. There is still room for considering the new work arrangements and adoption as the share of mobile workers has not increases significantly since the 2000 till today. Third, a critical evaluation of the e-service provision networks is essential. The current condition in which a limited number of global service providers such as Facebook, Google and Microsoft obtain the responsibility for collecting both personal data as well as company data through their cloud services requires more attention. These are practical issues of intellectual property rights agreements and the role of company responsibilities exceeding private-public categories. For example, some public authorities have started to use these commercial services as support tools in their service provision. The aspect of the boundaries of service provision arrangements and national legislations is an important and significant study field for the coming years in which technologies develop with accelerating phase.

Keywords: E-services, socio-spatial differences, survey, digitalization





Session-16-#321-1(SS3 & SS12)

# Cost aggregation in export logistics chain

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## Abstract

Logistics researchers during decades have discussed in logistics research papers how logistics and transport rates impacts to competition and profitability in export firms. When transporting freight especially through short sea shipping routes, it is obvious that costs are aggregating along logistics phases from the manufacturing unit to customers. This logistics route cover usually land – sea route – land transport stages and also freight handling and intermediate warehousing. These all operations increase cost burden, which should be invoiced from customers.

Purpose of this paper is to highlight more distinct picture of transport chain from the perspective of export industry, which is acting in multimodal maritime environment. World trade is highly dependent on smoothly and efficiently operating logistics. When a manufacturing company in Nordic countries delivers products to European continent, the products must go through Short Sea Shipping (SSS) routes. Nordic ports are operating according to weekly timetable and this makes the accurate deliveries to continent sometimes challenging. De Oliveira (2014) argues that any attempt to improve the integration of a country into the international trading system, should consider the effects of transport cost and its determinants. Every operation phase increases costs depending on the efficiency of this logistics are fundamental dimensions of strategy of export dependent industry (e.g., Pagh and Cooper, 1998).

Research data contains large amount of customer invoices (n=930) from real purchases and deliveries. These invoices contain all necessary costs components of logistics of delivered orders. The paper exposes how exporting and maritime bound logistics is behaving between markets. This study brings in to the logistics discussions much needed micro economic view, which brings accuracy, how export logistics is behaving in practice. The authors present how supply chain from hinterlands to customers develop in one large market. Anderson and van Wincoop (2004) stressed that it is very difficult to perceive and measure the actual costs involved in trade between countries. Transportation through multimodal chain adds both costs and delivery time. Volume of exports from a country to

another country depends on many reasons like the comparative advantage in production (see e.g. Krugman, 2017; Khan and Kalirajan, 2011). Logistics costs are varying continuously over time and also the manufacturing costs and currency exchange values have influence on the export performance. The industry location models (see e.g. Davis and Weinstein 1999; Krugman, 1991) have highlighted that transport costs play important role.

In this paper, 1. we address how value-add process develop during whole freight transport chain, 2. we show how logistics costs aggregate from warehouse to customers using detailed empirical data, 3. we clarify real costs of logistics to main markets, which has rarely been presented (see also Albornoz et al. 2016), 4. The authors will provide the evidence for freight handling and warehousing costs at ports. McCann (1996) addresses that additionally to pure transport costs there are other components in total logistics costs. Engblom et. al (2012) revealed that averagely logistics costs comprise a significant and relevant proportion of business costs, often exceeding 10 per cent of company turnover. Hämäläinen (2011) addressed that in export sector the share of logistics costs from turnover vary a lot between markets and especially between customers, usually even up to 20 % of turnover.

The authors reveal phenomenon of one supplier - multi market - variety in export supply chain. Martincus et al. (2014) stress that a crucial issue is that many of buyer–seller characteristics are likely to be unobserved even with very detailed data. Our empirical detailed data gives an opportunity to make rarely presented contribution to logistics research discussion. The paper shows variation in customer based logistics of export industry.







## **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 16 (Friday)

# Session-16-#301-2(SS8 & SS22)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 13:00~14:30)

## "Open Innovation of Service Sectors"

- Chair: DaeCheol Kim(Hanyang University, Korea)
- Paper 1: "Consumer Acceptance Analysis on Home Energy Management Systems" by Eung-Suk Park, Byung-Yong Hwang, Kyung-Wan Ko & Dae-Cheol, Kim
- Paper 2: "A Case Study on the Improvement of Institution of 'High-risk high-return R&D' in Korea" by **Byung Yong HWANG, Hee Ju Jun & Dae Cheol KIM**
- Paper 3: "The Effects of Hallyu on Tourism in Korea" by Eun-Song Bae, Meehyang Chang, Eun-Song Bae & Daecheol Kim
- Paper 4: "Total Factor Productivity and the Features of Economic Growth: the Case of Lithuania and Latvia" by Irena Danilevičienė & Nataļja Lāce
- Paper 5: "Latvian Industry of Medical Devices: observation of current situation" by Nadezda Semjonova

## Session-16-#303-2(SS7 & SS15)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 13:00~14:30)

## "Management of Innovation and Technology Transfer"

- Chair: Mikus Dubickis(RTU, Latvia)
- Paper 1: "Identification of Innovativeness Level in New Product and Technology Development Projects: Case of Latvia" by Mikus Dubickis & Elina Gaile-Sarkane
- Paper 2: "Internal Evaluation of Intellectual Capital Management at Universities" by Laura Vitola & Jana Erina
- Paper 3: "Employee retention in knowledge intensive companies" by Iveta Ozolina-Ozola & Elina Gaile-Sarkane
- Paper 4: "How does a social open innovation succeed? Learning from Buro Battery, and Grassroots innovation Festival of India" by JinHyo Joseph Yun, Abiodun A.
   Egbetokun, Xiaofei Zhao & ChoongJae Im
- Paper 5: "Dismantling of the Inverted U Curve" by JinHyo Joseph Yun, DongKyu Won, EuiSeob Jeong, KyungBae Park, DooSeok Lee







## **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 16 (Friday)

# Session-16-#309-2(SS6 & SS14)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 309, Time: 13:00~14:30)

## "Technology Commercialization & Management"

- Chair: Eui-Seop Jeong (KISTI, Korea)
- Paper 1: "A new time seires analytic method using Fast-Fourier-Transformation" by Taehoon
   Kwon & Hyang Ho Son
- Paper 2: "Analysis of Technology and Market Gangwon-province base on Korean Patent
   Information" by Hyang-Ho Son, Eui-Seop Jeong, Eui-Soo Kim & Tae-Hoon Kwon
- Paper 3: "Analysis of the Effect of Technology and Market Dynamism on the SME(Small and Medium sized Enterprises) Business Performances by SME Supporting Services" by Hun Park, Jae-Young Yoo, Seong-Hee Moon & Hyuk Hahn
- Paper 4: "Comparative analysis of the Chilean and Latvian contexts for public policy on social innovation" by Nicolás Monge-Iriarte & Karine Oganisjana
- Paper 5: "Is micro finance successful finance source? Evidence from Sri Lanka" by Roshan Lakmal Kularatne Sella Kapu & Natalja Lace

## Session-16-#321-2(SS3 & SS12)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 13:00~14:30)

## "Evoluationary Economics, Economic Geography, Open Innovation and Business Networks"

- Chairs: Tommi A. Inkinen(University of Turku, Finland)
- Paper 1: "E-Capital and Economic Evolution in European Metropolitan Areas" by Juho Kiuru & Tommi Inkinen
- Paper 2: "Developing a classification framework for assessing ports' environmental effectiveness" by Olli-Pekka Brunila, Vappu Kunnaala-Hyrkki & Tommi Inkinen
- Paper 3: "The Role of Entrepreneurial Business Process on Improving Innovation: Based on Early-stage Companies" by Sanghyun Sung, Injun Choi & Junghyun Yoon
- Paper 4: "Impacts of Meta-cognition on Innovative Behaviors: Focused on the Mediating Effects of Entrepreneurship" by **Deasu Kim & Junghyun Yoon**
- Paper 5: "Recommending Suitable Alternative Performers Using process Mining Techniques: Toward smart organizations" by Jooseok Lee, Seunghoon Lee, Jinwoo Kim & Injun Choi

Session-16-#301-2(SS8 & SS22)

# Consumer Acceptance Analysis on Home Energy Management Systems

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## Abstract

The purpose of this paper is to study the consumer acceptance on the HEMS (Home energy management systems) which is the next generation electronic management system that Korean government plans to implement in households. The HEMS is a critical device in maximizing the efficiency of electric energy consumption for each household by using smart grid. Because it can visualize the real time price information on the electricity, households can easily monitor and control the amount of electricity consumption. With this feature, the HEMS can contribute to consumers' total energy savings. This is a major reason why the Korean government implements it nationwide. Since HEMS is a product that has applied new technology that has not yet been directly encountered by consumers, there may be a difference in the level of public perception of HEMS. Therefore, the impact of consumers' awareness of HEMS on their intention to use is important. To do this, the TAM (Technology Acceptance Model) is utilized in this study. Traditional research of TAM is including of awareness of usefulness and ease to use as well as intention to use. In contrast, in this research, an extended TAM with four additional factors such as economic benefit, social contribution, environmental responsibility and innovativeness that may affect the consumer's awareness of usefulness and ease of use is proposed. The survey is conducted with 287 respondents to collect the data. As a result, the proposed model is proven to be suitable in explaining the intention to use with a 70.3% explanation power. It is found that economic benefit (0.231) and innovativeness (0.259) impact on usefulness of HEMS. Moreover, usefulness (0.551) has a bigger effect on intention to use than ease of use (.338) does. Based on this, it is desirable for the





Korean government to pursue a public relations strategy that emphasizes the economic benefits, social contributions, and environmental responsibility that will be gained when introducing HEMS. In the beginning, it can be seen that it is effective to focus on PR for consumers who are inclined to accept innovation. In addition, it is considered that when referring to the usefulness of the HEMS, rather than referring to ease of use, more effective results can be obtained.

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## I. Purpose

A smart grid, also known as smart electrical grid, is an enhancement of the existing power grid and it utilizes the flows of electricity and information to build an advanced self-monitoring and distributed energy transfer network. By utilizing state-of-the-art information technology, the smart grid can supply power more efficiently and it is possible to cope with various events such as failures which occur anywhere in the grid. (Fang et al., 2012). Home Energy Management System (HEMS) utilizes a smart grid to monitor and measure electricity usage in real time. It ultimately contributes to consumer's total energy savings (Niyato et al., 2011). Therefore, the Korean government decided to install HEMS nationwide by establishing a system capable of operating the national intelligent power grid (Kim et al., 2011). Since HEMS is a product that has applied new technology that has not yet been directly encountered by consumers, there may be a difference in the level of public perception of HEMS. Therefore, it is necessary to grasp the acceptance intention of the product that the consumer perceives, but the study analyzing the acceptance intention of the HEMS has not yet proceeded in various ways and it is difficult to establish an effective PR strategy. Based on these problems, this study aims to investigate the factors influencing consumers' acceptance intention of HEMS. Through this study, we try to help the government to figure out the acceptance factors of the consumers and to get the government to effectively implement the successful distribution of HEMS.

## **II. Key Literature Reviews**

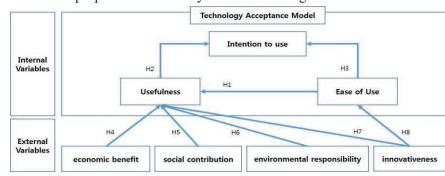
So far, much research has been done to find out what factors influence the acceptance of new products or the direction of new technology development. These studies have been applied to identify the determinants of consumer behavior in social psychology or to evaluate consumers' acceptance of new information and technologies. These research methods include TRA (Theory of Reasoned Action), TPB (Theory of Planned Behavior), and TAM (Technology Acceptance Model). TAM, introduced by Davis (1989), is a model applied to examine consumer acceptance of information technology, and is a model for assessing the effects of perceived utility and ease of use on consumer acceptance intention (Baek, 2009). Therefore, TAM is widely used not only for information technology acceptance but also for empirical studies to grasp consumers' willingness to accept new products.

The extended Technology Acceptance Model (ETAM), which includes external factors influencing the process of accepting information technology, has been proposed by Venkatesh and Davis (2000), and afterwards there have been many studies that specify external factors that may influence the technology acceptance process. Shih (2004) presented an ETAM by including users' search ability that can reflect characteristics of internet as an extended variable. In the study, Shih (2004) found that large-scale

enterprise Internet users showed higher acceptance intention than individual and small-scale Internet users. In addition, Celik and Yilmaz (2011) added external variables such as information quantity, service quality, system quality, reliability, and shopping pleasure to TAM for research on accepting a new technology called Internet shopping. The results show that all external variables used in the ETAM have an influence on the intention to use. Therefore, it can be concluded that the ETAM including such external variables is effective in developing a concrete policy model

Four factors, economic benefits, social contribution, environmental responsibility, and innovativeness, which are external factors used in this study, were used as major factors in measuring consumer acceptance intention in previous studies. In a study that analyzed consumer acceptance intentions based on economic benefits, Mert et al (2008) found that the reduction in electricity bills, an economic benefit gained through products with smart technologies, could be an important motive for using smart electric appliances. In addition, a study by Powers (1992) analyzed the incentive to use electricity to reduce energy usage to consumers. Regarding social contribution, Selman (1996) analyzed that it is effective to change the lifestyle and attitude of individuals through socialization to have a sense of belonging as members of society. Kranz (2011) examined whether it influences consumers' acceptance of eco-friendly information technology. As a result of the analysis, it was found that the intention of adopting eco-friendly information technology changes according to the degree of influence of interest from environmental protection and society. Arkesteijn and Oerlemans (2005) argue that even if people perceive environmental responsibility as important, it has been shown that environmental responsibility does not affect the intention to accept eco-friendly information technology unless people have a specific knowledge of the effects of eco-friendly information technology and climate change. Lewis et al (2003) examined the propensity for innovation acceptance, a variable introduced from the perspective of individual characteristics apart from personal perception and social motivation. In his study, he examined whether the willingness to accept information technology is influenced by the organization and social phenomena to which the individual belongs. As a result, he proved that the organizational and social contexts do not have a major impact, but that the individual 's willingness to accept is influenced by the tendency to accept innovation. In addition, Leung and Wie (1998) demonstrated that the high innovation acceptance propensity of potential consumers positively influenced the acceptance of new technologies.

#### **III.** Methodology



The research model proposed in this study is shown in <Figure 1>.

Figure 1. Proposed Conceptual Model





In this study, the extended TAM is constructed by adding four factors that might affect consumer's intention to use for HEMS.

Hypothesis 1: Ease of use will positively influence usefulness.

Hypothesis 2: Usefulness will positively influence intention to use.

Hypothesis 3: Ease of use will positively influence intention to use.

Hypothesis 4: Economic benefit will positively influence usefulness.

Hypothesis 5: Social contribution will positively influence usefulness.

Hypothesis 6: Environmental responsibility will positively influence usefulness.

Hypothesis 7: Innovativeness will positively influence usefulness.

Hypothesis 8: Innovativeness will positively influence ease of use.

## **IV. Results**

In order to verify the hypothesis of the research model, the path coefficients were obtained and the results as shown in the following table were derived. The results show that external factors such as economic benefits, social contribution, environmental responsibility, and innovativeness tend to have a positive impact on usefulness and that innovativeness has a positive effect on ease of use. In addition, ease of use has a positive effect on usefulness, and both usefulness and ease of use have positive effects on intention to use. In other words, as shown in the table, the p-value for the path for all hypotheses is adopted at a level smaller than 0.01, which shows that there is a positive effect.

Hypothesis	Path Coefficient (Standardized)	<i>t</i> -Value	Supported or not
H1: EU $\rightarrow$ US	0.195	4.354*	Supported
H2: US $\rightarrow$ IU	0.551	10.960*	Supported
H3: EU $\rightarrow$ IU	0.338	6.329*	Supported
H4: EB $\rightarrow$ US	0.231	4.607*	Supported
H5: SC $\rightarrow$ US	0.170	3.001*	Supported
H6: ER $\rightarrow$ US	0.165	3.921*	Supported
H7: IN $\rightarrow$ US	0.259	4.754*	Supported
H8: IN $\rightarrow$ EU	0.697	19.049*	Supported

## **Results of Hypothesis Testing**

*Note*:Bootstrap sample = 5,000. \* All *t*-values are significant at the 0.000 level

The effect of path coefficients on the variables shows that the effect of usefulness on intention to use is greater than the effect of ease of use on intention to use. It can be concluded that the consumer's perceptions of HEMS are more important for the usefulness of the product when comparing the ease of use with the usefulness that affects the intention to use. In addition, the degree of influence on usefulness

is the order of innovativeness (H7; 0.259), economic benefit (H4; 0.231), social contribution (H5; 0.170), environmental responsibility (H6; 0.165).

## V. Research implications and limitation

The purpose of this study is to analyze the HEMS consumer acceptance intention by using extended TAM. This implies that necessary factors for the consumer 's intention to use, which is the subject of HEMS, are demonstrated. All four factors, such as economic benefit, social contribution, environmental responsibility, and innovativeness, tend to affect usefulness and ease of use. Ease of use influenced usefulness and intention to use, and usefulness influenced intention to use. It can be concluded that social motivation, personal motivation, and personal characteristics influence the acceptance of new technology. Based on this, it is desirable for the Korean government to pursue a public relations strategy that emphasizes the economic benefits, social contributions, and environmental responsibility that will be gained when introducing HEMS. In the beginning, it can be seen that it is effective to focus on PR for consumers who are inclined to accept innovation. In addition, it is considered that when referring to the usefulness of the HEMS, rather than referring to ease of use, more effective results can be obtained.

In this study, only the respondents living in the metropolitan area including Seoul are surveyed and the difference is not compared in various regions. Future studies should be conducted to identify differences in acceptance factors by region. Since the function of the actual HEMS increases the power saving effect when a lot of consumers install it in each household in nationwide unit, analysis of nationwide unit will lead to more meaningful implications.

Keywords: Home Energy Management Systems, Smart Grid, TAM, PLS-structural equation modeling





Session-16-#301-2(SS8 & SS22)

# A Case Study on the Improvement of Institution of 'High-risk High-return R&D' in Korea

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## Abstract

## **Purpose/ Research Question**

Despite the increase of government spending on R&D in South Korea, there have been limits in enhancing the impact and commercialization of research outcomes. A new approach to the current mode of R&D is considered to tackle this problem.

Along the process of enforcement, however, programs are partly operated, and managed without distinction compared with existing programs due to institutional constraints. Thus this institution has limitations of its expansion.

The purpose of this study is to examine the actual conditions for adoption, and to further promote early establishment and wide implementation of the new High-risk High-return policy on National R&D, and to identify the ways for improvement.

## **Key Literature Reviews**

This study is not theoretical study with hypothesis testing but survey research with exploratory testing for the policy implication on improvement of High-risk High-return R&D.

In the literature review, national R&D programs National Science & Technology Council (2013-2015) introduced were investigated and then whether High-risk High-return R&D was implemented or not was analyzed. The existing researches on High-risk High-return R&D with internal trend of policy were examined. High-risk High-return R&D of developed countries were also compared.

## Design/ Methodology/ Approach

Field survey was conducted in this study. High-risk High return R&D with a life-cycle perspective of PLAN-DO-SEE was analyzed and the improvement of plan was suggested.

So a survey and unstandardized interviews with key staffs from 12 R&D management agencies were carried out.

One-sample t-test was carried out to prove statistical validity of the measurement result.

## **Finding/ Results**

The results from the analysis of the survey showed that the recognition of usefulness and overall satisfaction on the High-risk High-return R&D was positive.

However, in plan stage of High-risk High-return R&D, there were lack of distinctive factors compared with existing R&D. Although in management stage of High-risk High-return R&D, program public announcement was made separately with existing R&D, without distinction in management-evaluation system compared with existing R&D, there were limitations in challenge and creativity. In case of selection evaluation stage of High-risk High-return R&D, evaluation factors for both challenge and creativity were applied to the same project repeatedly because of confusing concept of High-risk High-return R&D. And there were many organizations implementing interim evaluation and also concentrating on the research outcomes in final evaluation. In the process of evaluation measures of High-risk High-return R&D, if done in honorable failure, the exemption from disadvantages and another opportunity to attempt were given. However, the improvements are needed in rewarding for successful research outcomes and systematically publishing cases of failure.

Additionally in this study, various plans of improvement are suggested. First, in the flexible system operation, subdivision of subordinate concept on High-risk High-return R&D are proposed. Second, in the government ministries' autonomy and accountability, improvement of program evaluation, implementation and management and flexible program management are offered. Third, in the effective incentives, minimization of problem and error through program process by budget enlargement of support, and enhancement of research autonomy and follow-up support reinforcement are recommended.

## **Research Limitations/ Implications**

In this research, there were limits in analyzing the quantitative data collected on the outcomes of the R&D program as there was no standardized categorization of the outcomes. Therefore, the measurement was mainly based on the individual perceptions during the life-cycle process of High-risk High-return R&D. Further research on the comparison of research outcomes between the stages prior to adopting the High-risk High-return R&D, and post the adoption, after 3~5 years of the operation of the program seems meaningful.

There were also some difficulties and limits in measuring the awareness of High-risk High-return R&D of the officers in the related government departments. The comparison between the government and the agencies needs to be conducted through more elaborately structured surveys and data collection methods in the future.

Key Words: National R&D Program, High-risk High-return R&D, Life-cycle Perspective, R&D Performance





Session-16-#301-2(SS8 & SS22)

# The Effect of Hallyu on Tourism in Korea

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## Abstract

The purposes of the study are to estimate inbound tourism demand and to analyze the effect of the Korean Wave and Economic indicators on it. For these purposes, we examined the influence of Korean Wave, GDP, CPI and exchange rate on inbound tourism demand for foreign tourists from the USA, China, Japan and Hong Kong to Korea. In order to measure the Korean wave, the export amount of Hallyu related contents exported to each of the four countries is used. GDP means the GDP of each of the four countries. However, the CPI and the exchange rate are relative to Korea. Penal data on tourism demand, Korean Wave, and Economic indicators from 1997 to 2014 are collected for analysis. Through the various tests for panel analysis model selection, the best fit model proved to be a random effect model. As a result, Korean Wave, GDP, and exchange rate have a statistically significant impact on tourism demand. Therefore, it can be seen that the Korean Wave is one of the important factors for attracting foreign tourists to Korea in four countries. Also, the results show that overseas tourism increases when the economic income of the country is high and the exchange rate is favorable. However, CPI does not appear to have a statistically significant impact on tourists are not overly concerned about the cost of the travel country when planning a trip.

Keywords: Hallyu(Korean Wave), Tourism Demand, Panel Data Analysis.

## 1. Introduction

Korean Wave is a term originally used by Chinese media in 1999. It refers to the phenomenon that young people in China are enthusiastic about Korean popular culture such as Korean dramas and popular songs. It is also defined as the phenomenon that Korean pop culture is spreading overseas or Korean pop culture is gaining popularity in global market (Korea Culture Tourism Research Institute, 2011). Recently, the Korean Wave is led by music such as K-pop, and visual media represented by drama and broadcasting. Due to the influence of the Korean Wave, interest in Korea has increased, and the number of foreigners who have visited Korea has been increasing. The number of foreign tourists visiting Korea has increased nearly fourfold from 3 million in 1998 to 11.8 million in the beginning of the Korean Wave. As of 1998, Asian visitors accounted for 71.3% of the total number of foreign tourists visiting Korea, up from 83.5% Asia, which is the center of the region. The number of Chinese tourists visiting Korea accounted for 43.14% of the total foreign tourists and 51.64% among Asian tourists in 2014 from the share of 4.96% in 1998, the year of liberalization of entry into Korea. China's overseas tourism demand growth rate, which is at the center of the Korean Wave, is growing at an annual average rate of 12.3% thanks to rapid economic growth. Hallyu tourism has contributed greatly to the expansion of the number of Chinese tourists, so systematic research on this issue is very important for the development of tourism demand in the Chinese market which is an infinite potential market. Despite Japan's earthquake that hit Japan in March 2011, 3,289,000 people, or 8.8% more than in 2010, came to Korea (33.6% of total outbound travelers), followed by China with the largest number of tourists (Korea Tourism Organization, 2012). Therefore, the Japanese market for Hallyu tourism is very important for Korea's tourism demand development and improvement direction. In addition, since Hong Kong is a place of East-West meeting leading the Asian tourism, financial and cultural industries with high purchasing income of the people, the success of the Korean Wave in Hong Kong is expected to have a great influence on other Central Asian countries (Kim Sung Sup, 20008). Therefore, systematic research is important. Some studies point out that the trend of increasing number of tourists visiting Korea and the increase of the proportion of Asian tourists are attributed to the Korean Wave (Jung-min, 2012; However, it is hard to find any research that tried to predict tourist demand and forecast tourism income by using quantitative indicators about the fact that Korean Wave is the cause. Therefore, the purpose of this study is to investigate the influence of Korean Wave and macroeconomic indicators on inbound tourism demand for foreign tourists from the USA, China, Japan and Hong Kong to Korea.

## 2. Methodology

## 2.1. Data collection and Operational Definition of Variables

panel data for 18 years from 1997 to 2014. Dependent variable: Inbound Tourism Demand. Explanatory variables: Hallyu(Korean wave), GDP, CPI and currency exchange rates. 4 Variables.



## [Table 1] Operational Definition of Variables

Variables	Unit	Describe Variables	Reference
Inbound Tourism	People	Number of travelers to Korea from USA, China, Japan and Hong Kong by year	Bank of Korea
Hallyu(Korean wave)	US \$	Amount of Hallyu contents exported to USA, China, Japan, Hong Kong (by year)	Korea Creative Content Agency
GDP	US \$	Each country's (USA, China, Japan, Hong Kong) GDP by year	World Bank
Customer Price Index	Num, (2010=100)	Each country's (USA, China, Japan, Hong Kong) relative CPI to Korea (by year)	World Bank
Exchange Rate KRW(\)		Korean Won exchange rates for each country (Average rate by year)	Bank of Korea

## 2.2. Hypothesis

## - Effect of Hallyu(Korean wave) on Tourism Demand

## H1 : Hallyu(Korean Wave) has a positive effect on tourism demand for Korea

## - Effect of Economic indicators on Tourism Demand

GDP refers to the nation's economic levels. Economic growth lead to national income growing and improvement in people's quality of life. In other words, a rise in national income has influence on the number of inbound tourists.

## H2 : GDP has a positive effect on tourism demand for Korea

Cost travel is the main explanatory variable as a determinant of international tourism demand. And the CPI is most widely used proxy variable for cost. The following hypothesis is generated with the assumption that the CPI has an influence on the number of inbound tourists.

H3 : CPI(compared to Korean CPI) has positive effect on tourism demand for Korea.

Exchange rate means the value of one country's currency in relation to another currency. The lower the exchange rate of the country you are traveling to, the less the financial burden of travelers. Thus, the following hypothesis is proposed.

H4 : Exchange Rate(Korean Won Currency) has a positive effect on tourism demand for Korea

## 2.3 Measures

In this study, panel data and STATA 13 program are used to was used for panel data analysis. The mathematical model of the estimates for inbound tourism demand is as follows.

 $Inbound_{it} = \alpha + \beta_1 Hallyu_{it} + \beta_2 GDP_{it} + \beta_3 CPI_{it} + \beta_4 Exchage Rate_{it} + \varepsilon_{it}$ (i = USA, China, Japan and Hong Kong; t=1997, ..., 2014)
[1]

The dependent variable of [1] is the number of tourists visiting Kore from each country *i* of USA, China, Japan, and Hong Kong at time *t*. The explanatory variable,  $Hallyu_{it}$ , means the amount of Korean Wave content exported to the country of *i* at time *t*. In addition,  $GDP_{it}$  is the gross domestic product of *i* at time *t*, and  $CPI_{it}$  is Korea 's CPI relative to *i*' s CPI at time *t*. And *Exchage Rate<sub>it</sub> means the exchange rate of country <i>i* against the Korean won at time *t*.  $\alpha$  is the intercept, which means the individual characteristics of each individual country. And  $\varepsilon_{it}$  means the error term.

#### 3. Results

3.1	Descriptive	Statistics
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Variable	Obs	Mean	Std. Dev.	Min	Max
Inbound	72	1,209,112	1,238,776	96,650	6,126,865
Hallyu	72	4,502,178.36	3.96e+07	1,662,277	174,554,033
GDP	72	6.41e+12	5.59e+12	1.57e+11	1.80e+13
СРІ	72	1.104262	0.1468298	0.9291508	1.5621
FX	72	625.9186	493.9769	114.74	1413.14

## 3.2. Selection of best fit Model

To select the best fit model among Pooled Ordinary Least Square Model(POLS), Fixed Effect Model and Random Effect Model, the F-statistic tests, the Breusch-Pagan LM test, and the Hausman test are performed.

As a result, the best fit model is identified as the random effect model.







Variable	Hypothese	Coef.	Z	P>  z	
Hallyu	H1	0.006693	3.64	0.000***	Adopt
GDP	H2	2.79e-07	14.61	0.000***	Adopt
СРІ	Н3	-613347.8	-1.37	0.172	Reject
FX	H4	1396.011	3.03	0.002***	Adopt

## Hypothesis Test Result

## 4. Conclusion

In this study, the effects of the Korean Wave and Economic indicators on inbound tourism demand or Korea is analyzed. For these, we examined the influence of Korean Wave, GDP, CPI and exchange rate on inbound tourism demand for foreign tourists from the USA, China, Japan and Hong Kong to Korea. Penal data on tourism demand, Korean Wave, and Economic indicators from 1997 to 2014 are collected for analysis. Through the various tests for panel analysis model selection, the best fit model proved to be a random effect model. As a result, Korean Wave, GDP, and exchange rate have a statistically significant impact on tourism demand. Therefore, it can be seen that the Korean Wave is one of the important factors for attracting foreign tourists to Korea in four countries. Also, the results show that overseas tourism increases when the economic income of the country is high and the exchange rate is favorable. However, CPI does not appear to have a statistically significant impact on tourism demand. This indicates that tourists are not overly concerned about the cost of the travel country when planning a trip.

Session-16-#301-2(SS8 & SS22)

# Total Factor Productivity and the Features of Economic Growth: the Case of Lithuania and Latvia

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## Abstract

The increase of competitiveness and productivity is the objective of improvement of every economic system. In this case, the economic development is closely related to the ability to retain competitive, the proper use of the available labour force and capital and to ensure the growth of the gross domestic product (or a company's turnover). Productivity is perceived as the ability to properly use the production factors to create value-added, implement innovations and to maintain the country's competitiveness. In the macroeconomic researches of different scholars (Solow, Saliola, Seker, Kathuria, Puharts etc.) special attention is given to the quantitative measurement of the various factors of development. These researches have shown that one of the more accurate methods of the productivity measurement is a calculation of total factor productivity. In the article, the total factor productivity is calculated by industry both in Lithuania and in Latvia. In this case, the proportion of the gross domestic product growth, which is explained by the labour and capital factors productivity growth, is emphasized. At the end of the article it is concluded, in what industries the growth of labour and capital are important in assessing the growth of the gross domestic product, in what industries are distinguished.

Keywords: economic development, gross domestic product, productivity, total factor productivity.

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Session-16-#301-2(SS8 & SS22)

# Latvian Industry of Medical Devices: observation of current situation

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#### Abstract

Global population ageing and rise in healthcare demands make medical devices industry one of the most promising business worldwide. Medical devices market demonstrated growth even during 2007 - 2009 recession, for example, the average growth over the period 2008 - 2013 comprises 4.2% (Maresova *et al*, 2015). Medical devices field is highly innovative, attributed by sound investment in R&D activities and start-up growth. In China, the medical device industry comprises predominantly of small companies with up to 50 employees. The similar situation is in Europe, where 95% of companies in the medical devices manufacturing field are small and medium enterprises. Medical devices industry does not require much natural resources, therefore it has a potential to booster economicy of small, natural resource poor countries, Latvia being one of them.

From the other hand, medical devises filed is one of the most strictly regulated worldwide (Altenstetter, 2012). Therefore, innovations and creation of new businesses in the field need sound investment of human capital. Any implementation of the state policy to support national business in the field of medical device manufacturing require thorough analysis of available resources and emerging demands.

The aim of the present work is to make a first insight into medical device industry in Latvia to evaluate current situation and mark some future development perspectives. The work is based on the analysis of public available data form the Registry of enterprises of Latvia (Latvian enterprises database, 2017) and Medical Devices Catalogue, sustained by State Agency of Medicines of the Republic of Latvia (State Agency of Medicines, 2017).

There are 779 enterprises in Latvia, registered under the field of Medicine and Pharmacy. The total net turnover of this industry in 2015 comprises 2.2 bil. EUR, with the net profit of 0.97 bil. EUR. The field employs totally 46615 people. Out of this, 142 enterprises are registered in the sub-field of Medical equipment, instruments and devices. In the same year 2015, net turnover of these companies was 243.6 mil. EUR with the net profit 19 mil. EUR. The number of employees in the industry is 1663, that corresponds to the average 12 person per company. This is in correspondence with the world tendency of prevalence of the small and medium enterprises in the field. Most of the 142 companies, operating on the medical device market in Latvia deals with import and distribution of medical equipment / devices from abroad. Following the data of the State Agency of Medicines, only 23 companies are medical devices manufacturers, whose products are registered in the state's Medical Devices Catalogue. In addition, 11 of



these companies – real medical devices manufacturers – appear in the state databases under other fields, such as footwear of clothes manufacturers.

The medical devices industry in Latvia followed world tendency and demonstrated steady growth with a small drop in 2008 due to financial recession (Fig.1a). The profit stays at the level of 2 - 3 milj per year since 2011 (Fig.1b).

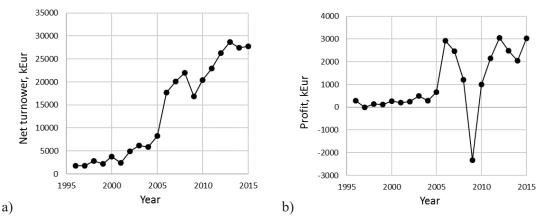


Fig.1 Net turnover (a) and annual profit (b) of the medical device industry in Latvia

From other hand, the number of employees in the field decreased slightly from 577 in 2013 to 561 in 2015.

Performed research demonstrates some successes of the medical devices industry in Latvia. The field recovered well form the 2008 recession and demonstrates steady growth. This may indicate potential for future development.

Keywords: medical devices industry, net turnover, profit

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Session-16-#303-2(SS7 & SS15)

# Identification of Innovativeness Level in New Product and Technology Development Projects: Case of Latvia

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#### Abstract

**Purpose:** Business can function if value is created for the stakeholders. Nowadays the significance of value creation is increasing due to fast technology and competition development. Companies often choose to develop new products, which as a strategy is defined in a fundamental model for diversification, as constructed by Ansoff (1958). Customer behavior, their requirements and values are changing thereby emphasizing the importance of innovation. However, new product development as a growth strategy may provide both advantages and challenges related to the lack of resources and expertise. It may be possible that a new product is launched too early – stakeholders may not be ready to notice the value, and accordingly – the market potential of it. In the past, one of the most outstanding examples of a product potential not being valued was the commercial value of radio (see e.g. Zook and Smith, 2016). Nowadays, for example, the Internet can be considered one of the breakthrough inventions of the last century. At the beginning, society failed to recognize its potential but now it is clear that, individuals, who were able to seize upon the opportunities of the Internet, have created platforms where product value is created by external stakeholders: "Uber, the world's largest taxi company, owns no vehicles. Facebook, the world's most popular media owner, creates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world's largest accommodation provider, owns no real estate." (Goodwin, 2015) Moreover, it is known that new products and inventions with a lower value and impact both exist and are being developed. There is a very popular quote - "Innovate or die" (see e.g. Townsend, 2013), and hence *innovation* is one of the most overused terms today – it is often used in advertisements and other marketing communication unjustifiably.

New product development with a high novelty level is significant for a company's competitiveness; meanwhile the state is interested in promoting business activity – eager for new workplaces, tax income and other benefits. The Latvian science, technology development and innovation framework 2014-2020 suggests that sustainable development of the national economy requires encouragement of the economy's structural change in favor of producing products and services with a higher value added, including development of the role of industry, modernization of manufacturing and services as well as development of export complexity; it could be made possible by increasing the innovation based economy





competitiveness of Latvia (Ministru kabinets, 2013). Smart specialization strategy provides a requirement for further development of both technological and non-technological innovation as well as entrepreneurial ability and creative development in all economic fields and the social sector (Ministru kabinets, 2013). To promote innovation, the Latvian science, technology development and innovation framework 2014-2020 established a goal for the proportion of innovative companies to reach 40% among all other companies by year 2020, which is 10 percentage points more than in 2010 and 2014 (Ministru kabinets, 2013) thus emphasizing topicality of new product development.

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By implementing support programs, a specific impact on economy is expected from new product and technology development projects. However, in such projects and common practice the measurements of innovativeness are not always well defined, thus the purpose of the Paper is to develop a theoretical framework and identify the innovativeness level in new product and development projects in Latvia.

**Key Literature Review**: Although it transpires that almost every change is named an innovation in practice thus devaluating the concept's meaning, various novelty classifications have been developed. A deep analysis of innovation classifications is offered by Garcia & Calantone (2002), Hang, Neo, & Chai (2006) and Coccia (2006). A rather less known and not included in abovementioned articles, but possibly the most extensive analysis on novelty level is done by Altshuller (2007), who analyzed several million patents in many rounds. Altshuller (2007) discovered that among analyzed inventions (from their systemic viewpoint) only a few are substantially new. Meanwhile, Technology Readiness Levels (TRL) are more frequently used for technology analysis. TRL is a type of measurement system used to assess the maturity level of a particular technology (Mai, 2015).

**Research Approach**: The Paper applies Directed Content Analysis (Hsieh and Shannon, 2005) with predefined categories (Ezzy, 2002) as a research method. Categories used for data coding in the research are obtained from literature review thereby testing preexisting theory against empirical data (Mayring, 2000). Considering that the European Union implements support programs for innovation promotion, the authors analyze the following activities implemented in Latvia:

- New product and technology development support for new product and technology introduction in manufacturing (Part I) (LIAA, n.d.a);
- New product and technology development support for new product and technology introduction in manufacturing (Part II) (LIAA, n.d.b);
- New product and technology development (LIAA, n.d.c).

According to the purpose of the research, collected data were coded in several sections – to establish the technology readiness level, the innovativeness level and drivers of innovation. Analysis of the data was done independently by both authors to ensure validity of the findings. The codes assigned were discussed and finally the agreed results were presented.

**Expected results**: Research results show that most of new product and technology development projects analyzed in the Paper do not reach a high novelty or technology readiness level. The results obtained in the Paper are in line with Altshuller's (2007) findings. Based on his approach to novelty level characterization, knowledge from different areas within an industry, other industries or the field of science i.e. technology transfer has to be used in order to achieve a higher level of innovation. Altshuller

(2007) has concluded that people use methods for higher-level problem solving that are relevant only to the lower levels. Therefore, further research is needed to explore how to implement technology transfer for achieving a higher novelty level.

**Research limitations and implications**: The sample used in the Paper represents a small number of new product and technology development projects, thus generalizability of the results is limited. However, the results confirm a previously identified proportion of innovation levels and emphasize a necessity to implement further research on technology transfer. The theoretical framework developed in the Paper can be applied by companies to new product and technology development as well as policy makers to the planning and implementation of support programs and can serve as a basis for further research.

**Keywords**: Innovativeness, Innovation Level, New Product Development, Technology, Effectiveness, Measurement, Content Analysis.

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Session-16-#303-2(SS7 & SS15)

# Internal Evaluation of Intellectual Capital Management at Universities

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#### Abstract

#### Introduction

Nowadays higher education sector have growing role of the knowledge based economy. Higher education sector is playing an increasingly prominent role of intellectual capital and it's development. Universities are the main creators of knowledge and higher education sector has significant role in the intellectual capital creation, development and transfer.

Emphasize the higher education sector role and the need for implementation of the new objectives are set in several policy planning documents. That fact stressing the importance of knowledge and innovation, as well as the need for a competitive economy, including the several reform at the national level.

Universities need for greater exchange of information on intellectual capital for both the public and decision-makers and management process should be more focused on results of intellectual capital components.

Evaluation and analysis of the intellectual capital management at universities are meaningful in order to develop intellectual capital and define priorities and tasks for next planning periods.

Authors would like to emphasize internal evaluation as one of important instruments what gives opportunity to develop and manage intellectual capital at university.

The significance of research is based that intellectual capital evaluation process at universities in Latvia and Baltic States practically not exist. Several components of intellectual capital concept are analysed separately for specific purposes, instead of analysis of intellectual capital and evaluation like unified concept.

Intellectual capital is complex definition what consists from several elements of intellectual capital. For purposes of the evaluation authors started with identifying process of elements of intellectual capital in theoretical basis in publications and find out most common components of concept in scientific literature. For intellectual capital component analysis we use systematic literature review and content analysis for well cited articles about intellectual capital structure.

Authors analysed intellectual capital components at universities and identify most popular components and analyse how often elements are related with strategies at universities. Important is to identify how





the planning documents - strategies meet real intellectual capital management and related processes on a daily basis. For assessment of intellectual capital management process questionnaire now is under development stage. Questionnaires will provide an internal intellectual capital management evaluation at universities.

The principal objective of the research is to identify, systemize main intellectual capital elements at university strategies and internally evaluate its significance at university intellectual capital management process.

Scope of the research is to analyse intellectual capital elements which are linked with three types of capital: human capital, organizational capital and relational capital.

Research object is intellectual capital.

Research subject is evaluation of intellectual capital management.

Research question: Whether there a relation between intellectual capital management and intellectual capital elements of strategies at the universities?

#### Methods and research design

For formation of scientific background for the research a systematic literature analysis and content analyses methods was used to describe intellectual capital division and main components.

The analysed scientific articles are covering a wide range of theoretical base and having a high citation. For analysis article fragments that answers the research question were selected: what elements characterize the intellectual capital concept? Priority was selected articles that created the new theoretical concept of the intellectual capital. Content analysis categories were established for each fragment individually as well as all text fragments together. Each article were selected 20 most commonly used features and as a result the elements sorted by frequency. From the analysis removed elements which include adjectives and verbs that are not directly attributable to the studied object. Not all the leading value applicable to analyse the intellectual capital at universities, but most of the value used as the basis for content analysis.

In order to analyse intellectual capital elements at strategies of universities, also content analysis and comparative data analysis is used. For data processing both – qualitative and quantitative research methods are applied.

Within the research relation of main intellectual capital elements and their interaction with strategies at universities and intellectual capital management are analysed.

For purpose to analyse intellectual capital management the questionnaires will be applied at universities and analysed. Questionnaires ensuring internal evaluation of intellectual capital management process according to intellectual capital elements included at university strategies.

Limitation of research is bound with the availability of information and strategic planning policies at universities. Despite the need to systematically plan and manage intellectual capital, it is still a challenge in several public universities. Summarizing publicly available information from universities, we must conclude that a relatively large part of the universities have no strategies or not published in English. None of the universities of the Baltic States have no intellectual capital strategies, as it is practiced in the leading European universities. Taking into account the limited university's information policy, a large part of the university does not publish complete information, but only very shortened version.

#### Results

Through content analysis and systematic analysis of the literature, authors conclude that there are countless intellectual capital concept definition with a variety of elements, categories, typologies, but most are faced with three main categories of intellectual capital elements of characterization: human capital, structural capital and relational capital.

Result of the analysis, we obtained 50 more often prevailing intellectual capital elements and the frequency of how many times a given element is mentioned in the text fragments and how those factors value under the program NVivo calculations. Uncommon found the concept of frequency of 7 times and more often found element 85 times.

According to the content analysis the most important elements are "knowledge", "relational", "structural", "employees", "organization", "process", "human" and other elements. Frequently those concepts clearly characterizes the 3 most common categories - human, structural and relational capital. Other elements are sorted under these categories that fall into these main categories.

Mentioned basic categories of intellectual capital is also in line with the most widespread opinion in the scientific literature. Other frequently mentioned categories, often characterized by the elements and processes (eg, knowledge, personnel, organization, process, customers, information, innovation, etc.) in relation to the concept of intellectual capital. Also, each individually analysed fragment content analysis carried out within the framework dominated by the same elements, which is also often referred to common article fragment analysis.

Element analysis of intellectual capital concept of the university strategies and relation of internal evaluation of management according to intellectual capital are currently in the research process stage.

#### **Conclusion / Discussion (expected results)**

According to the research undertaken expected conclusion that exist medium strong correlation between intellectual capital elements in strategies and intellectual capital management process at universities.

From the results we can conclude that large part of the strategies already includes intellectual capital concept key components. Therefore, necessity for separate intellectual capital strategies are under discussion. Author's recommends develop intellectual capital chapters to the universities strategies.

For possible further research authors will analyse the strategies from top universities in Europe and also intellectual capital strategies. Similarly, the authors conclude that a useful research would be analysis of the national policy planning documents on the context of intellectual capital components and relation with strategies of the universities.

The research results give conclusion whether universities (in specific region) need separate intellectual capital strategies and or intellectual capital management conform to the strategies at universities. **Keywords:** intellectual capital, strategies, universities, intellectual capital management.





Session-16-#303-2(SS7 & SS15)

# Employee retention in knowledge intensive companies

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# Abstract

# Purpose/ Research Question:

There are many empirical studies that have confirmed the negative effect of the high rate of voluntary employee turnover on organization's productivity and profitability (Brown et al., 2009; McElroy et al., 2001), workforce performance (Shaw, Gupta, Delery, 2005), instrumental communication and behavioral commitment (Mueller, Price, 1989), social capital (Shaw et al., 2005) and organizational capital (Eckardt, Skaggs, Youndt, 2014). It is notable that voluntary employee turnover's negative impact on organization's performance figures results highly from turnover of employees which have achieved high level job performance (Jackofsky, 1984; Dess, Shaw, 2001; Shaw, Gupta, Delery, 2005) or have been employed at workplaces where high job involvement and confidence are significant (Siebert, Zubanov, 2009). High rate of voluntary employee turnover has negative impact on organization's management by using instruments of human resource management.

In the contemporary scientific studies, the effect of human resource management on employee turnover is investigated by various ways:

- by measuring the correlations between organizational performance, including the variables characterized the employee turnover, and human resource management effectiveness or human resource management systems expressed as a set of specific practices or techniques (e.g. Arthur, 1994; Huselid, 1995; Richard, Johnson, 2001);
- similarly to previously mentioned but by focusing directly to the connections of employee turnover with human resource management systems (e.g. Gardner et al., 2011);
- by measuring the employee turnover correlations with the specific human resource management practice (e.g. Barrick, Zimmerman, 2009) or with the specific technique of some practice (e.g. Williams, 2000);
- by presenting the results of review or meta-analysis of studies on employee turnover (e.g. Holtom et al., 2008);
- by developing the employee turnover models (e.g. Steers, Mowday, 1981);
- by discovering the non-managerial causes of employee turnover that can be avoided with human re-

source management measures (e.g. Zimmerman, 2008).

While there is a large amount of studies on employee turnover, there is a lack of theory based and practically available guideline for knowledge of employee retention. To understand how to promote retention of knowledge employees, the main research question is: which human resource management practices and in what way they affect turnover level of knowledge employees.

#### Key Literature Reviews:

Results of employee turnover models content-analysis (Ozolina-Ozola, 2016a) show that job and organizational factors are the most stated in the model descriptions, that is, factors which form employee's work environment either directly or indirectly. The different factors are listed in employee turnover models which directly specify on job and organizational factors. Mostly, job and organizational factors' group indicates parameters relevant to work content (autonomy and accountability, work repetitiveness, job complexity etc.), wage rate and congruence between job role and other employee's roles in life.

According to the author's systematic review results (Ozolina-Ozola, 2016b) information about the employee turnover correlation with specific job and organizational factors is not unambiguous. There are studies which state specific factors being present in lower employee turnover level while other studies state the exact factors being present in higher employee turnover level or there is no confirmation of any statistically significant relation. Other studies of employee turnover in relation with complex human resource management practices present similar results. For example, there is more evidence that employee retention is promoted by high-involvement work practices (Batt, 2002; Batt, Colvin, 2011; Cottini, Kato, Westergaard-Nielsen, 2011; Doellgast, 2008; Guthrie, 2001) than it having a neutral effect (Wood, de Menezes, 2008). It is observed that lower employee turnover level is in organizations which have strategic human resource management (Richard, Johnson, 2001); practices of 'investments and inducements' (Batt, Colvin, 2011); skill-enhancing, motivation-enhancing or empowerment-enhancing human resource practices (Gardner, Wright, Moynihan, 2011); commitment human resource system (Arthur, 1994) or gender-focused policies and practices (Ali, Metz, Kulik, 2015). Human resource management practices which are accustomed to family needs (flexible schedule, sick and maternity/paternity leave) reduce turnover among employed women but do not affect turnover among men (Yanadori, Kato, 2009). Organizations which are oriented towards control human resource system (Arthur, 1994) or 'performance-enhancing practices' - both frequent control and commission (Batt, Colvin, 2011) have higher employee turnover level. Broader "high-performance work practices" counter to the latter are relevant to lower employee turnover level (Guthrie et al., 2009; Huselid, 1995; Wu et al., 2015). According to scientific research findings on correlations between employee turnover and complex human resource management practices, it can be concluded that effective employee turnover management require not separate instruments but an integrated set of instruments.

#### Design/ Methodology/ Approach:

For evaluation of human resource management impact on knowledge employee turnover level, the author used *CRANET* (The Cranfield Network on International Human Resource Management) research data base.

Respondents were selected by using Lursoft's list of large organizations' contact addresses. According to





the addresses, the selected organizations' representatives or employees responsible for personnel issues were contacted either in presence, via telephone or electronically and asked to participate in *CRANET* research and to find time for completing a survey. There were 67 completed and valid survey forms or approximately 21.61% organizations from the population. It meets average response level which has been observed in *CRANET* researches (Cranet, 2009).

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46 organizations have revealed employee turnover level. The sample is little, hence the empirical data was examined for having extreme values. Eight cases or organizations which revealed significantly high employee turnover level were identified by using boxplot diagram. These extreme cases were withdrawn from the research list and analyzed separately. Therefore, the main research list is 38 organizations or approximately 12.26% from the population.

Survey forms have 58 principal questions in 7 parts: Personnel management organization (11 ques.); Human resource administration (6 ques.); Personnel development (8 ques.); Wage and benefits (3 ques.); Labor relationships and communication (7 ques.); Organization's information (17 ques.) and Respondent's information (6 ques.).

*IBM*© *SPSS*© *Statistics Version 23* software was used for processing the retrieved data. Organization's employee turnover level data have been verified by statistically significant differences and correlations with every variable. Altogether, there are 484, including 118 author's added, variables which characterize the organization, its employees, human resource management practice and the respondent itself.

Chi-Quadrat-Test, Mann-Whitney test, Jonckheere-Terpstra test, Kruskal-Wallis test and median test were used to determine statistically significant differences. Spearman's rank correlation coefficient and Kendall rank correlation coefficient were used to identify statistically significant correlations.

# (Expected) Findings/Results:

Results of empirical research show that employee turnover level is higher in organizations:

- which have evaluated their innovation level lower than the average in the field;
- which have not drawn up human resource management strategies in written;
- which do not have computerized human resource management system that can be used by both managers and employees for solving both business and everyday issues;
- which search for new managers and specialists by the received applications and which use employment agencies to find specialists not managers;
- which use numerical test for managers selection or do not have individual interviews or job performance monitoring for specialists selection;
- where managers are not evaluated by subordinates or colleagues or do not require self-estimation, moreover higher employee turnover level is present when specialists are not evaluated by colleagues;
- which often have individual project work or almost never have work in project groups;
- where specialists do not have bonuses according to the unit's performance results;
- which do not offer individual healthcare improvement plans for employees, for example, health insurance or other flexible benefits;
- which do not address the main issues at regular employee meetings, either through trade union or together with the senior management;
- which do not inform specialists about organization's business strategy or work organization.

By comparing systematic review results (Ozolina-Ozola, 2016) with empirical research results, several

human resource management practices' relation with employee turnover level have been both confirmed and negated. Both systematic review and large organizations research results conform to lower employee turnover level in organizations which have group projects that not only help to complete a specific job or solve job related issues but also serve as development for employees. Both research results are similar with employee involvement in decision making: use of various vertical and horizontal communication methods are related to lower employee turnover level. Both researches show a weak correlation between employee turnover level and exploitation of performance appraisal results for employee career change and employee surveys as type of feedback.

Empirical research results indicate that large organizations' untypical employment forms prevalence, personnel staffing from internal human resources, personnel recruitment following current employee recommendations, personnel training, development opportunities, performance appraisal system and employee financial participation are most likely not related with employee turnover level. Rather, there is a relation with personnel selection methods which help to evaluate the applicant's suitability more throughout, use of various material benefits, variable wage tied to individual or unit work results. It does not contradict systematic review results which show ambiguous evidence about correlation between these human resource management practices and employee turnover.

In comparison with systematic review results, the existing research shows opposite results in connection with employee turnover relation with human resource managers participating in the strategic level of organization's management, managers and new employee training, pension funds, trade union member count among employees and information about organization's plans. In all mentioned factors, except the latter, Latvia's largest organizations do not have significant relation with employee turnover level. Counter to systematic review results, employees being informed about organization's plans is significant in Latvia's largest organizations - use of the practice is related to lower employee turnover level.

## **Research limitations/ Implications:**

The research does not include non-market sector organizations, that is, legal entities whose services are free of charge or charge is economically insignificant (central and local government institutions, funds, foundations and associations, include commercial companies controlled by general government) (CSP, 2014). Personnel management in these organizations is mainly determined by institutional factors.

Research includes large organizations in private and public sector. Exactly the large organizations, that is, with 250 and more employees, have an objective necessity for human resource management process arrangement.

The term "human resource management practices" is understood by the author as the activities of the organization's managerial staff, structural units or persons responsible for human resource management in work or labor relationship field. Human resource management practices are measured in dichotomous scale, that is, 'is' or 'is not' at an organization.

The author's revealed employee turnover management solutions may be used by executives or personnel management specialists in Latvia's largest organizations for evaluation, planning or coordination of human resource management practices to achieve preferable employee turnover level.

Keywords: employee retention; employee turnover; human resource management; knowledge employee.





Session-16-#303-2(SS7 & SS15)

# How does a social open innovation succeed? Learning from Burro Battery, and Grassroots innovation Festival of India

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## Abstracts

As people pay attentions to social innovation as the source of innovative ideas and the repository of new business models, this study poses the following research questions:

How does a social open innovation succeed?

What is the success factor of social open innovation?

What is the successful dynamics of social open innovation?

This study selected 2 case study; one is the Burro Battery Company in Ghana, and the other is Grassroots Innovation festival of India. The forth is the Social open innovation firm case. But the latter is the Social open innovation policy case. Through deep case study, we found out the ways of success of social open innovation strategy, and social open innovation policy.

**Keywords**; Burro Battery, Grassroots innovation festival of India, social open innovation, social open innovation strategy, social open innovation policy

Session-16-#303-2(SS7 & SS15)

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# **Dismantling of the inverted U curve**

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# Abstract

The purpose of this study is to address the two following issues.

What are the causes of differences of open innovation effects?

What are the differences of open innovation effects according to the surrounding situations of firms? Depending on the specific strategy of the firm, the industry where the firm belongs to (i.e., knowledge characteristics of the corresponding industry), and on the time dimension where the corresponding open innovation is in progress, open innovation creates various levels of performance.

**Keywords:** aircraft industry, open innovation, simulation, game of life, inverted U curve, mathematical modeling





Session-16-#309-2(SS6 & SS14)

# A new time series analytic method using fast-fouriertransformation

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## Abstract

A time series is defined as a series of data points indexed in time order. In the most cases, a time series is expressed as discrete time data which is a sequence sampled at equally spaced time. For examples, stock information, precipitation information, heights of ocean tides, counts of sunspots, etc.

The main purpose of time series analysis is to extract the meaningful and statistical information. Generally, time series is used to predict the future trends based on the previous estimated values. It is called as "time series forecasting". While regression analysis is often employed in such a way as to test theories that the current values of one or more independent time series affect the current value of another time series, this type of analysis of time series is not called "time series analysis", which focuses on comparing values of a single time series or multiple dependent time series at different points in time.

In this paper, in time series analysis, the new time series analytic method is proposed to answer the following question.

- 1) In correlated time-varying data, although there are some missing data, how can we reconstruct the missing data?
- 2) In correlated time-varying data, although there are some errored data, how can we reconstruct the errored data?
- 3) In correlated time-varying data, how can we expect the future data trend based on the previous data?

The proposed algorithm is as follows:

- 1) By applying FFT (Fast Fourier Transformation) to the correlated time-varying data, we can change the time domain to the frequency domain.
- 2) In frequency domain, the uncorrelated parts have the high frequency values.
- 3) If we cut high frequency values above the certain threshold and use zero-padding, we can erase the uncorrelated parts.
- 4) By applying IFFT (Inverse Fast Fourier Transformation), we can reconstruct the missing or errored data or expect the future data trend.
- 5)

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As a result, we expect the following results:

- 1) In correlated time-varying data, although there are some missing data, we can reconstruct the missing data.
- 2) In correlated time-varying data, although there are some errored data, we can reconstruct the errored data.
- 3) In correlated time-varying data, we can expect the future data trend based on the previous data.

## Purpose/ Research Question:

- 1. In correlated time-varying data, although there are some missing data, how can we reconstruct the missing data?
- 2. In correlated time-varying data, although there are some errored data, how can we reconstruct the errored data?
- 3. In correlated time-varying data, how can we expect the future data trend based on the previous data?

# Key Literature Reviews (About 3~5 papers):

- T. Kwon, H. Song and D. Hong, "Robust Channel Estimation in Multicell OFDM(A) Downlink Systems With Propagation Delay," 2007 IEEE 65th Vehicular Technology Conference - VTC2007-Spring, Dublin, 2007, pp. 1450-1454.
- 2. J. L. Melsa and D.L. Cohn, "Decision and Estimation Theory", McGraw-Hill Book Company, 1978.
- 3. A. Papoulis and S. U. Pillai, "Probability, Random Variables and Stochastic Processes", McGraw-Hill Book Company, 2002.

#### Design/ Methodology/ Approach:

- 1) By applying FFT (Fast Fourier Transformation) to the correlated time-varying data, we can change the time domain to the frequency domain.
- 2) In frequency domain, the uncorrelated parts have the high frequency values.
- 3) If we cut high frequency values above the certain threshold and use zero-padding, we can erase the uncorrelated parts.
- 4) By applying IFFT (Inverse Fast Fourier Transformation), we can reconstruct the missing or errored data or expect the future data trend.
- 5) In this process, the proper threshold and points of FFT and IFFT should be decided.

## (Expected) Findings/Results:

- 1. In correlated time-varying data, although there are some missing data, we can reconstruct the missing data.
- 2. In correlated time-varying data, although there are some errored data, we can reconstruct the errored data.

3. In correlated time-varying data, we can expect the future data trend based on the previous data.

## **Research limitations/ Implications**:

- Depending on the number of correct data and the correlation of data, the correctness of the proposed algorithm should be changed.

Keywords: FFT, Time series analysis, Estimation





Session-16-#309-2(SS6 & SS14)

# Analysis of Technology and Market Gangwon-province base on Korean Patent Information

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## Abstract

**Purpose/ Research Question**: The purpose of this study is to analyze the industrial characteristics of Gangwon-province by analyzing the technology activity based on the patent analysis of Gangwon-province upbringing industry using the industry - patent linkage table.

## Key Literature Reviews (About 3~5 papers):

1. JinHyo Joseph Yun, EuiSeob Jeong and JeongHo Yang, "Open innovation of knowledge cities", Journal of Open Innovation: Technology, Market, and Complexity 2015 1:16 Published on: 4 November 2015.

2. Hojin Lee, Sangyoon Cha and Heejun Park, "The effect of technology-exploration on product innovation: an analysis based on Korean manufacturing SMEs", International Journal of Quality Innovation 2016 2:1, Published on: 4 July 2016.

3. In-Sik Yun · Seok-Jin Kim · Eui-Seob Jeong, "Evaluation of Technology Activity, Innovation and Productivity using Korean Patent Information", Journal of information management v.42 no.2 ,pp. 151 - 165 , 2011.

**Design/ Methodology/ Approach**: Patent information is an innovation index of industry and science and technology activities and can be utilized as a tool to reflect the achievement of invention such as country, region, technology, company, and to measure the spread of technology and R&D performance. In the

past, patent statistics related to technology used IPC (International Patent Classification) were used and various industrial and economic statistics were difficult to analyze by using KSIC (Korean standard industrial classification) It is possible to analyze in depth and effective patent information and industry related information by using the linkage table.

(Expected) Findings/Results: The core strategic industries of Gangwon Province are food manufacturing, medical materials and pharmaceuticals manufacturing, and medical equipment manufacturing. As of 2014, the index of technological activity of the food manufacturing industry is 4.70, that of medical materials and pharmaceuticals is 2.15, and that of medical devices is 3.44. Strategic industry in Gangwon province shows high degree of patent concentration.

**Research limitations**/ **Implications**: The KSIC code has a linkage with the patent in the major category and the middle class, and there is a limit to the patent analysis of the subdivision industry.

Keywords: analysis patent, industry - patent linkage, technology activity





Session-16-#309-2(SS6 & SS14)

# Analysis of the Effect of Technology and Market Dynamism on the SME(Small and Medium sized Enterprises) Business Performances by SME Supporting Services

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# **Expanded Abstract**

## **Research Objectives and Questions**

Research objective of our study is to find the effect of environmental dynamism on the business performances by SME supporting services. Environmental dynamism has been introduced as a moderating variable, utilization degree of SME supporting services was selected as an independent variable and SME business performances such as revenue increase, cost reduction, export increase, employment growth, etc. were selected as dependent variables. Environmental dynamism describes the rate and instability of changes in a company's external environment. To analyze the effect of environmental dynamism on SME supporting services and business performances will be a meaningful study.

Our research questions are as follows.

- Q1. Is there a statistically significant correlation between SME supporting services and business performances?
- Q2. Does the environmental dynamism have a positively or negatively moderating effect on the business performances by SME supporting services?

#### **Key Literature Reviews**

H. Jiao et al. conducted an empirical verification of the relationship between innovation strategy and dynamic capabilities, and also analyzed the effect of environmental dynamism on innovation strategy and dynamic capabilities. They postulated that innovation strategy will have a positive relationship with dynamic capabilities and the interaction between innovation strategy and environmental dynamism is positively related to dynamic capabilities. From the statistical analysis, they concluded that innovation strategy has a positive effect on dynamic capabilities, however, the interaction between innovation strategy and environmental dynamism is not significant in predicting dynamic capabilities.

#### Methodology

11 KISTI SME supporting services were selected to investigate the effects of SME supporting services on SME business performances. Investigation into business performances from SME supporting services was conducted by a survey method. Questionnaires for each SME supporting service were prepared and the survey had been conducted for two months. Moderating effects of environmental dynamism on business performances and SME supporting services was statistically analyzed by using SPSS program.

#### **Expected Results**

Correlation and regression results between utilization degree of SME supporting services and SME business performances will be shown. And the moderating effects of environmental dynamism on utilization degree of SME supporting services and SME business performances will be elucidated. The core insights into the role of environmental dynamism in the route from SME supporting services to business performances will be described on our final report.

#### **Research limitations and Implications**

The method to measure utilization degree of SME supporting services needs to be more defined. And in our study only financial SME performances were considered. However, the relationship between SME supporting services and non-financial performances should be also elucidated in the future work.

Keywords: SME supporting service, SME performance, environmental dynamism, moderating effect

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Session-16-#309-2(SS6 & SS14)

# Comparative analysis of the Chilean and Latvian contexts for public policy on social innovation

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#### Abstract

The purpose of the research is to compare the Chilean and Latvian social innovation contexts, focusing on the public policies which both countries are implementing. The aim is to analyze the current situation and to determinate what they can learn from each other. Actions and procedures will be suggested as a result of this process.

## Key Literature Reviews:

As a new topic, there are different definitions and interpretations of the social innovation concept. For the effects of this paper, we will understand social innovation as initiatives co-created and/or co-implemented by the community and the stakeholders (not imposed from outside) that aim to overcome one or more social problems generating a solution where there was none before or proposing a more efficient and fair one than the one that already exists (Monge, 2012). Social innovation is a process and the result is a new social practice (Howaldt & Schwarz, 2010).

Considering the socioeconomic literature about Chile and Latvia, it was concluded that both countries have a similar GDP per capita \$US13.383,9 for Chile and \$US13.663,9 for Latvia (World Bank, 2016). Besides, the poverty headcount ratio at US\$1.90 a day (purchase power parity), shows a low rate for both countries. In Chile the 0.92% of population earn US\$1.90 or less, and in Latvia - 1.38%.

Nevertheless, considering the GINI index for income inequality (0=complete equality; 1=complete inequality) both show a high inequality rate. According to OECD (2016) Chile is the most unequal country (0.456) of this group of nations, but Latvia is in the eighth place (0.352). This information is relevant for considering that the evidence probes that economic growth is not correlated with the index of social problems, but inequality (Wilkinson & Picket, 2009), so countries with a high inequality rate as Chile and Latvia, would present a significant rate of social problems.

The literature indicates that social innovation in Chile is becoming more visible despite the fact that the national innovation system and the innovation policy is technology oriented (Domanski et al., 2015). Further, an increasing number of public and private organizations are adopting and fostering the concept





of social innovation in order to enhance their social impacts. However, there is not a unified public policy and each organization has its own interpretation and strategy (Escuela de administración PUC, 2012). Also, the empirical knowledge on social innovation is rather incipient (Domanski et al., 2015). In the case of Latvia, the concept is getting attention and some studies have come to light (Dobele, 2015; Grinberga-Zalite et al, 2015; Oganisjana & Surikova, 2015) including the project "Involvement of the Society in Social Innovation for Providing Sustainable Development of Latvia" as part of the National Research Program 5.2. "Economic Transformation, Smart Growth, Governance and Legal Framework for the State and Society for Sustainable Development – a New Approach to the Creation of a Sustainable Learning Community (EKOSOC-LV)". Besides, the government is working in a new policy but focused on social entrepreneurship, a related concept to social innovation.

## Design/ Methodology/ Approach:

The research is a comparative analysis of the Chilean and Latvian social innovation ecosystems, specially focused on public policy. The methodology is based on a review of different sources in order to: 1) discuss about the concept of social innovation and its implications; 2) describe and compare the socioeconomic contexts in Chile and Latvia; 3) describe and compare the social innovation ecosystems in Chile and Latvia; 4) describe and compare the social innovation policies in both countries; 5) offer a social innovation policy for each country; 6) suggest actions and procedures to initiate a collaborative process between Chile and Latvia.

## (Expected) Findings/Results:

At this moment the research team is reviewing different sources, including books, papers, journals and policy documentation. The next step is to analyze and compare all the information in order to extract the best practices of each country.

Nevertheless, preliminary it can be said that both countries present a similar socioeconomic situation, low poverty rate but high income inequality which is associated with a significant amount of social problems. Further, both countries have a top down approach to face social problems instead of a bottom up (inclusive) vision (Monge, 2012; Oganisjana, et al., 2016). In this context, social innovation as a new paradigm seems to be an important way to enhance the development of the Chilean and Latvian societies. In fact, both countries have recently been discussing about the concept of social innovation and the issues on how to materialize it in the base of one or more public policies, but it seems that the whole spectrum of social innovation is still remaining away from the debate. That is so because the policy discussion is focused on social entrepreneurship, a related concept, instead of social innovation itself.

However, Chile has some governmental initiatives which consider some elements of social innovation as a wide concept, but there is a lack of coordination between public institutions. Latvia, instead, has a central coordination for its policy but it is strongly focused on social enterprises.

On the other hand, in Chile there is a boom of private and civic society which are adopting social innovation as a way to generate social change. Latvia goes in the right direction as well, but the discussion in the society is still poor but necessarily it is to be aware of the social innovation benefits.

#### **Research limitations/ Implications:**

Considering that this is a comparative analysis based on the review of different existing sources, there is a limitation referred to the lack of research in social innovation in both countries. That is why different secondary sources will be used in order to reach reliable results.

Implications of the research include, first of all, the presentation of the policy proposal to policymakers and public authorities of each country in order to be discussed and, ideally, implemented. Secondly, the establishment of a collaboration process between researchers, practitioners and policymakers from Chile and Latvia, can be considered.

In any case, the contents of this document will be useful to support the promotion and practice of social innovation.

Keywords: Social innovation, social entrepreneurship, inequality, public policy, sustainable development

#### Acknowledgement

The research is conducted within the project 5.2.7. "Involvement of the society in social innovation for providing sustainable development of Latvia" as part of the National Research Program 5.2. "Economic Transformation, Smart Growth, Governance and Legal Framework for the State and Society for Sustainable Development – a New Approach to the Creation of a Sustainable Learning Community (EKOSOC-LV)".

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Session-16-#309-2(SS6 & SS14)

# Is micro finance successful finance source? Evidence from Sri Lanka

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#### Abstract

Economic development and the social development are the main expectations of each and every government. Countries have categorized as less developed, developing, and developed according to economic and social development indicators. These less developed and developing countries are struggling to find financing sources. Poverty is the main barrier for the development of less developed countries and developing countries. Therefore, governments are trying to increase the involvement of poor people towards economic development of the country. Microfinance concept is more popular in the world as effective poverty alleviation tool. To become a successful finance soured, microfinance projects should have positive outcome from their operations. Sri Lankan government started a microfinance project named "Janasaviya" over decades ago and now it is modified as "Samurdi". Further, there are numerous microfinance projects conducting by local and foreign organizations. Microfinance allows increasing the household income, savings, and women empowerment which is most important nowadays. The study was done based on Matale Regional Economic Advancement Project. Descriptive statistics, Ordinary Least Square (OLS) estimation, Difference in Difference (DID) method, correlation analysis and regression analysis were carried out in relation to the objectives of the study. Findings from descriptive statistics indicated that majority loans were granted during the first 3 years of the project among people more than 51 years of age within the higher margin of Rs. 100,000 (approx. USD 850). DID method indicate the net impact of microfinance project on treatment group. Correlation analysis and the OLS estimation indicated the factors that have influenced on income of the households. Analysis found that post microfinance project performances of households were better than the pre project and there was a decrease in real income due to unhealthy economic conditions of the country.

This paper aims to examine the successfulness and the long term sustainability of a microfinance project based on evaluating before and after performance of the particular microfinance project in Sri Lanka.

The research aims to investigate and address the **research question** "How does microfinance really help to reduce the poverty in long run?"





Key words: microfinance, financial sources, poverty, long term sustainability

## Acknowledgement

The research is conducted within the project 5.2.7. "Involvement of the society in social innovation for providing sustainable development of Latvia" as part of the National Research Program 5.2. "Economic Transformation, Smart Growth, Governance and Legal Framework for the State and Society for Sustainable Development – a New Approach to the Creation of a Sustainable Learning Community (EKOSOC-LV)".

Session-16-#321-2(SS3 & SS12)

# E-Capital and Economic Evolution in European Metropolitan Areas

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#### Abstract

#### Purpose

E-capital, like other forms of capital, is likely to agglomerate in cities. Therefore, we investigate the level of e-capital in European metropolitan areas. Our interpretation of e-capital relies on the amount of tweets in Twitter. The most likely receiver of the tweet is the one who follow one's tweets, but also everyone interested in hashtags one use, can read the tweets. The most likely followers are users from the same region, but also users from anywhere interested in the same themes. Data mining from Twitter gains us access not only to intra-regional but also inter-regional ties, which Moreno (2013) concluded to be actually more important generating social capital and regional development.

We are interested in particular innovative networks forming social capital. Therefore, we will data mine tweets containing hashtags related to innovativeness. We used keywords from the earlier literature. These are 'innovation', 'startup', 'tech' and 'refugees welcome'. We will consider current topic in social media that is not location bound. For example, Brexit discussion in Twitter seemed to cluster heavily in Britain and Euro 2016 in France and participating countries. Therefore, we used hashtags from other continents that were discussed in Europe. All in all, hashtags that were mined from Twitter were '#innovation', '#startup', '#tech #refugeeswelcome'.

The amount of tweets presenting the level of e-capital of the metropolitan areas was compared to the level of economic development (GDP). The first interpretation discusses with the school of thought that considers the digitalization in the light of inequality and digital divide (e.g. Chen 2013 & 2014). The second step was to answer where the e-capital has clustered in Europe. We were also interested in whether e-capital clusters in the areas that have higher economic development and vice versa, thus inequality approach.

In summary, our research questions are:

- 1) Does region's level of e-capital correlate with regional development?
- 2) Geographies of e-capital and potential growth in Europe.





- a) Where has e-capital clustered in Europe?
- b) Which areas have managed to capitalize their e-capital?
- c) Which metropolitan areas could grow their other forms of capital, i.e. human, social, cultural and further economic capital, by "jumping into" the e-capital conversation process?
- d) Which metropolitan areas could grow their economy even greater if there were more e-capital?

## **Key Literature**

Bourdieu (1986) defined social capital as social relationships that are directly usable in the short or long term. Later social capital has been described as "connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam 2000: 19) and "that enable participants to act more effectively to pursue shared objectives" (Putnam 1995: 664). 'Better-connected' people have informational advantage as they gain timely access to high-quality and fine-grained information faster and earlier than 'less-connected' people (Burt 1992; Podolny 1993). People with more social capital receive more job information via informal social interactions (Granovetter 1973; Son 2013). The information advantage enabled by social capital can translate into higher compensation, faster promotion, and better ideas. Third, the literature on cultural capital shows that diverse network contacts require and facilitate a diverse repertoire of cultural knowledge (DiMaggio 1987; Erickson 1996).

There are several studies that can prove the correlation between social capital and regional development. One line of research has measured innovative networks that produce social capital and thus economic capital. Moreno (2013) investigated the spatial correlation between regional research networks and regional development in Europe. She concluded that collaborations with inventors outside the region, i.e. weak, distant ties are more important for innovation than networks within region (notice the same notion as Granovetter 1973). Moreno's suggested policy implication that interregional collaborations should receive greater attention than intra-regional linkages motivates us to investigate innovation flows in digital space. We believe that both intraregional and inter-regional networks can be found the best in Twitter Social Network Site (SNS).

This leads us to a concept of digital social capital (Mandarano et al. 2010). Furthermore, Merisalo (2016) applies the concept of electronic capital. She redefines Hall's (2000) original definition of ecapital, which related to college graduate workers use of business methods based on computers. Merisalo (2016) sees e-capital as a form of capital, which: "emerges from the possibilities, capabilities and willingness of individuals, organizations, and societies to invest in, utilize and reap benefits from digitalization and thus create added value". Further, all forms of capital are required, but also produced in the process of e-capital. This means that e-capital is likely to emerge in same locations than other forms of capital. On the other hand, regions "can gain access to other forms of capital by investing and utilizing digitalization, simply by jumping into the e-capital conversation process".

#### **Design and approach**

The measures of e-capital we got from SNS Twitter's API. First, we had to create an account to Twitter API. After that, we loaded TwitteR package for R software. Both of them are open source. We used code that brought us list of tweets containing certain hashtag from specific location from the period of last two

weeks. For example, code for innovation tweets from Paris was following: searchTwitter('innovation', n=30000, geocode='48.8566,2.3509,30mi')

Where n=expected amount of tweets from last two weeks. The smaller the number, the faster the software mines the data. Therefore, for smaller metropolises we used n=1000 and if command brought us 1000 tweets, we raised the amount (process is slower the bigger the number). With the largest metropolises, it was necessary to use n=30000. Geocode is latitude and longitude of the location where the tweets are mined from. Coordinates have to be in four-digit form. Coordinates we got one by one from the website 'Find latitude and longitude' (2016). After the coordinates, the radius where the tweets are mined can be defined. Radius must be in miles. We consider that 30 miles' radius would be a grounded estimate size of a European metropolitan area. By changing the parameters to code, we mined the list of tweets city by city and marked the number of tweets into table of metropolitan areas, which had information of GDP per capita, employment rate and population from Eurostat database.

After collecting the amount of tweets in metropolitan areas defined by Eurostat, we calculated the amount of tweets per capita. Population of the metropolitan areas was from Eurostat. Then we made a regression analysis using amounts of tweets as predictors and GDP and employment rate as constant variables. With the coefficients of the analysis, we could answer on which hashtags correlate with economic indicators.

Both research questions can be answered with the means of regression analysis. First, where has e-capital clustered in Europe, is answered with predicted GDP scores of the analysis. Second, the inequality in Europe could be answered with Moran I bivariate where the two variables are GDP and predicted GDP, i.e. e-capital. With Moran I bivariate, we found also areas that grow their economy even greater if they experienced higher e-capital level. Analysis was also made with open source software GeoDa. As Moran I bivariate finds spatial clusters of two variables, we took into consideration the four nearest neighboring metropolitan areas. We pay our focus on the clusters with statistical significance under 0.05.

There are limitations. First of all, tweets are only from two weeks' period. This makes single events or users possible to bias the results. While longer period of examination may have proved steadier results, this was the only option data was possible to collect from Twitter API. Another problem is the geographical area. Searching tweets within the 30 kilometers radius from the city center is an analytical restriction. For example, in coastal metropolitan areas, the area where the tweets are collected from is much smaller than in continental ones. Final problem comes from the used language: English spoken areas are overrepresented in the data. However, after considering the weaknesses of the model, we still think that our approach is the best possible way to collect the data. Advice was asked also from the peer users of TwitteR, for example from R-Help mailing list, to make sure this was the best method available. All this considered, we believe that even greater shortage of the analysis comes from the data from Eurostat. Comparing real time data from SNS to four years older information of economic development neglects for example the effect of recent growth in e-capital.

#### Findings

Results are discussed both with an approach of inequality and e-capital as an accelerator. We wanted to investigate which metropolitan areas have managed to capitalize their e-capital into economic capital and





which not. Alternatively, areas that are performing better than the level of ecapital could succeed because, in addition to e-capital, other forms of capital have agglomerated in these areas. They are likely to grow their economy if only e-capital develops to same levels as other forms of capital in the area. Areas with low level of e-capital and lower GDP than expected, in turn, could grow their other forms of capital, i.e. human, social and cultural capital and further economic capital, by "jumping into" the e-capital conversation process. This could succeed possibly with public investments in digitalization, or in human capital, which is said to produce ecapital with the knowhow of people. Similarly, investing in other forms of capital could turn into electronic capital (Merisalo 2016).

DIANST

Answer to the first research question is that e-capital correlates with regional development. Regression analysis where GDP per capita was predicted with the amount of tweets related to innovations was highly significant (sig. <0.001). With used indicators, 17.7% (R-square) of regional development could be explained with the level of region's e-capital. When regression analysis was made with employment rate as constant variable, there were no significant correlation between ecapital and employment. Second research question concerns the geographies of e-capital and potential growth in Europe. We answered this with predicted GDP scores from the regression analysis. Metropolitan areas with the highest level of e-capital locate in England, Belgium and the Netherlands. There is also evidence of larger clusters that follow the forms of the so called Blue Banana and Golden Banana. The Blue Banana starts from British Isles and continues in the continent in the valley of Rhine to southern Germany and Northern Italy. The Golden Banana, or the Sun Belt, lies in the coast of Mediterranean between cities of Valencia and Genoa. These areas are also the most populous areas in Europe.

Finding advances the conclusions of the correlation between social capital and economic capital to correlation between digital social capital and economic capital (Mandarano et al. 2010) and further the correlation between e-capital and regional economic wealth (Merisalo 2016). However, not all e-capital correlated with regional development. Tweets containing only word innovation per regions population predict economic development. Tweets containing words 'startup', 'tech', and 'refugees welcome', are not significant predicting region's GDP. Neither did absolute amount of tweets predict regional development.

#### Implications

Residual values can be interpreted in different ways. Higher GDP than predicted regarding to e-capital can result from several explanative factors. They could be seen as areas which have managed to capitalize their digitalization the best. Another interpretation is that these areas are wealthy in terms of other forms of capital (i.e. human capital, social capital and cultural capital) that has impacted their economic indicators. This interpretation is in line with earlier studies that have concluded that e-capital is likely to agglomerate in the same areas as the other forms of capital (i.e. areas with low level of e-capital but higher GDP than predicted). These areas could grow their economy if they invest in e-capital. Areas with high level of e-capital, but lower economic development than expected, are potential locations for e-capital growth. We categorized these (potential) growth areas into three categories:

1) Successful areas despite low e-capital

- 2) Unsuccessful areas despite high e-capital
- 3) Unsuccessful areas with low e-capital.

Group 1 "successful areas despite low e-capital" clusters in Southern Germany, Eastern France and Scandinavia. The second group formed with Moran bivariate method and named as "unsuccessful areas despite high e-capital", include only two cities (Warszawa and Leeds). A way of improving areas such as them could be considering public investments and procurements. The third group is the most problematic one.

**Keywords**: Social capital, Economic evolution, Metropolitan areas, Economic Growth, Quantitative analysis





Session-16-#321-2(SS3 & SS12)

# Developing a classification framework for assessing ports' environmental effectiviness

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## Abstract

## Purpose and Research Question:

The regulation landscape of the Baltic Sea is changing all the time towards a greener society. One of the biggest recent changes has been the Sulphur Directive (2012/33/EU) and IMO's SECA recommendation. NOx emissions will be the next issue for regulation. While the EU-level legislation is uniform for ember countries, previous studies have showed that there is a lot variation between countries in the actual implementation of the legislation and in how ports manage emissions (eg. Kunnaala-Hyrkki et al. 2015). A stable economical environment requires a predictable regulation landscape and thus it can be said that the continuing changes in the Baltic Sea Region might negatively influence the region's potential for growth. Previous study by Kunnaala-Hyrkki et al. (2015) showed that there are also differences in national approaches to environmental regulation and the permits related to the environment.

The research questions are:

1. What kind of key environmental issue should be incorporated into the port environmental effectiveness assessment framework?

2. What should be the performance criteria that address the key environmental issues and allow for comparison between different ports?

Some examples for the potential criteria or measured categories are:

- Energy Efficiency
- Waste Management
- Eco-driving
- Water Conservation
- Staff Awareness and Training

- Environmental Management System
- Stakeholder Dialogue

#### **Key Literature Review**

Pollution (from ships, port operations and logistics) has a direct connection with handled cargo volumes in the ports. Dense ship traffic, port operations and port related land transportation cause a lot of different kinds of emissions to air and water. Especially ships produce waste, black and grey waters, ballast waters etc. Emissions to air are the most important factors that increase the greenhouse effect and climate change. The main source is exhaust gas from combustion engines that are used in marine and road traffic and partially in train traffic, as well as, working machines in the port area.

In addition to emissions to air and water, ports are facing many other challenges also, such as the changes in the economy, increasing competition, as well as various environmental and other legislative changes. Globalization and an increasing demand for goods have led to a growing requirement for freight transport in Europe. Transport is responsible for around a quarter of EU greenhouse gas emissions making it the second biggest greenhouse gas-emitting sector after energy. (European commission, 2012). Maritime transport emits around 1.000 million tonnes of CO2 annually and is responsible for about 2,5 % of global greenhouse gas emissions (IMO 2015).

Ports' competitiveness is comprised of several other factors: geographical location, logistical connections, ship connections to other ports, port infrastructure and port operations. According Kunnaala-Hyrkki et al. (2015), ports also have a lot to gain from implementing environmental measures. For example, obtaining a greener image will come more and more important factor to the ports and its customers in the future.

Because of the changing regulatory environment and the growing competition between ports, it is vital to study how environmental performance measuring and monitoring practices and standards, as well as, best practices are executed in the Baltic Sea Region and how they should be performed in the future. In order to facilitate competition, the ports' environmental performance measurements and practices should be comparable. Yet, nowadays it is not so. Ports have adopted different kinds of standards and best practices and measure their environmental performance with different metrics and criteria. In addition, ports are different, which is why all the standards, best practices and measurement metrics do not necessarily apply to all ports.

Ports that have adopted standards usually use ISO 14000, EMAS or CSR standards. In addition, many ports have developed best practices in their operations. Yet it should be noted that not all standards are applicable in every port; there are differences in the ports' sizes and types of operations, which in some cases affect the implementation and accreditation of standards. Implementation and accreditation might also be expensive and small ports do not have enough recourse to do that.

In addition to standards, there are different kinds of benchmarking systems and performance measurement instruments that have been developed so that organizations can assess their operations, find the issues that should be developed and compare their performance with other organizations. Yet, it is





rare that a benchmarking or performance measurement instrument is completely applicable to all organizations of the same field, regardless of their sizes or types of operation. In this study we aim to develop a framework for assessing the ports' level of environmental performance and efficiency that would be applicable to all ports.

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#### Design/ Methodology/ Approach:

This study consists of a literature review and interview study. During the literature review, different kinds of standards, measurement systems and benchmarking that are used in different industry field are studied. After that, the features of the standards, benchmarking and measurement systems that are applicable also in assessing ports' environmental performance are further developed to suit for the purpose of the developed classification framework.

In addition, an interview study will be conducted. In the interviews, relevant personnel from ports and port related operators will be interviewed in semi-structured interviews that have features from both, structured and unstructured interviews. The interviews will be constructed around the interview themes based on the research questions and do not concentrate strictly on a defined list of questions. Instead, the interviews will be based on discussion, which will allow the concentration on issues that were considered significant by the interviewe, which is not necessarily possible in a structured interview. Furthermore, the semi-structural manner of interviewing allows the interviewer to produce additional questions outside the original plan or list of questions. The interviews will audio-taped and additional notes will be written during the interviews.

An adaptation of qualitative content analysis will be used as the analysis method for the interview study. The interviews will be transcribed and thematically organized. After that, the interview data will be transferred into an Excel worksheet, in which the data will be organized into a matrix. The columns will be comprised of interview themes and related questions. The rows consisted of the answers of each interviewed person. The purpose of the matrix is to facilitate the examination of the data.

#### (Expected) Findings/Results

'The expected result of the study is the development of a draft of the classification framework for assessing ports' environmental effectiveness. The framework will indicate the environmental status of the ports and can be used practically in all ports regardless of their sizes and types of operations. In future studies, the draft framework may be tested in ports.

#### **Research limitations**

There is a risk that the authors do not get enough interviews in order to form a generalizable view of the situation. Thus, the interview data sample might be too subjective for creating the framework. In addition, it is important to remember that an interview always provides the interviewee's subjective perspective on issues. For instance, the prevailing situational conditions, the interviewees' mood and their experiences can impact the interviews' outcome. In addition, the interviewer's manner of asking questions or participating in the discussion with the interviewee can impact the outcome. The thematic interview method also has some weaknesses which are related to the analysis of the gathered data and the interview

situations. When the interviewees are using their own words, it can be difficult to interpret the answers. The researcher's preunderstanding which can be biased, can affect the interviewer's views on what he considers important enough to make notes of.

Keywords: Ports, Environmental impacts, Measurement system, Benchmarking.





Session-16-#321-2(SS3 & SS12)

# The Role of Entrepreneurial Business Process in Improving Innovation: Based on Early-stage Companies

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# Abstract

# **Purpose/ Research Question**

: This study proposes a methodology for modeling and managing Entrepreneurial Business Process (EBP). The correlations among firm value, infrastructure, organizational structure, corporate culture, and business process management tool/system are analyzed.

# Key Literature Reviews (About 3~5 papers)

: Most entrepreneurship studies have concluded that startup companies fail due to the lack of resources and the absence of network with external stakeholders. Early-phase startups face difficulty in obtaining the knowledge and information about how to systematically secure and manage insufficient resources. Systematic management of resources can be achieved by Business Process Management (BPM) proposed to improve business efficiency, that is, by specifying procedures to use the existing resources efficiently.

# Design/ Methodology/ Approach

: The impact of each element on business performance are explored and both are analyzed by structural equation modeling. The survey asking the business incubator members of the Korea business incubation center about key factors of entrepreneurial business process of their companies are performed.

## (Expected) Findings/Results

: This is the first research of analyzing relationships among business process and organizational characteristics from the perspective of startup companies considering the limitations of startup companies. Therefore, the findings indicate theoretical implications for mechanisms of the correlations with the uncovered factor and insights into the relationships among business process, organizational characteristics, and business performance.

## **Research limitations/ Implications**

: We will contribute to more effectively model entrepreneurial business process and manage factors affecting the success and growth of startups.

**Keywords**: Entrepreneurial Business Process, Business Process Management, Organizational Characteristics, Korea Business Incubator, Structural Equation Modeling





Session-16-#321-2(SS3 & SS12)

# Impacts of Meta-cognition on Innovative Behaviors: Focused on the Mediating Effects of Entrepreneurship

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# Abstract

# Purpose/ Research Question:

The emergence of entrepreneurship is not generated suddenly, but is caused by solving the problems raised in one event or more. This stimulus can be realized through a systematic procedure to solve the problem. In other words, through this process, positive attitudes and attitudes toward solving problems can be said to be manifested in entrepreneurial spirit. Meta-cognition is utilized in the process of solving problems that stimulate the manifestation of entrepreneurship.

# Key Literature Reviews:

Meta - cognition is an idea of thinking, a concept of perception of cognition, a function of understanding the cognitive process of an individual and planning, checking, and controlling the process of thinking and problem - solving. In this context, meta-cognition means planning what order to learn in order to solve the problem, effectively checking and evaluating what kind of information is connected to construct knowledge and how to achieve the goal. In conclusion, metacognition is a systematic plan for the performance of tasks as an activity and an accident that learners engage in while learning.

If the function of planning, checking, and controlling in the problem solving process is good, it will solve the problem without difficulty, but if it does not work properly, it will become difficult and frustrated and stressed by psychological pressure. In this case, the weakened meta - cognitive function is expected to increase the risk sensitivity of entrepreneurship and negatively affect innovation and initiative. In the end, the negative effects of entrepreneurship will act as a stimulus to weaken motivation in innovative behavior of individuals.

This study suggests resilience, about what factors may improve the initial metacognitive ability in the present study. Resilience is contributes to the speed and degree of recovery after being exposed to stress(Brooks, 2009), and it can be said that the resilience is a strong factor in positively converting the negative situation as a result of assimilation and control seen in the negative situation(Leipold & Greve, 2009). Even though the meta-cognitive ability is weakened, if the resilience is well controlled,

entrepreneurship will work more positively and it will lead to a more innovative behavior and positive effect on the individual as well as the organization.

Metacognition is actively and intentionally storing and retrieving the relationship of actor-information in its environment. Furthermore, it is the perception of self as strengthened self of self and development of memory as the application which applies all the intellectual means developed by the individual to the problem in memory(Flavell, 1985). Schoenfeld(1985) has emphasized three categories of Intellectual behavior, beliefs and intuition, control or self-regulation, and knowledge about thought processes.

In other words, he emphasized how accurately describe his thinking process and his managerial ability in solving problems in control or self-regulation. He said that one's resources, the process of one's interpretation, and one's mental state are objects to be controlled. In particular, beliefs and intuitions are subjective knowledge of the world acquired through living a cognitive life, so that belief and intuition act as important determinants of behavior as well as control and self-regulation.

In this respect, the relationship between metacognition and entrepreneurship can be defined as an algorithmic relationship. In other words, entrepreneurship can be seen as part of the mental, physical, and situational experience of humans manifested in the course of transforming a series of uncertain situations into certain situations. In particular, entrepreneurship in the spiritual aspect can be said to be an expression of individual 's beliefs and intuition.

According to previous studies, Metacognition is a learning strategy in the process of completing active and innovative behaviors such as self-directed learning. In order for an individual to have the ability to set and carry out learning goals, he or she needs a mechanism to plan, establish and control the learning objectives.

The voluntary plan in self-directed learning assumes that the metacognition should precede the individual's strategic behaviors in order to achieve self-learning by cognitive characteristics(Bae & Lee, 2010). These relationships suggest that metacognition can be an influential factor in entrepreneurial as well as innovative behavior, and that resilience is a moderating role in enhancing the static function of metacognition.

## Design/ Methodology/ Approach:

This study will be test to find the relationship between meta-cognition, entrepreneurship and innovative behavior. First, we suggest that metacognition will be strong related to innovative behavior. Second, in order to make a stable relationship between meta-cognition and innovative behavior, entrepreneurship will be mediating role in a mutual relation. Third, Resilience will have an impact to metacognition. Therefore, we tested to mediating effect of entrepreneurship and moderating effect of resilience how strongly to make connecting between meta-cognition and innovative behavior. We will use the AMOS and SPSS statistical program to verify the hypothesis.

#### (Expected) Findings/Results:

Metacognition will have a positive impact on innovative behavior.

Entrepreneurship will have a positive impact on innovation behavior.

Metacognition will have a positive impact on Entrepreneurship.

Resilience will have a moderating in the relationship between metacognition and entrepreneurship.

Entrepreneurship will play a mediator role in the relationship between metacognition and innovation





behavior.

# **Research limitations/ Implications:**

In the management aspect, we can confirm that metacognition and entrepreneurship are very important factors for the innovative behavior of the members.

The importance of metacognition can be confirmed as a factor in strengthening entrepreneurship.

It can be confirmed that resilience is an important factor in overcoming the negative situation.

In the pedagogical aspect, it can confirm the importance of entrepreneurship education and metacognition learning.

Keywords: Meta-cognition, Entrepreneurship, Resilience, Innovative Behavior.

Session-16-#321-2(SS3 & SS12)

# RECOMMENDING SUITABLE ALTERNATIVE PERFORMERS USING PROCESS MINING TECHNIQUES: TOWARDS SMART ORGANIZATIONS

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# Abstract

A key capability of a smart organization is to flexibly and effectively react to unexpected events. A critical case of an unexpected event is sudden unavailability of process performers or increase of workload, which was not properly addressed by the existing dynamic resource allocation approaches. This paper proposes an approach to finding alternative performers from event logs. In particular, the degree of substitution between performers is assessed from the perspectives of task execution and transfer of work. Process mining and social network analysis (SNA) techniques are mainly used in the proposed approach. Using the proposed approach, suitable alternative process performers can be found rapidly to replace the original performers, enabling more dynamic and flexible resource allocation in case of exceptional situations. This approach is expected to contribute to redesigning organizations into more smart ones.

Keywords: smart organization, business process management, resource allocation, process mining, social network analysis







# **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 16 (Friday)

# Session-16-#301-3(SS16 & SS25)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 14:50~16:20)

"Open innovation for roadmapping future technology & society"

- Chair: Jeonghwan Jeon(Gyeongsang National University, Korea)
- Paper 1: "Open roadmap for open innovation at the national level: A case of Roman period" by Jeonghwan Jeon & Yongyoon Suh
- Paper 2: "Roadmapping for export of space segment based on portfolio analysis: A case of Korea" by Jeonghwan Jeon & Jieun Kim
- Paper 3: "How to improve future mobile app service quality: Exploring the rule of satisfaction from user reviews" by Jieun Kim
- Paper 4: "Exploring open innovation network in safety systems for future society: A patent analysis" by YongYoon Suh & Jeonghwan Jeon
- Paper 5: "Revisiting LPI index in regionally polarized economies: comparative study for Russia and Kazakhstan" by Anna Svirina, Marina Munina, Prause G, Lukashevich N., Garanin D., Bozhko L, Zarubina V.

# Session-16-#303-3(SS4 & SS17)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 14:50~16:20)

# "Japan's role of business innovation in emerging economies"

Chair: Yuri Sadoi(Meijo University, Japan)

## Honor Discusser: JinHyo Joseph Yun

- Paper 1: "Human Resource Development through Re-manufacturing Business in Myanmar" by
   Yuri Sadoi
- Paper 2: "The Role of Higher Education in Industrial Development in Myanmar" by Ye Tun Min
- Paper 3: "Outlook of the implementation "Routeman" system on the Russian market (the case
- of DyDo DRINCO Inc)" by **Sandugash Aimanova, Maria Vasilyeva & Vera Gurova** • Paper 4: "The role of a business model in market growth: The difference between the
- converting industry and the emerging industry" by **JinHyo Joseph Yun, DongKyu Won, KyungBae Park, EuiSeob Jeong & Xiaofei Zhao**
- Paper 5: "Comparing Validity of Risk Measures in Newsvendor Models" by SungYong Choi, KyungBae Park & Sang-Oh Shim







# **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 16 (Friday)

# Session-16-#309-3(SS18 & SS20 & SS29)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 309, Time: 14:50~16:20)

# "Open Innovation by Design Thinking"

- Sunah Kim(Kumoh National Institute of Technology, Korea)
- Honor Discusser: Natalja Lace
- Paper 1: "Participatory Public Service Design" by Suhyun Baek & Sunah Kim
- Paper 2: "Collaborative Workshops for Design Development" by Hye-Jeong Choi, Young-ok Jeon, Jiyoung Christine Koo & Ken Nah
- Paper 3: "An empirical study on Taiwan enterprises' open innovation activities and their added value" by Lo chih-cheng & Jason Kao
- Paper 4: "An intellectual property service Ecosystem for Chinese small and medium sized enterprises based on Incentive mechanism: A case of Mashan County" by Xiaojing Huang, Tianyu Huang & Jingxian GAN
- Paper 5: "An Empirical Analysis for The Application Level of Chinese Internet Big Data Ecology: An Entropy Approach" by **Tao Li, Lei MA & Yue ZHU**

# Session-16-#321-3(SS23)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 14:50~16:20)

# "Open Innovation and Business Model Competition Session"

- Chairs: ChoongJae Im(Keimyung University, Korea)
- Paper 1: "A novel approach in noninvasive Self Diagnosis of Silent Heart attacks using BioElectrics" by Akash Manoj
- Paper 2: "Sustainable agriculture through technology" by Girish Badragond
- Paper 3: "Improved wheelchair for the physically challenged and silk reeling cum spinning machine" by Nabajit Bharali
- Paper 4: "Modified Walker with Adjustable Legs" by Shalini Kumari
- Paper 5: "Design Awards Business Model" by Do-Young Kim Hyo-Jin Kim & Ken Nah
- Paper 6: "Farmer Friendly Biogas Compressor Nature of problem solving: Biogas Bottling" by
   Ajay Kumar Sharma
- Paper 7: "Smart Finance Business Model" by KyungYang Park(Non-Confirmed)
- Paper 8: "Open innovation & Business model of Megagen Implant co., Ltd." by KwangBum
   Park(Non-Confirmed)
- Paper 9: "Business model and open innovation of DISEC" by Oh JungPyo(Non-Confirmed)

Session-16-#301-3(SS16 & SS25)

# Open roadmap for open innovation at the national level: A case of Roman period

# Jeonghwan Jeon<sup>1</sup> and Yongyoon Suh<sup>2</sup>

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## Abstract

Technology planning with considering both internal capacity and external resource is necessary for successful open innovation. However, technology planning for open innovation at the national level has not been researched sufficiently. This study proposes Open roadmap for open innovation at the national level. The proposed open roadmap can manage the inflow & outflow open innovation systematically. Six types of open roadmap are classified with respect to the innovation direction and characteristics. The proposed open roadmap is applied to the open innovation cases of Roman period. The proposed open roadmap is expected to be helpful tool for technology policy planning at the national level.

Keywords: Open roadmap, Open innovation, Technology planning, Roman period.





Session-16-#301-3(SS16 & SS25)

# Roadmapping for export of space segment based on portfolio analysis: A case of Korea

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# Abstract

Space industry is technology-intensive comprehensive industry. Governments around the world are actively investing into space industry since its high industrial relevance on employment or technology. In Korea, space industry is also evaluated as a power industry for realizing the creative economy and focus on successful acquisition of technical capability. However, most companies in space industry of Korea are small and medium enterprises (SMEs) and they need to reinforce the global capability to export aerospace product. Nevertheless, the link between target country and product is still insufficient. Accordingly, the purpose of this study is to propose an export roadmap of aerospace product for providing SMEs with export opportunities and strategic guidelines. Technology roadmap and portfolio analysis are applied to this purpose. This study is expected to be helpful to SMEs and government agency.

Keywords: Roadmap, Export, Space industry, Portfolio analysis, Open innovation

# 1. Introduction

Space industry is technology-intensive comprehensive industry. Governments around the world are actively investing into space industry since its high industrial relevance on employment or technology. In Korea, space industry is also evaluated as a power industry for realizing the creative economy and focus on successful acquisition of technical capability. The scale of global space industry is about 30 billion dollars and is growing 4.9% per year within 5 years. Korea government also consider space industry as the power for implementing creative economy and try to acquire the technological capability.

However, most companies in space industry of Korea are small and medium enterprises (SMEs) and they need to reinforce the global capability to export aerospace product. Almost Korean SMEs in space industry has insufficient technological capability and export records. There are several difficulties to export such as policy issue such as national security. Technology roadmapping with considering both internal technological capacity and external market condition is necessary for export of space segment. Nevertheless, the link between target country and product is still insufficient.

Accordingly, the purpose of this study is to propose an export roadmap of aerospace product for providing SMEs with export opportunities and strategic guidelines. The export roadmap is made by considering both technological capacity and marketability of internal space product. Also the export

roadmap is customized by considering market situation, technology level, and policy status of each country. The remainder of this paper is organized as follows: section 2 briefly reviews the previous research; section 3 presents a research methodology; and section 4 presents the conclusions.

# 2. Literature Review (Under progressing)

## 3. Methodology

This study develops a strategic roadmap for the exports of Korean aerospace products (including technologies, components, systems, equipment, and service platforms) to other countries. At first, the promising aerospace product segments of Korea and the target countries for entry are explored. The promising aerospace product segments are selected by experts' opinion on the competitiveness of Korean aerospace products. The target countries are selected considering their aerospace import markets as well as recent political and diplomatic relations with Korea.

Then, the product segments for each of target countries are analysed in terms of product marketability, technological competitiveness, and policy trends, which are the definitely core factors of aerospace export strategy (Goldstein 2002; Park et al. 2012). Including these factors, the strategic mapping of product segments and countries are derived using portfolio analysis. Specifically, this study plans to assess several key measures for each factor, as shown in Figure 1.

In terms of the marketability of a space product segment for each country, a government's intention to invest and an import competitiveness are measured. As the space industry is developed by the balanced attempts of the government's needs and the market's interest, we measure both sides. The government's intention to invest is measured from R&D investment budget and the import competitiveness from the import RCA (Revealed Comparative Advantage) index. The RCA index is an index used in international economics for calculating the relative advantage or disadvantage of a certain country in a certain class of goods or services as evidenced by trade flow, which is commonly presented by Balassa (1965). If the import RCA of an aerospace product is high in a certain country, the country is said to have a comparative advantage in the product import and thus to be largely interested in and to need for importing the product.

Likewise, the technological competitiveness of a space product segment for each country is evaluated by a technological capability and an export competitiveness. Since the space industry is a technology-intensive industry, the domestic technology level and the export competitiveness of target countries are important factors in establishing export strategy of Korean products. The domestic technological capability is measured by the number of patent application and the export competitiveness is measured by the export RCA index that represents the comparative advantaged in the product export. The policy trends for a product segment for each country are also collected for roadmapping.

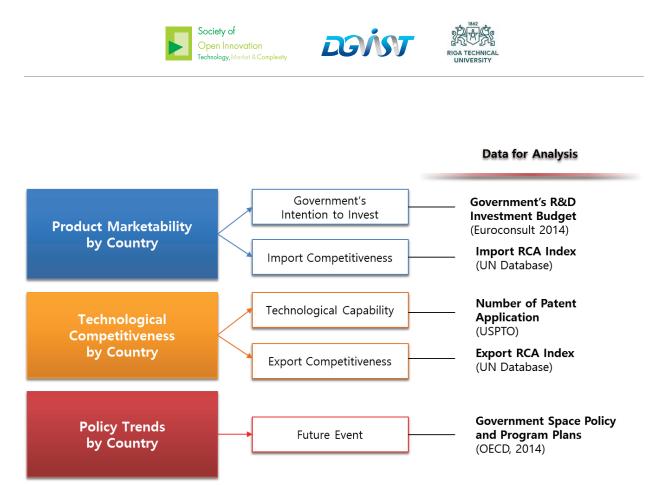


Figure 1. Key measures and data for portfolio analysis and roadmapping

For each product segment, the target countries have heterogeneous marketability and technological capabilities so that basic strategies to entry can be established. For example, if a country has high marketability as well as high technological capability, it is attractive but highly competitive market; in order to foster exports to this market, participating to projects led by that country or finding subcontracting business are appropriate strategies. If a country, on the other hand, has high marketability and low technological capability, it is highly import-dependent since they cannot produce required product; in this case, the export contracts can be activated by governmental collaboration or programs conditional on transferring superior technologies of Korea.

Thus, based on measurements, the detailed roadmapping is implemented in three steps: classifying country type using portfolio map, establishing the strategies for product entry, and developing export roadmap (see Figure 2). First, the portfolio maps are constructed using product marketability and technological capability as an axis of the map and countries as the mapping points; and then countries are classified for defining the basic strategies. Second, detailed strategies for product entry are elaborated using detailed future events according to the countries' future aerospace plans. The future events such as launching or developing a satellite can be reference points to plan when and what to do for the exports. Thus, the product segments (in our lists) related to the future events in particular are identified. Integrating basic strategies, future events and their relevant product segments, the detailed strategies for product entry are established. Lastly, the export roadmaps are developed for each product segment. The layers of roadmap are target countries with categories and three elements of future events, export products, and detailed entry strategies are placed according to their time to action and dependencies.

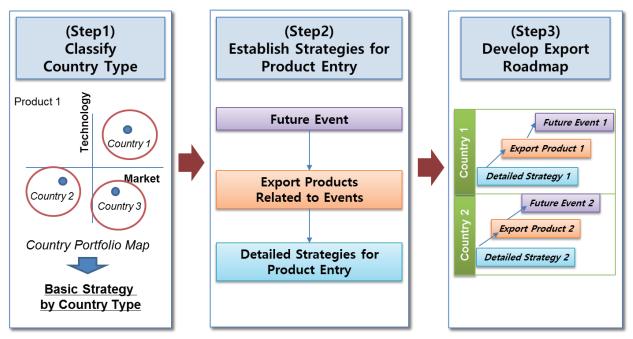


Figure 2. Process of roadmapping the export of aerospace product segment

## 4. Conclusions

This paper proposes an export roadmap of aerospace product based on portfolio analysis. The roadmapping of exports of aerospace products is extremely complex problem due to the need for associating a variety of products and alternative target countries. Responding to the complexity, this study suggests the comprehensive views of product marketability, technology capability, and governments' policy plans and provides the systemic roadmapping processes to establish basic and detailed strategies. Subsequently, this paper is expected to help SMEs to identify export opportunities and strategic guidelines.

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Session-16-#301-3(SS16 & SS25)

# How to improve future mobile app service quality: Exploring the rule of satisfaction from user reviews

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## Abstract

In mobile app service market, with the popularity of smartphones and mobile devices, numerous user review data have been accumulating. Although the user review data involve the key factors of service characteristics and experiences affecting service quality, there are limited attempts to analyse those quality factors in whole mobile app service market. In response, this paper applies decision tree analysis and regression to user review data in 17 categories of app store. Using user reviews for mobile application services, we explore the rule of user satisfaction in each categories and compares them among categories. Thus, with a data mining approach, the specific aspects of mobile app service quality that most influence user satisfaction can be efficiently extracted and compared. Our research can help app developers and market analyst to gain strategic implications to improve mobile app service quality. *Keywords:* mobile app service, user review, service quality, decision tree, empirical analysis

## 1. Introduction

In the era of open innovation, the importance of users as a source of innovation has been widely recognized (Von Hippel 2005; West and Bogers 2014). As one easiest way for users to express their ideas is user reviews, online user reviews have become one of important information source to identify user feedbacks. This study, in particular, focuses on the user reviews in mobile application (i.e. app) service market. As mobile app service market is exponentially growing in terms of number of users and downloads and app stores allow users to submit feedback for downloaded apps in form of star ratings and text reviews, a large amount of user reviews are accumulating (Guzman and Maalej 2014). Recent empirical studies (Chen et al. 2014; Hoon et al. 2013; Kang and Park 2014; Song et al. 2016) have showed that app store reviews include information of user expreiences with specific app features. This feedback can represent a voice of the users and be used to drive the development effort and improve forthcoming releases (Panichella et al. 2015; Song et al. 2013). Thus, it is crucial to monitor the user review data and extract valuable and actionable information in order to make an enhancement in mobile application service quality.

Previous studies have developed methods which are widely known as sentiment analysis or opinion mining (Pang and Lee 2008) to elicit the users' opinion from the huge volume of and complex app review data. They have focused on the technical improvements in areas such as sentiment identification (Hassan and Radev 2010) and expensively investigated reviews of books, movies and hotels. However,

there is a limited understanding of and extracting valuable information from user reviews for mobile app services. There are a few attempts used the sentiment analysis in mobile app service quality evaluation (Kang and Park 2014; Song et al. 2016). Although they typically analyzed the reviews for one or some case of mobile app service, there are a lack of the empirical analysis of quality factors in whole app service market to understand the rule of user satisfaction.

In order to improve future mobile app service quality, a key aspect is to specify how much service attribute affects overall user satisfaction. The easiest way to the analyze attribute-satisfaction relationship has been a direct questionnaire in customer satisfaction survey and apply regression model to infer the important service attribute (de Oña et al. 2012). On the contrary, the inference of service attribute importance from user review data is difficult, due to the format of and the volume of review data. First, in terms of format, user reviews are mostly textual and categorical data and thus may not satisfy model assumptions and pre-defined relationships between dependent and independent variables, which leads to erroneous estimations. Second, in terms of volume of data, the generic regression for this big data increases inefficiency of analysis.

In response, this paper adopts decision tree analysis. Decision tree is a well-known data-mining technique to extract valuable rules and relationships and usually is used for the purpose of classifying or prediction. It does not require any pre-defined underlying relationship between dependent and independents variables, to identify the key factors affecting mobile app service quality. The application of decision tree model in service sector has been advocated by many authors (de Oña et al. 2012; Duchessi and Lauría 2013; Lee et al. 2007; Seol et al. 2007). Likewise, this paper uses decision tree approach to explore and model the relationship between various service quality attribute and user satisfaction; and then applies regression analysis to suggest specific empirical implications.

## 2. Method

At first, data in online user reviews of mobile application service are identified and collected. The review data can be crawled from various mobile application review community websites. In this study, "Appcrawlr (www.appcrawlr.com)", a 3<sup>rd</sup> party website for reviewing mobile apps in various platforms, is chosen because of its massive data pool and well-categorized review data. Note that this website offers the secondary data, resulting from their own sentiment analysis and taxonomy collection. Thus, rather than process raw textual review data, we crawl and use those processed information, as shown in Table 1. The attributes of database is categorized as four folds: general mobile app service profiles; sentiment scores that are derived from reviews for the criteria such as usefulness, reliability, or social aspects; tags that writer provides and website collects for further searches; and user satisfaction including rate score and percent of positive reviews.

Category	Data attribute and values	Data type
General	(1) Category (Books and Reference, Business, Communication,	Categorical
	Education, Entertainment, Finance, Game, Health and Fitness,	
	Lifestyle, Media and Video, Medical, Music and Audio,	
	Productivity, Searching security, Shopping, Social, Tools)	Text
	(2) Title	Numerical

Table 1. Structure of database collected from Appcrawlr.com





	(3) Price	Categorical
	(4) Rate (Teen, Rated for 3+, Rated for 12+, PEGI 3, etc.)	Categorical
	(5) Platform (Android, iPhone, iPad, iPad&iPhone, Windows phone)	
	(6) Developer	Text
	(7) Description	Text
Sentiment	(1) Usefulness	Numerical (0~100)
	(2) Ease of use	
	(3) Reliability	
	(4) Security & privacy	
	(5) Fun & engaging	
	(6) Social aspects	
	(7) Family friendly	
	(8) Updates & support	
	(9) Battery	
	(10) Ads not intrusive	
	(11) Production values	
	(12) Repeat value	
	(13) Value for money	
Tag	(1) Topic (Book reader, Note taking, Voice search, Dictionary app, File	Categorical
	manager, Augmented reality, Social media, etc.)	
	(2) Helps you (Reading at night, Find books, Reading pdf, Get to sleep,	
	Build your vocabulary, Playing a game etc.)	
	(3) Audience (Book lovers, Writers, Developers, Students, Teens,	
	Teachers, Beginners, Kids, Christians, Ages 7-9, etc.)	
User	(1) Rate score	Numerical
satisfaction	(2) Percent of positive reviews	

Then, the decision tree models are developed for each of total 17 categories of mobile app services. The independent variables we plan to use are the general data attributes including price, rate, and platform, every sentiment score and tag data attribute; the two user satisfaction attributes are used as dependent variable. Since there are various decision tree algorithms such as CHAID, C4.5/C5.0, CART, etc., that are differ in the splitting criterion, the data types of the predictors that the algorithms can process, their handling of missing data, the method used to reduce overfitting, and whether the algorithm builds regression models and/or classification models. Thus, appropriate algorithm for our database will be selected and implemented. Lastly, the regression analysis is conducted for each categories and aggregated for comparison. The independent variables that affect user satisfaction in decision tree models are selected as the independent variable.

## 3. Conclusion

This study suggests a way of investigating the rule of user satisfaction in mobile app service using decision tree approach based on the user reviews. Despite the value of user reviews in mobile app service quality, the empirical study of the service attribute-user satisfaction relationships in whole service category are limited. This research can contribute to satisfy this needs and be a starting point of operationalzing the way of improving future service quality. The exploratory investigation of the rule of

user satisfaction is expected to provide implications in establishing improvement strategy in the mobile app service field. The research enables firms and mobile app developers to understand what aspects of service to be focused importantly to increase user satisfaction

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Session-16-#301-3(SS16 & SS25)

# Exploring open innovation network of safety technology convergence for future society: The patent class-based network analysis

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## Abstract

#### Introduction

As the technology is improved and society is matured, the occupational and health safety has been recently highlighted. Risks have been derived from change in technology, product, service, and society. A new type of dangers is emerging in modern industry according to these changes. The importance of managing industrial and occupational accidents is increasing in various field systems such as factory, construction site, and real life. Amongst others, these risks have pointed out a distinct feature of safety convergence. Traditionally, a reason of risks is very simple, but recently, that of the risk becomes complex. Since industrial systems were designed intricately according to convergence of various technologies such as IT, mechanics, and ergonomics, it has become difficult to discover problems and fails of the systems. Thus, to solve problems of these systems' risks derived from technology convergence, the safety technology is being developed by integrating various technologies as well (Kokangul et al., 2017; Patriarca et al., 2017). It is also required to consider the interdisciplinary approach of ergonomics, machinery, chemistry, and building systems to safety issues.

The research on technology convergence has been studied in a last decade in manifold fields (Lichtenthaler, 2004; No and Park, 2010). A number of various methodologies are proposed to investigate a core of technology convergence in terms of function, field, and industry (Yoon, 2008; Paulheim, 2014). However, in safety management, these approaches to identifying a state of the art in technology convergence have been not applied yet. As technology convergence is critical to design recently advanced systems, risks in the recently advanced systems become complicated more than previously simple systems (Wahlstrom and Rollenhagen, 2014). The solution for assuring safety in systems is also derived by technology convergence. For example, in a smart home, which is a result of technology convergence between building and information technology, a risk can be a complex one as managerial risks of lighting systems in building, incorporated by ICT. In this case, it is important to find the solutions in both areas, building and information technology. In other words, as technology





convergence is intensified, it is needed to monitor safety convergence to design and maintain safety systems. These situations are strongly related with open innovation strategy. By combining various approaches, effective solutions to converging fields can be found. The needs for interaction between various industries for safety systems are being important in terms of open innovation.

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In this respect, this study aims to explore technology convergence for safety for structuring open innovation network. By identifying knowledge flows interacting various technology fields for safety, we provide safety managers with effective solutions and indicative information. The patent is a fruitful resource for investigating the convergence information because patents related to safety technology are classified into various patent classifications. Here, we mainly use co-classification (hereafter, called as "co-class") information of International Patent Classification (IPC) codes, consisting of code A to code H, to identify the converging fields of safety technology. In general, the patents have multiple classes because most of patents can apply various technology fields. These multiple classes are defined as co-class. For example, when such a patent related to information technology includes the mobile technology for unmanned vehicle, this patent has multiple codes related to mobile technology and vehicle. In this case, we determine this patent represents convergence between mobile and vehicle technologies. Thus, the co-class (which means multiple classification codes) is used to monitor technology convergence.

The co-class analysis has been widely applied in studies on monitoring technology trends and changes so far, but as aforementioned, being less conducted in the fields of safety management. A main part of the co-class analysis is to conduct network analysis for monitoring patterns of technology changes and paths of technology evolution. Also, roles of patent classes are extracted by identifying a core node and patterns based on structure of co-class network. In this study, we conduct three types of network analysis to represent various results of core nodes and their patterns of co-class network: centrality analysis, brokerage network analysis, and association rule mining analysis. Based on three types of network analysis, we compare different network of safety technology convergence and reasonable results can be derived such as common core class and change patterns of co-class network. It is expected to identify core safety technology in convergence network formulate development strategy of safety technology.

## **Research Procedure**

To construct co-class network and analyze core class and change pattern, this research procedure is divided into five steps as depicted in Figure 1. First, in Step 1, patent documents related to safety technology are gathered and the classification code contained in patent documents is extracted. Second, in Step 2, the co-class network is constructed through the extracted classification codes. Third, in Step 3, social network analysis of centrality analysis and brokerage network analysis is applied to identify core classes and convergence patterns of co-class network. In addition, the association rule mining is used to identify the relationships between co-classes. In Step 4 and Step 5, focusing on the core classes and convergence patterns, we explore main technology and industry fields. The contents of safety technology convergence such as core technology and problem solution are summarized through mining text description of the patents such as title and abstract included in the core classes.

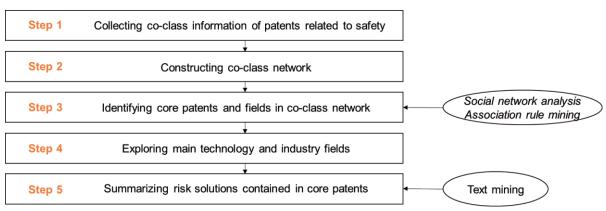


Figure 1. Diagram for research procedure

## **Data and Methods**

The patent data is collected from a patent DB website of Korea, WIPS. The WIPS provides various fields of patents such as patent title, abstract, assignee, class (i.e. IPC, USPC, and CPC), and citing and cited patents. Here, we use IPC information to structure co-class network. We collected 592 patent documents related to safety technology searched by such keywords, "safety", "technology", "risk", "danger", and "hazard" (In searching process, the keyword of "safe" was excluded since it usually means the product of "safe", which is a strong metal cupboard with special locks). By constructing the co-class matrix, the network analysis can be applied to monitor core classes and patterns of safety technology in co-class network.

The three types of network analysis are applied: centrality analysis, brokerage network analysis, and association rule mining. They are applied to achieve different purposes. The centrality analysis is used to find the nodes which are frequently related to other nodes (Suh & Lee, 2017). The nodes that have many relations with other patents are derived as the core nodes in network. On the other hand, the brokerage network analysis is to identify roles of connecting the groups of nodes (Suh & Kim, 2015; Lee et al., 2015). Through brokerage relation indexes in co-class network, we extract different roles of brokerage: "coordinator", "gatekeeper", "representative", "consultant", and "liaison". Based on these roles, the core classes and patterns can be quantitatively determined. Finally, the association rule mining has a somewhat different approach. The association rule mining is to probabilistically analyze the degree of relations based on *Bayesian* theory (Liu et al. 1998). Three indexes, which are "Support", "Confidence", and "Lift", are used to represent relationships between technology classes. Consequently, through three network approach, the common core nodes and patterns are systematically summarized to monitor safety technology convergence.

## **Conclusions and Future Study**

This study focuses on monitoring safety technology convergence using three types of network analysis. From various methods of network analysis, we represent different results of core classes and patterns of safety technology convergence. The results contribute to identify the convergence patterns in various perspectives. By comparing the results of each network analysis, common core nodes and patterns are proposed as very significant results. In the future work, we apply network analysis based on the co-class





matrix to represent various and useful convergence patterns. Also, the potential safety technology that has a substantial influence future society will be derived. As new technology is continuously adopted in future society, unexpected dangers and risks can emerge. Thus, we should construct anticipatory safety systems by developing preventive safety technology in advance. The results of safety technology convergence can be applied to be cope with these unexpected dangers and risks.

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Session-16-#301-3(SS16 & SS25)

# Revisiting LPI index in regionally polarized economies: comparative study for Russia and Kazakhstan

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## Abstract

Purpose/ Research Question: During past 5 years Russian Federation and Kazakhstan had invested in transport infrastructure development over 380 billion euro of state money, and the about the same amount of investments was made by private and state-owned companies; special investments made to ensure infrastructure quality for major international events such as Sochi 2014 Olympics or Expo-2017 have added investments in logistics infrastructure. According to transportation system development strategies in these countries in upcoming years total investments in transportation system development would be almost doubled. As a result of this strategy implementation shipment through Russian ports should increase 2.2 times, railroad transportation due to development of New Silk Road, cargo transportation speed in both countries should increase more, than 4 times leading to 97% on-timedelivery rate (opposite to 67%). At the same time the restructured transportation system is bound to become eco-friendly (according to the strategy, pollution from transport should be decreased by 70% by 2030), which can be achieved by implementation of new technologies in transportation system development. Taking into consideration the territory of Russian Federation and Kazakhstan and very high level of depreciation of existing capital funds, ramified structure of transportation system, climate limitations and ecological and environmental restrictions, implementation of the suggested strategy becomes a complex task that requires specific competences on national, regional and local level - which include the need for optimization of transportation flows by use of adequate software solutions. Implementation of such solutions should lead to 2-3 multiplicative effect on development of socioeconomic systems.

At the same time according to analysis of transportation development strategy and relevant federal and regional implementation in both countries, instead of achieving multiplying effect by introduction renewed infrastructure, the measures taken to improve transportation infrastructure currently result billion euro losses for the companies running newly developed infrastructure. According to expert estimations, one of the reasons for this is the lack of specialist in logistics management, who could



provide optimization of transportation flows.

According to Boston consulting group and Russian Chamber of Trade and Commerce's analysis of Russian and Kazakhstan logistics perspectives, the main obstacles for efficient logistics in Russia are: (1) low average speed of transportation (11-14 km per hour on railroad) - this challenge can be addressed by optimization of transportation flows and use of alternative transportation options; (2) low level of direct investments in infrastructure - can be addressed by increase in efficiency of state investments; (3) absent or unbalanced logistics infrastructure - which can be addressed by optimization of storage premises which are currently concentrated in certain areas of the country; (4) customs and other legal procedures that require significant time to fulfill - can be addressed by educating specialists in the field; (5) lack of competence and small scale of logistics companies - can be addressed by educating specialists.

The other important question is that overall estimation of logistics perspectives for both Russia (1<sup>st</sup> largest country on Earth) and Kazakhstan (9<sup>th</sup> largest country) can not be assessed along the same guidelines for the whole country – some of the regions are much less inhabited (for example, in Russia 86% of the population lives in European part while the rest live in bigger Asian part), others witness higher development of ground transportation, third ones experience high level of traffic intensity while the others use a variety of transportation methods efficiently. Thus we propose the need to develop an instrument to assess large countries by means of sophisticated LPI that considers internal differences within the country. The need for such instrument was discussed by several authors (for instance, Behar, 2010), and in this paper we target empirical evaluation of LPI index in polarized economies of Russian Federation and Kazakhstan.

# Key Literature Reviews:

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## Design/ Methodology/ Approach:

Russian Federation and Kazakhstan regions experience high spatial inequalities in terms of income, logistics development, transportation routes development, shipment opportunities and many others. This does not represent a new problem – in literature spatial polarization have been addressed several times (Kanbur and Venables, 2005), and researchers have found a number of reasons behind the problem. For example, economic growth is in many cases considered the consequent of uneven regional and urban development, and policy makers in many cases develop specific policies to provide better regional development by means of special programs. In Russia and Kazakhstan development of logistical infrastructure is being implemented to ensure lessening of spatial polarization in both countries. This leads to a variety of outcomes, but the fact indicates that in existing circumstances one should address LPI index developed for the whole country like Russia or Kazakhstan keeping in minds the spatial differences which are very important for both states.

In the paper we use case study method to approach differences between 6 regions in Russian Federation and 3 regions in Kazakhstan to compare these results with the evaluation provided by LPI index as an

average characteristic of the country.

## (Expected) Findings/Results:

Figure 1 presents the difference between evaluation of Russian and Kazakhstan LPI index; as our preliminary research indicates, almost the same variety of results can be found when different regions of both countries are assessed along the same methodology. An indirect confirmation of this thesis comes from high increase Russia had witnessed in Doing business ranking when the country was evaluated not on the basis of one capital city, Moscow, but Saint-Petersburg was also taken into consideration. In this paper we expect to see the same disproportion in LPI index assessed in different regions of the states in question.

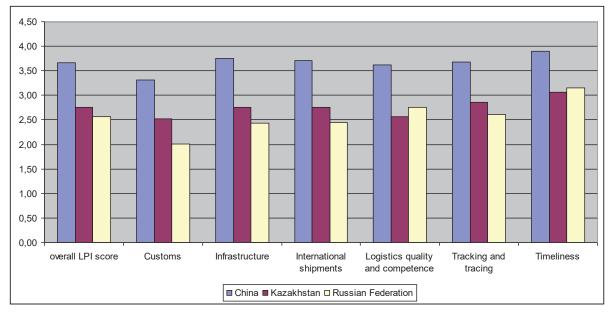


Figure 1. Comparative analysis of Russian and Kazakh LPI in comparison to regional leader China

Keywords: LPI index, logistics, spatial differentiation.





# Human Resource Development through Re-manufacturing Business in Myanmar

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## Abstract

#### Aim of Study

This paper focus on the re-manufacturing of construction machineries industry from the perspectives of innovation study and human resource development process. Those cases will shed light to effective way to develop key engineers and technical workers with high skills and technologies in emerging economies.

The Japanese construction equipment industry is playing an important role as technological development and innovative perspectives. However, few studies have done about the construction equipment industries and roles in innovation and human resource development. In emerging countries, high demands for construction equipment and, especially, re-manufacturing in construction industry increased the demands for emerging economies. Therefore, this paper focus about re-manufacturing from the view point of innovative roles and human resource perspectives.

As an emerging country, this paper analyses the case of Myanmar, one of the last frontier which opened its economy in 2011. In Myanmar, the attention of foreign direct investment has been accelerated since the start of new government on April 2016. However, as one of the latest country who has just started to industrialization, human resource development to support manufacturing and supporting industry lag behind. The demand for skilled workers and engineers are increasing, but the human resource development is far behind in numbers and quality.

#### **Research Question**

In emerging countries, the high demand on construction has been required the development of industrial equipment production in the country. In the process of production localization, re-manufacturing process was started in Myanmar by a Japanese construction equipment company.

Q1. What is the innovative contribution of construction equipment manufacture in emerging countries? Q2. How does the re-manufacturing process in construction equipment contribute local human resource development?

## **Innovation Study in Industrial Equipment Industry**

In order to study innovation in industrial equipment industry, the progress of mechanical excavator is a good example to explain the technological development and innovation as Christensen (2004) picked up the mechanical excavator industry for explaining disruptive innovation.

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In recent years, the Japanese excavator industry has been continuing disruptive innovation in excavators by using IoT, internet of things. With utilizing internet to each excavator, mechanical excavators drastically improved their operational productivities by improving maintenance and production information through internet. ICT (Information and Communication Technology) progressed to innovate the operation system which improves the efficiency of operation, management, and product support of construction machinery and the construction computerization system.

From the view of human resource development, mechanical excavators have been contributing technology transfer and skill formation to emerging economies. That is "re-manufacturing" strategy in skill formation to emerging economies. Japanese construction equipment companies have been conducted the "Re-manufacturing" business which aims to recycle used main components of the construction and mining machinery and sell them as the units with the quality comparable to those of the new components. The reuse of the parts to be discarded as an important issue from the aspects of machine operating cost, environment preservation and skill formation.

#### **Re-Manufacturing Studies**

Although not many, but there are several studies on re-manufacturing. Re-manufacturing is not well known or regarded important in general compared to other certain specific industries. What is re-manufacturing? According to the study of European Re-manufacturing Network<sup>1</sup>, re-manufacturing is "returning a product to at least its original performance with a warranty that is equivalent or better than that of the newly manufactured product." It is an important component of a resource-efficient manufacturing industry and a key strategy within the circular economy: by keeping components and their embodied material in use for longer, significant energy use and emission to air and water (e.g.  $CO_2$  and  $SO_2$ ) can be avoided. More importantly, the study pointed out re-manufacturing is beneficial for human resource development as citied "In addition to its environmental benefits, re-manufacturing provides opportunities for the creation of highly skilled jobs and economic growth."

However, it is also true that despite many positives, re-manufacturing is an undervalued part of the industrial panorama and generally under recognized the importance. Therefore, re-manufacturing activities are undertaken on a sector-by sector basis and the activities to facilitate knowledge transfer and promote the industry do not well exist.

Re-manufacturing is differ from reuse or recycle. Re use and recycle are highly regarded and publicly recognized as important issues from an environmental perspectives. Attention from environmental economics tend to focus these issues from CO2 emissions and lower energy point of view. Re-manufacturing is differ from them, but not well understood.

In the studies, eight requirements and obstacles faced by companies in developing a new remanufacturing business were summarized by Lund and Skeels (1983) as product selection, marketing strategy, re-manufacturing technology, financial aspects, organization factors, and legal consideration. Steinhilper (2001) pointed out eight criteria to be evaluated in establishing the suitability of products for re-manufacturing as follows;1. Technical criteria, 2. Quantitative criteria, 3. Value criteria, 4. Time criteria, 5. Innovation criteria, 6. Disposal criteria, 7. Criteria regarding interference with new manufacturing.

<sup>&</sup>lt;sup>1</sup> Re-manufacturing Market study 2015 by European Re-manufacturing Network





Matsumoto and Umeda (2011) showed the motives for re-manufacturing and the measures to overcome the obstacles of re-manufacturing from the three requirements for re-manufacturing: (1) collection of used products, (2) efficient re-manufacturing processes, and (3) demand for re-manufactured products. The motives are long-term economic and environmental incentives. The importance are (1) establishing a new collection channel; (2) developing reverse logistics to collect used products; (3) designing products for re-manufacturing; (4) accumulating knowhow to establish re-manufacturing processes; and (5) controlling product quality to stimulate demand for re-manufactured products. Matsumoto and Umeda (2011) also pointed out that Japan's Home Appliances Recycling Law and End-of-Life Vehicle Law have promoted material recycling but have been insufficient to stimulate re-manufacturing within the country.

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Although the importance, re-manufacturing is unvalued as pointed out. Moreover, few studied or discussed from the view point of human resource development or skill formation. Therefore, this paper will show how re-manufacturing contributes to skill formation and technology transfer using the case of Japanese industrial machinery re-manufacturing operations in Myanmar, the late industrializing country in ASEAN.

### **Required Technological Processes for Re-manufacturing**

Re-manufacturing is, as stated before, to return a product with original performance with "equal or better" quality. The practice and terminology in re-manufacturing differ slightly according to produce or sector. APRA Europe (2012) shows the levels of re-manufacturing practices listed at the top from the view point of quality level, as equivalent or better quality than new parts. Followed by rebuild, lower or equivalent, recondition, lower or equivalent, reconstruct, lower or equivalent, refurbish, lower, and so on. As shown here, re-manufacturing is the equivalent or better product than the new product using used parts.

Re-manufacturing includes major technologies of manufacturing. Re-manufacturing process start first collecting used products. The used products were disassembled totally. Each sub parts were cleaned in special knowhow and surface treatment are applied. The cleaning and surface treatment process are the most important and needs special knowhow and techniques. Then, each parts are reconditioned to recover high quality and performance. Then, all the subparts are reassembled to finished product. After reassembly, all the products are tested to assure the quality and performance. Re-manufacturing is a manufacturing process that involves dismantling a product, restoring and replacing components, and testing the individual parts and the whole product to its original design specifications. The performance after re-manufacture is expected to be at least the same as the original performance specification (like new) or better, and the re-manufactured product generally comes with a warranty.<sup>2</sup>

Industrial tooling, machine and cutting tools is an essential component of almost all manufacturing industries. The manufacturing technologies association, which represents them, defines machine tools as power drive machines and not portable by hand. This equipment is used to work and shape metal or other materials into the correct form before product assembly occurs. The size and operation of machines in these sub-sector varies greatly, due to the wide range of functions carried out. Due to the advances in

<sup>&</sup>lt;sup>2</sup> This definition was drawn by several process explained in Re-manufacturing market study by European Community European re-manufacturing network. Reference EC-09 404 ERN WP2.2

technology in this sub-sector in recent years, more complex systems have been introduced in this equipment, notably computer numeral control system.

All of these processes involves human skills and techniques which cannot replaced by automated machineries. Sadoi (2014) pointed out there are two opposite strategies of technology transfer of Japanese MNCs to host countries. One is human skill oriented strategy and the other is high-tech machine oriented strategy as shown in Figure 4. The former case shows that there were a quite a few highly skilled workers performing the finishing and profiling processes, which required a minimum of a year of specific skill training. These workers use multiple-purpose machines to shape a variety of parts. The latter case shows that firms install state of arts mother machines to eliminate human skill or quality instability. Those mother machines are the same or even higher specification and prices than those of in Japan. In the case of re-manufacturing process it is based on human skill oriented strategies. In return, all the process is highly dependent to human skill or manual process. Therefore, HRD is the key issue for re-manufacturing.

Automobile parts are the most prevalent target of re-manufacturing in the world. In the world, about two thirds of re-manufacturing business is estimated to involve auto parts.<sup>3</sup> Japan has a relatively well established re-manufacturing sector. Re-manufacturing is estimated at up to 500 billion yen, with the automotive sector 109 billion, as the highest among other sectors such as retread tires and photocopiers.<sup>4</sup> Heavy duty and construction equipment for re-manufacturing is started to active in Japan. Hitachi construction machinery and Komatsu are the active players.

#### **Research Methodology**

For the empirical study, a major Japanese construction equipment manufacture, Komatsu, is surveyed by author in Japan and Myanmar from 2014 to 2016. Detailed interviews were conducted by author to Japanese managers and engineers in Japan and Myanmar, and Myanmar engineers and staffs during the period. For the comparative purpose, other metal and parts manufacturing factories in Myanmar was surveyed and evaluated.

#### **Summary of Findings**

- 1. High demands on construction in Myanmar as well as emerging countries lead local remanufacturing business prior to manufacturing base.
- 2. Re-manufacturing requires higher level of local engineers or technicians than manufacturing.
- 3. Careful examination of skill formation process of local engineers showed the positive effects on skill formation and quality and productivity achievement.
- 4. Global training system in Komatsu
- 5. The Japanese construction equipment manufacturer case shows the effective way of HRD in emerging countries.

#### Implication

<sup>&</sup>lt;sup>3</sup> Steinhilper R. Re-manufacturing: The Ultimate form of recycling. Stuttgart Fraunhofer, Verlag; 1998

 <sup>&</sup>lt;sup>4</sup> Ramstetter, E. Re-manufacturing and the 3Rs in Japan: Lessons for Thailand, Thammasat Economic Journal Vol. 30, No. 4 Dec 2012





The role of construction equipment industry was not much studied yet. Especially in emerging countries, the role is essential in the initial phase of industrialization. This study will shed light to the HRD and re-manufacturing business and can be applicable for other emerging countries.

Key Words: Re-manufacturing, Construction Equipment Industry, Human Resources Development, Myanmar

Session-16-#303-3(SS4 & SS17)

# The Role of Higher Education in Industrial Development in Myanmar

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## Abstract

#### **Purpose/ Research Question:**

The status of Myanmar economy needs to be more closely monitored and improved whereas the general access to industrial sector could be improved by increasing the number of educated citizens and facilities for higher education. Even Myanmar, nowadays, is under the power of State Counselor Aung San Suu Kyi's civilian government which came to power in April 2016, Myanmar higher or tertiary and technical education are still very weak. It is because Myanmar had been ruled by the military junta for over 50 years until 2011, when a quasi-civilian government backed by the military came to power under the former president Thein Sein. Without enough high level educated and highly-skilled workforces, Myanmar will be very difficult to sustain technological absorption that effective industrial sector reforms would bring in the future.

The aim of this paper is to analyze the problems of higher education which hinder the development of industry in Myanmar. The clear analysis of problems help to show right directions for higher education which can provide huge visions and breakthroughs in Myanmar industrial development for changing from poor nation to rich one rapidly.

## Key Literature Reviews (About 3~5 papers):

The development of higher education is a necessary condition for the modernization of Myanmar. It has been universally recognized that knowledge is the most precious of all possessions. (Myint 2010) The effect of education is evident in economic, social and environmental developments. No one can deny that education is the best policy for the advancement and the quality of life. The objective is how to achieve the best results in a relatively short time for the country. The first essential condition is that the government must allocate more than sufficient financial resources for educational purposes at the time of rapid economic development. Myint (2010) states Myanmar's industry has always been low-tech. To develop the sector, the government needs to start almost from its conception. Industrial development obviously has to be properly planned and executed with the objective to foster fast industrial growth. High-tech industry should also commence in order to transfer technology for various industries. ...Knowledge is abundant in the world ready to reap. Some emerging technologies may be limited by trade secrets, but there are more than enough technologies available for a country like Myanmar to use in various sectors of the economy.

Be able to sustain technological absorption for boosting Myanmar industrial sector, Myanmar need to solve out the poor system of higher or tertiary and technical education as fast as possible. It is





because higher education in Myanmar is ranked one of the lowest systems in the world because all Universities are state run and higher centralized by government of the military regime almost five decades. According to Institute of International Education (2013), higher education in Myanmar is needed to reform intensively and the entire system requires nothing less than a complete renovation-from the physical infrastructure to the academic curriculum. The fact is the current Myanmar higher education system is facing a cumbersome administrative structure, high costs of higher education administration, and inadequate teaching capacity. These are some of the challenges of Myanmar higher education investment and reform for the new elected government in early 2016.

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According to World Bank (2000), the world economy is changing as knowledge supplants physical capital as the source of present (and future) wealth. Technology is driving much of this process, with information technology, biotechnology, and other innovations leading to remarkable changes in the way we live and work. As knowledge becomes more important, so does higher education.

Although different countries exhibit different paths in developing higher education system, Suehiro (2008) thinks that one of the most important supporting catch-up industrialization is the educational system, since it greatly to absorb and improve imported technology. Dore (1987) sees the raised standard of general education and the high level of continuation to higher education as major factors fueling high economic growth in postwar Japan. Additionally, Vogel (1979) thinks that one of the reasons for Japan's success in the system of selective examinations and homogenization of education.

However, Suchiro argues that the process of job selection and human capital allocation by schools happens to match the human resource development requirements of catch-up industrialization. He also states that late-developing countries aiming at rapid industrialization do not necessarily require and education system that fosters an elite class through early selection, or reproduces an elite affiliated to a particular social class. School education in catch-up countries is expected to give students the basic knowledge and skills required by industrial society, thereby cultivating a large-scale, high-quality workforce. Once people make the transition from school to workplace, companies themselves give them the more firm-specific skills that they require, through training on the job. It is the combination of a highly selective education system and an internal labor market at individual companies that generates the workforce required for latecomer industrialization on the basis of imported technology.

According to Chirathivat & Yen (2009: 323), Thailand's industrial sector achieved high growth and structural changes in the decade before 1997, with an outstanding performance in the late 1980s. Since 1987 the industrial sector has diversified its production and exports from products based on the processing of raw materials and products in labor-intensive industries, to industries with increased intensity in capital, skilled labor, and technology. In order for Thailand to continue undergoing rapid structural transformation and sustain high growth, it is necessary for Thailand to continue diversifying products and to deepen the industrial base by emphasizing more skilled and technology-intensive production. The production of these products which normally have high technological content needs an efficient combination of factors of production, such as capital, skilled labor and a higher level of technology. These factors inputs are not readily available but they need to be acquired. They can be obtained by two ways, namely through technology transfer from direct foreign investment and by developing these inputs based on our own efforts... The most appropriate role of the Thai government in promoting industrialization now is probably to focus on developing human labor force becomes more skillful and Thailand's technological know-how sufficiently enhanced, can Thailand shift production to

new products with increased quality and value-added.

## Design/ Methodology/ Approach:

In order to identify the problems from both academic and industrial sides, questionnaire survey data was collected from Myanmar university students in Myanmar or Japan, educators, employers from management sides, and Japanese managers perspectives who interested in Myanmar, and Thai managers perspectives who interested in Myanmar from April to December 2016. In detailed interviews for selected samples contributed to lead identifying problems Myanmar higher education facing.

After identifying, 6 aspects of problems, stated in the following Findings section, detailed case study at Technological University Mandalay was conducted to illustrate the problems in 2016-2017.

# (Expected) Findings/Results:

Based on the questionnaire and interview survey result, there are various factors were raised as problems of Myanmar's higher education system. The analysis will focus particularly on the 6 aspects of the following problems. They are;

- 1. Lack of physical Infrastructures
- 2. Lack of modern curriculum
- 3. Highly Centralized and Rigid Administration System
- 4. Poor Quality of Faculty
- 5. Poor Information Technology
- 6. Poor International Engagement

After identifying the problems, the case study at Technological University Mandalay showed in detail description of above listed 6 problems and suggestions for possible attempts for solutions.

## **Research limitations/ Implications:**

This study not only showed the institutional higher educational problems that many emerging countries face, but lid light to the way those countries proceed to catch up industrialization in new ways. Through the empirical research, there is a hint that the IT education in Myanmar might develop disruptive innovation which lead to the different development path from conventional higher education system of developed countries.

Keywords: Myanmar, Higher education, IT education





Session-16-#303-3(SS4 & SS17)

# Outlook of the implementation "Routeman" system on the Russian market (the case of DyDo DRINCO Inc)

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## Abstract

Japan is the leader in amount of vending machines per capita. Vending machines became the indispensable part of Japanese lifestyle. Vending machines replace the function of supermarkets as they are more convenient for busy Japanese consumers. Therefore, it is possible to meet vending machines almost everywhere even in very remote places in Japan.

DyDo DRINCO is a Japanese company-operator, which works on the market of soft non-alcohol drinks. Nowadays the company has more than 55 Stock Keeping Units (SKUs). The key feature of DyDo DRINCO is a distribution channel the company uses. DyDo DRINCO sells its products through vending machines directly to the customers. DyDo DRINCO has presence in the convenience stores too but in a very small percentage. Vending business is well developed in Japan and DyDo DRINCO has several strong competitors like CoCa-Cola, Suntory, Asahi, Kirin, Itoen and other companies, which also distribute their products using vending machines. In order to survive in this tense and strongly competitive environment DyDo DRINCO has to gain its own competitive edge. The competitive advantage of DyDo DRINCO comes from its operational system called Routeman. Routeman is a key part of DyDo DRINCO's business model. Therefore, it is essential to concentrate on this system to get the essence of the successful business model of the company.

Routeman is a special corporate system of DyDo DRINCO, which helps the company to serve the vending machines very quickly and efficiently and to contribute to customer satisfaction. The main function of Routeman within the company is to install vending machines and to fix them quickly. Routeman system is also in charge of filling the vending machines with products depending on the location. DyDo DRINCO as any other Japanese company has a well-developed customer service, which implies to quick solution of problems with the vending machines. DyDo DRINCO is a company, which is very dedicated to its customers.

Routeman is a specific system used by DyDo DRINCO to serve vending machines and to implement sales. Routeman has 70 vending machines and can serve 5-6 vending machines per day. The main purpose of Routeman is to put beverages into the vending machines. If Routeman changes the sales of the company also will change. Routeman tends to have 'out of a stock'. When all the products are bought then there is a special red button, which announces that there is no such product left in the vending machine. In a good Routeman there is no 'out of a stock' at all but it is very difficult to achieve such result as the system can serve only 5 to 6 vending machines per day. This is a key feature of supply chain of Japanese companies – to get rid of stocks and warehouses. The main idea is to calculate the exact amount of products which will be sold in a particular vending machine and avoid 'out of stock' situations.

As there are different seasons it is also Routeman's obligation to change the bottles in the vending machines according to the seasons. DyDo DRINCO's key feature of vending machines is that they can serve both hot and cold drinks. That became possible because of company main suppliers – Panasonic, Fuji Electric and Kubota – which produce refrigerators for Dydo DRINCO's products. It is Routeman's work to decide which cans to put in to the vending machines based on different locations. Moreover, another issue, which Routeman system has to cope with, is about potential location of vending machine. Companies require a specific amount of sales for installing vending machines; Routeman has to check the potential sales in this area.

The article describes the term and main objectives of the Routeman system in DyDo DRINCO Company. Furthermore, the article is assessing the potential of Routeman system is being implemented in Russian realities from the economical, managerial, cultural and personnel perspectives. The purpose of the article is assessing conditions and prospects of development of Routeman system in Russian market.

The Routeman system has not been discussed widely, that is why the main sources for this article were such primary sources as interviews and DyDo DRINCO Corporate Reports. It was held 3 interviews with General Director of DyDo DRINCO Rus, Kazuyasu Tateuchi. During those interviews Mr. Tateuchi shared his view on the DyDo DRINCO in Russia, explained the operation process in Russia, future plans of developing DyDo DRINCO in Russia, which problems DyDo DRINCO faced in Russia. Mr. Tateuchi also gave the overview of the process of operators working in Russia and pointed out the main differences in service system in Russia and Routeman system in Japan. Another interview was held with Executive Officer & General Manager-Marketing DyDo DRINCO Japan, Mamoru Mitamura. Mr. Mitamura provided diverse information about brand development in DyDo DRINCO, explained peculiarities of DyDo DRINCO operation in Japanese market, gave broad overview of Routeman system and explained the main duties of Routeman.

Due to the fact that information about Routeman is limited, such methodologies as interviews and data analysis were used to conduct the research on the effectiveness and efficiency of Routeman. The article contains descriptive and applied types of the research with using of comparative approach. The article describes the meaning and purpose of the Routeman system, then compares this system to the existing system in Russia and finally examines the possibility of entirely integration of Routeman system in Russian realities.

The market of vending machines is still growing in Russia. In order to install the vending machine the company has to win city tender. On the Russian market DyDo DRINCO is the first company, which involves vending machines. Moreover, refrigerators of DyDo DRINCO are unique as no one else is able to combine both hot and cold drinks. However, there are a lot of differences between Russian and





Japanese customers whose needs the company has to satisfy.

The implementation of Routeman system in the Russian market will definitely bring more benefits to the company. However, there are several obstacles. Firstly, it is impossible nowadays to calculate how many bottles will be bought in particular vending machines as Russian customers still buy products in the vending machines not because it has become a habit but because of the interest and uniqueness. Therefore, this means it is quiet difficult to analyze and planning the future sales and remove "out of stocks" problem in Russia. In the same time, DyDo DRINCO uses Routeman in order to fix quickly the problems with vending machines. However, still within one big city with parking problems and traffic congestions it is very big problem to fix existing technical troubles and maintain products in vending machines on time. In addition, the amount of customer claims in Russia is much higher than in Japan as there are a lot of cases with vandalism where people break the vending machines so they do not work properly. However, for the long perspective the implementation of Routeman may be very good opportunity to improve the efficiency and effectiveness of the vending business in Russia. Such long duration of the implementation of Routeman in Russia can be the main research limitations for the article. The DyDo DRINCO has been operating only 3 years in Russian market. This is far from enough to see the adequate results.

Keywords: Routeman, vending business, vending machines, DyDo DRINCO.

Session-16-#303-3(SS4 & SS17)

# The role of a business model in market growth: The difference between the converted industry and the emerging industry

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#### Abstract

This research was conducted to establish the role of a business model in the growth of a new market, realized through the creative combination of IT-based technologies and markets, emerging from the Fourth Industrial Revolution. The topic of this research is as follows:

What are the role differences between the business model of an already-existing market–based industry and that of a new emerging market–based industry?

This study analyzed the statuses of the technology and business model of the autonomous car and intelligent robot industries, as well as the recent two-year growth based on technology and business model patents. In addition, it analyzed the current status of the technology, business models, and markets of the two industries based on existing research. Furthermore, the research team simulated the market





growth through system dynamics analysis with a causal map of the autonomous car and intelligent robot industries proven and established by analyzing the references and citations of the technology patents and business model patents of the two industries. We concluded two items by combining the simulation analysis result and supplementary researches. First, in case of a new industry with a converting market, the strategy for the advanced development of a business model in the early or growth stage of the industry is much more effective than the advanced development of technology, taking into consideration the width and speed of a market. Second, for the quantitative expansion and rapid growth of a market in a new industry, it is necessary to systematically develop a business model.

Keywords: Business model, Open innovation, converting market, Emerging market, intelligent robot, Autonomous car

Session-16-#303-3(SS4 & SS17)

# **Comparing Validity of Risk Measures in Newsvendor Models**

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#### Abstract

**Purpose/Research Question:** The multi-product newsvendor model, initiated by Arrow, Harris and Marschak (1951), is a well-known classical stochastic inventory replenishment problem in supply chain management literature. In this model, there exist multiple perishable products with random demand in a single-selling season. Then a newsvendor should decide his optimal ordering quantity for each product in this single-period model before demand realization. Because the product demand is only given as a probability distribution, the objective function is represented as a random outcome. If the newsvendor orders too much for any product, all the leftover items are sold at a discounted price; if the newsvendor orders too little, it will lose sales opportunity.

Then, it is important to select quality risk measures to analyze newsvendor problems under risk. To find such risk measures in newsvendor problems, we review various risk measures of risk-averse inventory models and existing articles in inventory management literature.

**Key Literature Reviews (About 3~5 papers):** The original model by Arrow et al. (1951) maximizes the expected value of profits without resource constraints and demand substitution. Then the multi-product model is decomposable into multiple single-product models in each product and has a simple analytical closed-form optimal solution for each product. This solution is known as a fractile, described with overage and underage profits, of the arbitrary (cumulative) demand distribution function. Thus, it can characterize the optimal solution effectively with underage and overage profits as well as its solvability as a closed-form solution. Owing to its simple solution with trade-off analysis between underage and overage profits, it has many applications in industries such as overbooking problems or facility capacity problems.

To overcome drawbacks of risk-neutral models, risk-averse models have been studied in literature. In





risk-averse models, inventory managers consider the variability of the outcome as well as its expected value. That is, under risk aversion, a risk-averse inventory manager may prefer more stable outcome even if the outcome is worse on average. Schweitzer and Cachon (2000) conducted two empirical experiments to show risk preferences of inventory managers. By the experiments, they showed that inventory managers may be risk-averse for short life-cycle or high-value products. Therefore, risk aversion can capture the decision making of inventory managers at a different angle from risk neutrality and both of them are consistent with rational decision makers. Because risk aversion significantly aspects the optimal choices of inventory managers, it is a very interesting and important factor to analyze the optimal choices of inventory managers. Risk aversion has a very good fit especially to conservative decision makers. Some good examples are energy, environment, sustainability industries and so on.

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**Design/Methodology/Approach:** This paper aims to extend the series of previous works, Choi and Ruszczynski (2008), Choi, Ruszczynski and Zhao (2011) and Choi and Ruszczynski (2011). In those three papers, we conducted our extensive literature review for various risk measures used in the inventory management literature and categorized the risk measures into four typical approaches – expected utility functions, stochastic dominance, chance constraints and mean-risk models. Then we selected coherent measures of risk as quality risk measures in Choi and Ruszczynski (2008) and Choi, Ruszczynski and Zhao (2011) and an exponential utility function in Choi and Ruszczynski (2011), respectively.

(Expected) Findings/Results: We provide an axiomatic reasoning and framework to evaluate validity of each risk measure in newsvendor problems - consistency to the four axioms in coherent risk measures. In this framework, the underlying assumptions and managerial insights to the newsvendor problems are studied for each risk measure. Consequently, exponential utility function and coherent measures of risk are selected as two plausible risk measures to analyze multi-product risk-averse newsvendor models. We believe that there is an important extension that can be addressed in this axiomatic framework. In this paper, we discuss meaning and implications of the four axioms in coherent risk measures in newsvendor models.

**Research limitations/Implications:** A multi-period model can be a possible extension for the model. For a multi-period case, dynamic version of coherent risk measures were also analyzed in the literature (refer to Riedel (2004), Kusuoka and Morimoto (2004), Cheridito, Delbaen and Kupper (2006) and Ruszczynski and Shapiro (2006b)). Then, this axiomatic approach can be a good starting point of constructing another axiomatic framework to compare the validity of various risk measures for a multi-period case.

**Keywords:** (multi-product) newsvendor problem, risk aversion, coherent measures of risk, (exponential) utility function.

Session-16-#309-3(SS18 & SS20 & SS29)

# Participatory Public Service Design by Gov.3.0 Design Group

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#### Abstract

**Purpose/ Research Question**: As individual citizens' satisfaction with public service has become an important index for evaluating the competency of a nation's policy, there is a need for public service design that is in accordance with the requirements of citizens and able to elevate the citizens' degree of satisfaction. With a focus on the fact that the public service design process lacks publicness, and the resulting delivery gap between the supplier and the user are the main causes of the decrease in the citizens' satisfaction with public service, the present study was conducted to verify the possibilities that open innovation may provide for public service design.

The present study was conducted by using the case of Gov3.0 Design Group, which is a type of citizenparticipatory public service design platform. The present study focused particularly on the possibilities that may be found when the iterative thinking-based framework, emphasized by design thinking, and the co-creation-based design methodology are utilized. Accordingly, the following research questions were defined:

1. What is the core value delivered by a citizen-participatory public service design process?

- 2. What is the synergic effect caused by co-creation in a public service design process?
- 3. What is the role played by open innovation in securing the publicness of public service?

4. What do the opportunities of design thinking applications suggest in regard to public service design?

**Key Literature Review**: Efficiency and economic feasibility are the most important factors that have contributed to Korea's distorted economic growth through industrialization in the last five decades. Public service has been led for a long time by a small group of administration experts to accomplish efficiency and economic feasibility in the development and management of public services. Such a top-down public service delivery system has failed to accept the diverse demands that the public have with regard to public service, thereby extending the service delivery gap between the suppliers and the users.





The problems of the public service delivery system are closely related to the process of developing and operating public services. The supplier-focused public service system has been passive in securing communication channels with the users and searching for opportunities to access users' demand. Such a closed feature of the system is a significant factor that makes the users distrust the publicness and transparency of public services. The supplier-focused public service design has failed to satisfy the users due to the top-down delivery system and the closed development process. In other words, while the overall capital input to public services increased day by day, the output did not increase in proportion to the capital in the aspect of citizens' satisfaction, which is considered the result of the government's low policy competency. Hence, there is a need for a novel approach to public service design in order to improve the government's policy competency and to enhance the nation's competitiveness.

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The present study was conducted to find a novel approach to public service design. To verify the core value, synergic effect, role, and new opportunities that may be provided by applying design thinking-based open innovation to public service design.

To find the answers to these research questions, a case study was conducted with theGov3.0 Design Group, which is a type of citizen-participatory public service design platform.

Gov3.0 Design Group was planned and proposed in 2014 by the Ministry of Public Administration and Home Affairs in conjunction with the Ministry of Trade, Industry and Energy, and the Korea Institute of Design Promotion.Gov3.0 Design Group is a policy working group that develops and improves public services by using a service design technique on the basis of the policy suppliers (public servants) and service users (citizens) participating in the entire policy process, including agenda-setting, policy decision-making, enforcement assessment, and feedback. Public service projects are divided into central government projects and local government projects. Public servants, citizens, and relevant experts, such as service designers, work as a group for about two months to discover agendas and produce improvement plans for the currently enforced policies by using service design techniques and processes. The number of projects tested by theGov3.0 Design Group has increased every year. In addition, the Gov3.0 Design Group won the first prize in the Service Design category of the iF Design Award, indicating that the excellence of the Gov3.0 Design Group was globally recognized as a citizen participatory policy development model.

The Gov3.0 Design Group has three major features. First, with regards to the organization of the working group members, the citizens, otherwise known as the service users, participate in the working group. This enhances the contact with the users and potential demands are discovered so that high quality policies may be realized. Second, with regards to the framework, the Service Design is utilized. The Service Design is a service problem-solving algorithm based on the iterative thinking emphasized by design thinking. Since the issues of public service have become more complex as the user demand has become diversified, complex problems are solved by an integrated thinking system where divergent thinking and convergent thinking are performed repeatedly. Third, with regards to the methodology, the strategic methodology proposed by design thinking is applied to enhance co-creation by the members. From summarizing these features, the Gov3.0 Design Group may be considered as a valid research subject to verify the innovative possibilities suggested by open innovation based on design thinking in policy-making.

The present study was conducted with the case of Goryeong(name of location) project, which is one of the Gov3.0 Design Group projects conducted in 2016. This case study researches the causes of the

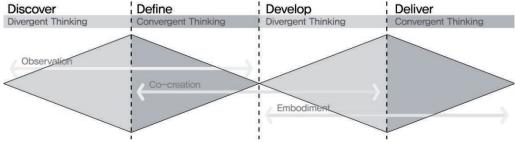
delivery gap in the educational support for students studying culinary art at Goryeong High School as the policy targets and proposes a solution to the problem (Table 1).

[Table1] Case-study Outline					
Title	Education	Overcoming Mismatch Between Characterization High School			
		Curriculum and Occupations			
Policy Target	Adolescents	Goryeong High School students majoring inculinary art			
Period of	Eight weeks	08.01.2016 ~09.23.2016			
Operation					
	Suppliers	Public servants (2 persons)			
		Students majoring in culinary art (4 persons)			
Working Group	Users	Teachers (2 persons)			
Organization		Parents of students (2 persons)			
	Experts	Service designer (1 person)			
		Experts in relevant field (4 persons)			

[Table1] Case-study Outline

The casestudy was conducted on the basis of Double Diamond, which is a type of service design framework. Double Diamond, which is defined by the UK Design Council, is recommended by the Ministry of Public Administration and Home Affairs operating the Gov3.0 Design Group because it has been evaluated as a framework optimized to public service design.

Double Diamond consists of "Discover", "Define", "Develop", and "Deliver" stages, where divergent thinking and convergent thinking are alternately repeated. Therefore, Double Diamond may be considered as an algorithm that reflects design thinking characterized by a repeated thinking process (Figure 1).



[Figure 1] Double diamond, Case-study Framework

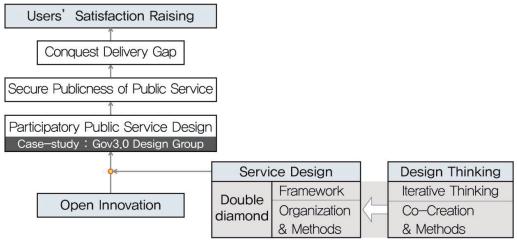
The goals of the individual "Discover", "Define", "Develop", and "Deliver" stages were defined, and the methodology to accomplish the goals was strategically chosen and applied (Table 2).



	Goal	Task	Methods
Discover	Discovering potential demand on the basis of empathy, and understanding of interest- based interaction between stakeholders	Understanding of service context through frequent contacts with service users and relevant stakeholders	_Desk Research _Field Research _Contextual Interview _In-depth Interview
Define	Definition of user types andproblemcategory,andestablishment of service goalsthroughthe summaryanalysis of information	Agreement and coordination to establish common service goals	_Relationship map _Persona _Customer Journey map _Stakeholders map
Develop	Development of balanced service solutions considering software, hardware, and networking	Establishment of strategies to develop service solutions in an integrating perspective	_Service Concept _Service Flow _Service Scenario
Deliver	Correction of errors and supplementation of service	Test of service	_Service Blueprint

#### [Table 2] Case-study Process & Methods

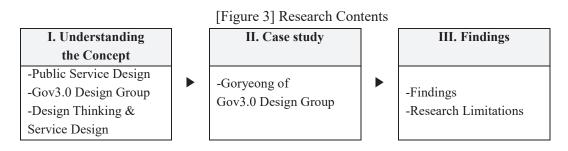
**Design**: The case study was conducted by using the service design that included the framework established by structuralizing iterative thinking, the main feature of design thinking, and the organizational structure and methodology (Double Diamond) that can maximize the effectiveness of cocreation. The case study was conducted to verify if the participatory public service design may contribute to the securing of publicness and new possibilities that the participatory public service design may suggest were discovered. In addition, the case study was conducted to verify if the satisfaction of public service users may be increased by solving the ultimate problem, which is the delivery gap (Figure 2).



<sup>[</sup>Figure 2] Research Design

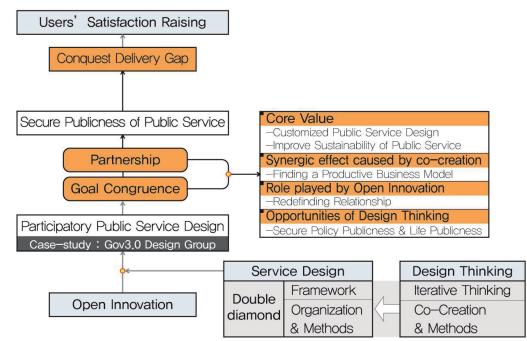
The research contents included three categories. Category I gave the understanding of the definition, delivery system, and purposes of public service, identified the problems of past public service design,

and introduced the concept of Gov3.0 Design Group as an alternative solution to the problems.



The characteristics of design thinking and service design were reviewed to understand why Gov3.0 Design Group should apply the service design techniques based on design thinking. On the basis of understanding the concept, Category II introduced the operation procedure of the Goryeong case, which is one of the Gov3.0 Design Group projects, to verify the logical structuring of user demands as well as the problems, opportunities, or possibilities involved in the application of the service design techniques to policy-making as a strategic tool. CategoryIIIsummarized and analyzed the results of the case study in Category II, listed the findings from the results, and suggested future research topics (Figure 3).

**Findings**: The findings from the case study were explained by using the study model (Figure 4). When open innovation based on iterative thinking and co-creation, which are the two highlights of design thinking, is applied to the citizen-participatory public service design, the members of the working group accomplish goal congruence, and the service suppliers and users ultimately form not a one-sided support relationship, but a partnership.



[Figure 4] Findings in Research design





From focusing on the changes in the relationship, specific answers to the research questions were found.

First, the core value delivered by a participatory public service design process is the development of user-customized service on the basis of community-based critical mind and the strengthening of service sustainability by promoting the will of voluntarily participating in public services.

Second, the synergic effect caused by co-creation in a public service design process is to develop an integrating service solution on the basis of coordination and agreement of mutual interest. The solution proposes a novel type productive business model that has been neither anticipated nor predicted.

Third, the role played by open innovation in securing the publicness of public service is to re-define the concept of the service supplier-user relationship by collapsing the boundary between service suppliers and service users.

Fourth, the opportunities where the application of design thinking may occur with regard to public service design include not only securing policy publicness through the accomplishment of public service transparency and publicness, but also the securing of the public life of service users in connection with the stabilization of the life and economic status of service users.

In conclusion, the open innovation based on design thinking may provide a process of re-defining the service supplier-user relationship, which in turn helps to overcome the problem of the delivery gap of the previous public service delivery system and operation process, thereby providing the driving force to increase the satisfaction of service users.

**Research limitations**: The present study is a practical research based on a case study and focuses on the findings from the process of planning and suggesting public service. Therefore, the present study is limited in quantitatively proving whether or not the users' satisfaction has been increased by the realization of the proposed policy.

Keywords: Public Service Design, Iterative Thinking, Co-Creation, Goal Congruence

Session-16-#309-3(SS18 & SS20 & SS29)

# **Collaborative Workshops for Design Development**

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#### Abstract

**Purpose/ Research Question**: This study was carried out with the view that the collaborative workshop with clients would be a desirable method to develop a proper brand system.

- 1. How can client and agency collaborate for brand system development?
- 2. How can agency expand its role for clients?
- 3. What is the collaborative workshop process?
- 4. What are the effects of the collaborative workshops?

#### Key Literature Reviews:

The development of brand systems is commonly left to external agencies. However, brand development is about creating a distinctive personality. The internal voice of the company should be taken as an important factor and reflected in the result. Collaboration between a brand agency and a client company is an indispensable element in the development of a successful brand system.

The recent emphasis on networked business models reflects that single companies cannot possibly master all the significant resources needed in R&D, production, and marketing.(Brigitte Gay, 2014). The need for a new approach for firms to deal with the increasing OI phenomenon in the form of strategies, business models, user innovation, collective intelligence, and crowdsourcing, is on the rise(JinHyo Joseph Yun\*, DongKyu Won and Kyungbae Park, 2016).

Client companies make a RFP(Request for Proposal) and brief which includes the background and context of their brand and objective of a project. They also use meetings, calls and emails for interaction, but it is not enough to fully derive inner issue and thoughts from client companies. More efficient and



creative collaboration methods should be sought.

With this challenge, this study was conducted to suggest a collaborative workshop of agencies and clients. The 'Collaborative Workshop' is combination of 'collaborative; and 'workshop'. Collaborative workshops are the process in which client and multidisciplinary experts gather together and collaborate to form ideas and discuss to solve challenges. It is aimed at revealing the inner thoughts of clients on their brand and deeply understanding the situation of a brand. It also derives the results with various directions. The effects of workshop are well known through previous research. According to John Kolko, the effects of the workshop can be revealed through dialogue rather than tied up with formal procedures, and participants can freely think about new ideas because they can discard concerns about the outcome. This study utilized the workshop method to develop more effective collaborative branding. It is expected to improve the brand development process.

The new brand development process was demonstrated through the process of a brand system development process of "Museum San", a museum in South Korea.

#### Design/ Methodology/ Approach:

As for the research, a methodology used is as follows: first, understand the research necessity by considering the characteristics of brand system development process and the change of collaborative work paradigm. Second, the brand development and collaborative workshop have been defined through literature review. Third, grounds have been prepared to validate the research, by analyzing and doing case study of SAP, a system service company. They carry out a collaborative workshop with clients to draw creative problem solving methods. The effect of collaborative workshop will be examined through a case study of how SAP utilizes the Design Thinking Workshop to collaborate with their clients. Fourth, the process and methods of collaborative workshop was customized and designed based on the contents of brand system and brainstorming. Fifth, the new brand development process was demonstrated through the process of a brand system development process of "Museum San", an art museum in South Korea. In order to prove the effectiveness of the collaborative workshop, this research analyzed the client's feedback to the workshop and changes in the number of the museum blog visitors after brand renewal.

#### (Expected) Findings/Results:

The process of the cooperative workshop is as follows. The workshop usually takes place in groups of several teams. In the team formation, client and agency including brand strategists, the specialists, and the designers is made in one team. A group leader or facilitator in agency should encourage clients to naturally express their opinions. The process of the workshop and its method of proceeding are as follows: understanding the overall context and background of the project, raising questions, developing ideas, presenting and sharing, and summarizing.

In this collaborative workshop, it is easy for the participants to draw out the key concepts of the brand. Participants collage keywords and images together and communicate with them, and draw ideas from various and appropriate perspectives within a short time of several hours. From the perspective of the agency, it can be used as an opportunity to find consensus with the client before reporting on the result, so it is more likely to produce high-quality results from the client, and it is easy to persuade them with appropriate results.

Through this collaborative workshop, agencies can present value to clients more than products or

services they have already provided. SAP is a software company, but works with clients based on design thinking and workshops to expand the client's creative possibilities. This new way of collaborating with SAP will create a powerful and lasting partnership(https://designthinkingwithsap.com). The work carried out by the Design and Co-Innovation Center (DCC) at SAP demonstrates how Design Thinking can be an effective problem-solving method regardless of the nature or size of a business. Clients come from various industries across the globe, including the food and beverage, agriculture, oil, biotech, news, and retail industries. To co-innovate with clients effectively, the DCC breaks down the complexity of Design workshop experiences, "DT Thinking into concise also known as Workshops." (https://experience.sap.com)

Agencies expand their role from providing clients with products, services, and tasks that they request to creating new value. There are cases in which client is expanded to recognize their internal identity or induce creativity for innovation.

#### A Collaborative Workshop for the 'Museum San' Project

This collaborative workshop was conducted on the development of a museum brand in South Korea. The museum, which was designed by Ando Tadao, had a unique surrounding environment located on the mountain. Prior to the development of a full-fledged brand system, museum staff and a branding agency including designers, brand strategists, and namists gathered together to conduct the workshop at the museum.

The client's idea on the collaborative workshop was taken into consideration to develop a new brand system of the museum. First, represent the distinctive environment of the museum being on the mountain. Second, express a tranquil atmosphere. Third, illustrate an image of oriental sensitivity rather than a Western one. These played a crucial role in helping to produce a result that had an oriental touch and mysterious emotions.

The effectiveness of brand development through collaborative workshops was verified through client feedback on the workshop and comparison of the numbers of visitors before and after the brand renewal. Clients said that they were able to communicate more smoothly through collaborative workshops, and inside people had the opportunity to think deeply about the project. The concept, mountains and reflection extracted from the workshop was used for their cultural and educational events such as an art camp called Mountain, Light, Art, and Emotion and a meditation experience event.

#### **Research limitations/ Implications:**

The effectiveness of the collaborative workshop with clients can be summarized as follows. First, the collaborative workshop is a method in which, the whole brand development process of definition and expression is done to get solutions in a short period of time. Second, the collaborative workshops provide brand strategists and designers a deep understanding of the brand, including the context in which the brand should be positioned. Third, in the collaborative workshop, experts from various fields such as brand strategists, verbal branding experts, and designers participate not only in the clients but also in the clients.

The collaborative workshops proposed in this study can be used in areas where all innovative ideas are needed, but not necessarily in all processes. It is surely a good method for branding to naturally draw out the inner thoughts of the brand owners and to discover the possibility of the brand. Therefore, it will be





helpful in the field of brand development. The proposed workshop process and techniques should be tailored to the situation and in a variety of ways. In a follow-up study, a quantitative survey of the effects of cooperative workshops will be conducted. With this workshop model, the total brand development process and method should be improved according to the needs of the times.

Keywords: Collaborative Workshops, Role of Agency, Brand System Development Tool

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# An empirical study on Taiwan enterprises' open innovation activities and their added value

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#### Abstract

With an era of razor-thin profit margins that Taiwan's industries have allegedly been through, this paper aims to comprehensively examine the relationship between Taiwan enterprises' added value and their open innovation activities. In doing so, an econometric model based on the panel data constructed<sup>1</sup> is employed and an innovation survey with revision of Oslo Manual framework is conducted to analyze the nature of Taiwan enterprises' innovative activities and the underlying factors for added values. The econometric model shows that Taiwan's industry has experienced decline in value-added ratio, particularly in information technology (IT) industries. In addition, the survey shows that the main components of firms' innovative activities are in-house R&D, acquisition of embodied technologies, and product designs. Major obstacles to the implementation of innovation activities are mainly due to the lack of skilled manpower and the excessively high cost of innovation.

Keywords: value-added, innovation activities, open innovation

#### 1. Purpose/ Research Question

The achievement of Taiwan's economic development has been paved on its flexible manufacturing capacities to adjust promptly and swiftly in the changing global business environment. For example, information technology (IT) sector was highly beneficial to the business model through using contract manufacturing for major international corporations, such as Original Equipment Manufacturer (OEM) orders. However, the volume of added value of Taiwan industry has been allegedly deteriorating due to the meager marginal profits derived from constant slashing of costs (Chen and Liu, 2005; Kung and Lee, 2004). Moreover, while competing with products from developing countries, the commonly seen "razor-thin profit" situation became worse. Therefore, this turns out to be a vital issue in terms of how to progress toward the high value added development and innovation-based industrial analytistic transport further envertice of a added development and innovation-based industrial analytistic of the envert further envertice envertice of a added development and innovation-based industrial analytistic of and competitive associates in a constant slashing of costs (Chen and Liu, 2005; Kung and Lee, 2004). Moreover, and the high value added development and innovation-based industrial analytistic of and competitive associates in the projects "The Evaluation and Analysis of National Innovation-based industrial analytistic of and competitive associates in a sponsored and eveloping attracting and the development is provided, attracting and a value added value is a sponsored and eveloping attracting and the sponsored and eveloping countries in the adveloping of industrial fraction of the developing attracting and the value is a sponsored and eveloping attracting the adveloping attracting and the value is a sponsored and the provide attracting the adveloping attracting and the value is a sponsored and the provide attracting the adveloping attracting and the value is a sponsored and the provide attracting the adveloping attracting attracting





(VA) has not been fully explored. Therefore, this study intends to the expanding literature on the linkage between industrial added value and innovation by providing evidence on the components and characteristics of industrial added value of Taiwan enterprises.

DGAST

Since the estimation of how much added values have been created in the innovation process is inadequate because of the complex process of commercialization process, an identical specification of the model and an identical method are required to explain heterogeneity of added value in the process of innovation. It must be noted that this study does not attempt to estimate the causal effect of innovation investment on the added value of innovation output or the causal effect on firm performance. Instead, we explore the underlying factors of added value behind Taiwan enterprises' open innovation activities by developing an econometric model and complement this with the survey carried out in Taiwan by the Taiwan Institute of Economic Research (TIER).

#### 2. Literature related to the measurement of added value and innovation

#### 2.1 The measurement of industrial added value

The continuous debate over the sources of long-term economic growth has shed light on the role of innovation. In neo-classical economics there is a subsequent and strong research commitment on investigating the influences of specialization and division of labor on economic growth since Adam smith (1776). From neoclassic point of view, the process of endogenous economic growth shall converge to a final state of equilibrium. The considerable explanatory power in new-classical economic model is based on the conditional convergence due to the assumption that the economic world is a mechanistic perspective which implies determinism and predictability (Castellacci et al., 2005).

The role of technological progress is recognized by neo-economists as an exogenous factor in the long term equilibrium growth. Neo-economists emphasize the importance of real capital accumulation, saving rate, population growth and technological progress as exogenous factors that influence the growth of economics (Solow,1956; Swan, 1956). However, with the predictive characteristics of conditional convergence, the problem of technological exogeneity remains. Therefore, in an attempt of resolving the problem, new growth theories endogenize technical progress as the driving force, thus modifying the production function. Romer (1986) facilitates a competitive equilibrium model of long-run growth as primarily driven by endogenous technological change and the accumulation of knowledge which have increased marginal productivity. In his modeling framework, long-run growth is primarily driven by the accumulated by devoting resources to research through forward-looking profit-maximizing agents.

With this framework, Romer (1987) further specifies the model by introducing R&D theory and imperfect competition into the growth model. By assuming that a production function requires an imperfectly substitutable and intermediate input developed by an R&D sector, economic growth would be mainly driven by such factors as saving willingness, production function (subject to the impacts of taxation or other government policies), R&D costs, and economy of scale. As for the role of technological progress, Romer (1990) argues that, as the major driving force of economic growth, technological progress would be benefited from intentional R&D activities, which would require inputs of human capital and other intermediate products. The availability of which input factor therefore would affect technological progress. Similarly, both studies of Grossman & Helpman (1991) and Aghion & Howitt (1992) confirm that technological progress affect the quality improvement of intermediate and final products, particularly the role of technological transfers from the leading countries to the developing ones.

However, a major problem in neo-classic equilibrium frameworks is their conceptual formalization. The existence of price and/or quantity is based on the adjustment mechanisms within deterministic closed-systems when mathematical models are available for dealing with (Dow, 2000). In this case, with the deficiency of continual technological progress is assumed to be exogenous, the prediction for the growth under the concept of equilibrium in deterministic closed-systems would come to an end. Therefore a lot of interests and insights have been attracted by the Schumpeterian theory in the study of economic growth which focuses on the central role of innovation for the process of economic development.

To correct this deficiency of neo-classic equilibrium frameworks, the economic analysis of evolutionary growth has been based on an open-system approach (non-deterministic) and more evolutionary micro foundations (Dosi, et al., 1988). Evolutionary economics conceive the economy as a never ending and ever changing process, and emphasizes that "growth is an evolutionary process". The innovative behavior of a firm with different technologies and organizational character interrelate under a set of investment decision scheme linked to "selection environment" of the persistent disequilibrium (Dosi, et al., 1988). According to

Schumpeter (1942), innovation and selection are the two main forces of growth and the competitive environment within which firms operate is dynamic. This in turn will affect firms' innovative behavior due to the fact that the decisions of innovative entrepreneurs on investment and innovation are selective ones. In short, evolutionary theory intends to model the firm as having certain capabilities, decision rules and selection sets. Thus, the core concern of evolutionary theory is related to the dynamic process that firm behavior patterns and market outcomes are jointly determined over time. From the point of view of evolutionists, more explicitly foci highlight the micro foundations of innovation by addressing firm-level decisions to invest in product or process innovations. The main contributions of above literatures are identification of the role of innovation and technological progress in economic growth. Consequently, while evolutionary economics focus on the micro foundations of firm-level innovation, which will be investigated by survey method in this paper, innovation also can bring significant productivity gains (added value) to upgrade the competitiveness of a nation from neo-economics' viewpoint.

#### 3. Design/ Methodology/ Approach:

#### 3.1 Econometric analysis of added value

High added value is not only created by the utilization of new technology into new products, but also can be made from various dimensions, such as employment and depreciation. In general, value added is defined as sales less the cost of bought-in materials, components and services (DTI value added scoreboard)<sup>2</sup>. However, this definition cannot be used to standardize the estimates of value added when some countries do not publish sufficient information in terms of bought-in materials. Since the limitation of audited company annual reports in Taiwan, a firm's nominal value-added is calculated by the summation of its gross profit, employee salary, and capital depreciation cost.

In terms of R&D activities, the enhancement of R&D not only can enlarge the scale of production due to the technological improvement, but also enlarge the value or price of products due to improved quality. In addition, branding efforts can enhance products' relative prices even when other tangible inputs being equal. Therefore, the analytical focus of this report is placed on measuring the contribution of R&D and branding activities.

Investigating the contribution of innovation to the growth of added value is a challenging task due the fact that innovation involves much broader and diverse activities than R&D. All entrepreneurial actions leading to the increased value-added can be perceived as innovation activities. In this regard, except for pure capacity duplication through expansion of labor and capital inputs, value of innovation is defined as the increased value-added resulting from innovation activities. Moreover, we attempt to overcome this limitation by conducting an innovation survey when R&D expenditure is not able to present the realities of firms' innovation activities. These quantities are extracted from an annual report of Taiwan is shown in Table 1 of the analysis

Variable		Variable/Proxy Definition	Data Source
Y	Nominal Value Added	Total of gross profit, employee salary, and depreciation cost	
R	Process and product innovation	R&D expenditure	Listed Firms' annual
L	Labor Input	Employees' salary	financial reports
Κ	Capital Stock	Property depreciation cost	
М	Branding and Marketing Input	Marketing expenditure	

Table 1 Regression Variables, Definitions, and Data Sources

Source: Collected by the authors.

To sum up, these panel data are extracted and calculated from Taiwan Economic Journal Data Bank which is based on the database of Taiwan Stock Exchange Corporation. Annual financial reports for 1109 listed manufacturing companies and 66 service companies were collected to obtain the required data for analyzing the impact on entrepreneurial value-added of R&D expenditure, employees' salary, capital, branding and marketing investment, after excluding those with incomplete data sets and market-channel firms.

<sup>&</sup>lt;sup>2</sup> Value added is calculated from a company's accounts as following formulation:

Value added= Operating Profit+ Employee costs+ Depreciation+ Amortization.





It must be noted that the estimates of value added are expressed in various measures and in the ratio form<sup>3</sup>. To avoid the effect of size of market and industrial scale, the indicators are divided by net sales for the purpose of statistical analysis.

#### 3.2 Innovation survey

Since innovation activities take place in all parts of the economy, we take all industries into consideration. The target population for innovation surveys is involved with listed corporation from all industries so that the results can be grossed up and comparisons can be made. In the case of sample surveys, the sample frames should correspond as closely as possible to the target population. We collect data on listed corporations, which R&D budget are over 10 million NTD or sales are over 30 billion without R&D spending record. In order to ensure a satisfactory response rate, we keep the questionnaire as compact as possible; and clearly formulate questions as well as instructions; and express the formal definitions in an appropriate and meaningful arrangement to all industries' respondents. To sum up, total 1200 corporations were selected and 120 questionnaires were received (response rate is 10.25%). Corporations from ICT industries accounts for 40%, both machinery and chemical industries account for 21%, service industry accounts for 11%, and householder industry accounts for 7 % respectively.

#### 4. (Expected) Findings/Results:

This section intends to analyze the effect of innovations on industrial value-added in Taiwan. In doing so, we develop multi-variable regression model and analyze data from the annual financial reports of the listed companies in Taiwan's stock exchange market to investigate entrepreneurial activities of value creation.

#### 4.1 A simple model

Since the impact of innovations could be reflected in the quantitative increase of production as we reviewed literature in section 2, this section intends to investigate the industrial value-added of innovations measured by the real output level as well as in the qualitative improvement. In doing so, Kung and Lee (2004) theoretical model is adopted to develop a regression analysis. In order to further conduct the statistic inference, the econometric model is derived as follows from the above theoretical model:

 $\ln Y = \beta_0 + (\gamma_1 + 1)\beta_1 \ln R + \alpha_1 \ln L + (1 - \alpha_1 + (\gamma_1 + 1)\beta_2) \ln K + \gamma_2 \ln M + \varepsilon,$   $\ln(\mathbf{VA}) = \mathbf{c} + \mathbf{a}^* \ln(\mathbf{L}) + \mathbf{b}^* \ln(\mathbf{K}) + \mathbf{d}^* \ln(\mathbf{RD}) + \mathbf{e}^* \ln(\mathbf{M} \text{ or } \mathbf{AD})$ where  $\beta_0$  depicts the intercept of the regression, and  $R \cdot L \cdot K \cdot M \cdot \varepsilon$  represent respectively

the R&D input, labor input, fixed capital stock, marketing and branding input, and error term. Note that given the cross-sectional data of year 2004 and 2005, every firm would face the identical economic cyclical impact, thus excluded from the empirical analysis. Also note that the cross-sectional data of two year period is assumed to render of no difference in using relative prices or nominal prices for our empirical study (Kung and Lee, 2004).

For the dependent variable Y, the nominal value-added data of listed companies in the Taiwan stock exchange market is used.<sup>4</sup> For the independent variables, listed companies' R&D expenditure data in their annual financial reports is used for the R&D input variable R; the employees' salary in a listed company is for the labor input variable L; the figure of property depreciation in a listed company is for the fixed capital variable K; for the variable of branding and marketing input, branding is determined by the listed company's marketing expenditure in its annual financial report.

#### 4.2 Empirical result

This section intends to demonstrate the empirical results from econometric model. The industrial

# <sup>3</sup> value added efficiency = $P_2(\%) = \frac{Total \ value \ added}{Employee \ cos t + Depreciation}$

<sup>&</sup>lt;sup>4</sup>A firm's nominal value-added is calculated by the summation of its gross profit, employee salary, and capital depreciation cost.

sectors are classified by the standard industrial classification system of the Republic of China<sup>5</sup> (Revision 8, 2006). To begin with, regarding to the discussion of each input component, the impact of R&D expenditure on firm's value-added performance is positive and significant (significant level of 5%), except for optical instruments and service industries. Secondly, capital effect is not significant in chemical, information and communication, and service industries.

Thirdly, regarding to the component of labors, employees' salary on firms' value-added performance is positive in most of the industries expect metal-machinery, semiconductor and information and communication. Moreover, the elasticity coefficients of transportation and storage and optical instrument industries are among the highest, reaching 3.45 and 2.175, respectively. This may infer that the highest benefit of the employees salary on the creation of added value. Finally, the impact of marketing and branding is not significant in metal-machinery and service industries.

To sum up, the result shows that the impact of R&D investment is beneficial for firms' value-added performance in most of industries expect in service industries, though the respective extent varied. For overall ICT industries, the elasticity coefficient is 0.862, meaning that per dollar of R&D investment may generate 0.862 in added-value due to the resulted technological improvement. Particularly, the coefficient in information and comm. industry is 3.1, which implies that R&D investment should bring them the greater added-value than that of other industries. In terms of branding and marketing, our result shows that only metal-machinery and semiconductor industries do not have significant effect on firms' added-value performance. This infers that these two industries produce intermediate goods; branding and marketing may not contribute much on their value-added. On the other hand, the coefficients in branding/marketing and employees categories are positive and significant in most of the cases; it implies that the innovation investment in 'soft' infrastructure within companies should not be overlooked.

Industry	n	Intercept	Branding & Marketing	Fixed Capital	$\frac{1-\alpha_1}{\text{Employees}}$	R&D Expenditure
ICT	494	0.128*	1.081*	0.714*	0.65*	0.862*
Chemical industries	87	0.126*	0.611*		1.262*	1.122*
Household industries	53	0.075*	0.692*	1.512*	1.167*	1.236*
Metal-machinery industry	81	0.111*		1.277*		2.925*
Computer & peripheries and	117	0.07*	0.094*	1.032*	1.469*	1.163*
Optical instruments	47	0.108*	1.863*	0.681*	2.679*	
Semiconductor manufacturing	66	0.182*		0.38*		0.694*
Information and Comm.	38	0.042*	1.432*			3.1*
Biotechnology	33	0.182*	0.509*		1.157*	0.859*
			•	•		•
All service sector	63	0.181*			1.828*	
Wholesale and Retail	16				1.981*	
Transportation and Storage	14				3.45*	

Table 4 Regression Findings of Impact on Industrial Value-Added

Note: (1) \* significant level of 5%

#### 4.3 The dynamics and evolution of innovation activities

In this subsection, we inquire about what kind of innovation activities Taiwanese enterprises mainly focus during three different periods, namely, before 2002, 2003-2005, and 2006-2010. According to table 2, before 2002 Taiwanese enterprises ranked production/supply/operation technique improvement, equipment use and operation method learning, and short-term new product development as top priorities; however, in 2003-2005, the priorities of innovation activities evolved into medium term product/production

<sup>&</sup>lt;sup>5</sup> please see <u>http://www.dgbas.gov.tw/public/Attachment/791216474871.xls</u> for detail





process research and development, specifically, near 40% of enterprises were expecting to invest in developing next generation product and production processes.

When we asked Taiwanese enterprises to project their next 5-years (2006-2010) innovation activity priorities, the focuses of their innovation shifted towards developing long term frontier/basic science research for next generation products and services, establishing business model and building brands (also see table 2).

Period	Examples of innovation	%
	1)Carry on improvement on existing technique	21.24
Before2002	2)Short-term R&D (one year) on innovation and prototyping	21.14
(include	3)Accumulate related skill and technique for production/supply/delivering	20.35
2002)	4)Learning operating procedure of new equipment	19.91
	5)Integrate production/supply/deliver technology and engineering support	17.92
	1)Carry on improvement on existing technique	38.94
	2)Research on mid-term product and production process	38.18
Year 2003- 2005	3)Develop mid-term product and production process	37.73
2003	4)Short-term R&D (one year) on innovation and prototyping	34.09
	5)Developing frontier/basic science research (next generation product and service)	32.27
	1)Developing frontier/basic science research (next generation product and service)	39.77
Year 2006-	2)Establishing new distribution or delivering method /new business model	34.73
2010	3)Research on mid-term product and production process	34.32
	4)Establish own brand	34.07
	5)Develop mid-term product and production process	33.64

Table 2 Top 5 priorities of innovation activities over different periods

Note: This question contains 10 options with duplicate selection frame

#### The impact of innovation activities on enterprises

Inspecting from intellectual capital point of view, the impacts of innovation activities on enterprises can reflect upon the gains on the following four aspects: process capital, relationship capital, human capital, technology innovation capital. The accumulation of above tangible and intangible assets aggregates to the final outcomes in generate competitive advantage and value creation.

According to the survey, the impact of innovation investment and activities on enterprises has been visible. On the average, innovation activities have positive contribution to all four aspects, while slightly higher impact on the process capital and technology innovation capital aspects can be observed. As to the impact on generate competitive advantage and value creation, increasing profitability and market shares are the highest while the impact on "increasing loyalty income" is the lowest.

The scope of Effect	Effect     Items	
Process capital		. ,
	Improving product and service quality	2.65
	Improving production or service providing flexibility	2.62
	Increasing production or service providing capacity	2.50
	Increasing product or service speed of delivery	2.40
	Reducing labor cost of per unit output	2.36
	Reducing production lead time	2.32
	Reducing operation cost on service providing	2.29
	Reducing cost of product design	2.29
	Reducing consumption on material and energy	2.24
	Improving information technology capabilities	2.22
Relationship capital		
	Increases abilities in accordance to the different customer demand	2.55
	Reducing response-time to customer demand	2.53
	Developing the better customer relations	2.41
	Improving enterprise internal knowledge sharing and transmission	2.26
	Improving communication and the interaction between the	2.24
	Increasing knowledge sharing and the transmission with between	2.23
Human capital		
	Enhancing human resources leaning capability	2.40
	Increases the structural density of high-level human resources	2.34
	Promoting human resources professional skill	2.30
Technology innovation	capital	
	Achieving industry technology standard	2.48
	Achieving average industry technical level	2.46
	Establishing new product and system integration technology	2.45
	Achieving technology independence or reducing technology dependence	2.45
	Establishing capability to develop key component, material and mass production technologies	2.37
Generate competitive a	dvantage and value creation	
	Increasing profitability	2.62
	Increasing market share	2.62
	Raising shares of new product and service to total sales value	2.45
	Establishment new spin-off enterprises	2.26
	Increasing loyalty income	

Table 3 Impact of innovation activities on enterprises

Note: Score (0-4) are measured by five likert-type ordinal categories, that is, 0=less important and 4=most important.





To sum up, firstly, production innovation and product designs are the main components of firms' innovative activities. Overall these innovation activities are commonly intramural. Secondly, factors influencing firms' innovation activities are analyzed through the importance of value activities on firms' decisions to innovate. In general, technology development, application research and mass production test are the top three targets assigned to Taiwanese enterprises' value activities. Thirdly, major impediments for enterprise to take on innovation are lack of high quality manpower and insufficient internal innovation capability. In addition, Taiwanese enterprises also take the economic factors, such as high innovation cost and excessive risk, and the uncertainty of market demand, into consideration with respect to whether prolong or withdraw from the innovation activities.

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#### 5. Conclusion

This paper examined the value-added performance and Taiwanese enterprises' innovation activities from both econometric analysis of added value and innovation survey. We identified major challenges to the growth of industrial added value, and discussed trends and characteristics of Taiwanese enterprises' innovation activities that may affect its future development. The findings have led to some general conclusions about the theoretical and policy implications of Taiwan's experience.

Firstly, the previous analyses of Taiwan's industrial added value reveal several factors that contribute to economic development. These factors consist of two categories. The first category includes factors such as the capital and labors. The second category refers to the Taiwan enterprise innovation activities such as branding & marketing, process & product innovation. When we consider value creation as a crucial factor in knowledge based economy, the empirical evidence shows that the growth of Taiwan's industrial added value depends on scale expansion more than innovation activities. These observations could be inferred as a warning sign with regard to the long-term growth on added value, and a need for readjustment in policy actions to encourage innovation.

Secondly, survey results show that, in Taiwan, most of enterprises managed to create their value mainly through expanding factors of production, and some also go through company self-financed innovation activities, such as in-house R&D and acquisition of embodied technologies. However, the devotion of product and process innovation is generally larger than that of branding and marketing. In addition, innovation investment appears to be one of high risk methods for uplifting of entrepreneurial value-added performance in the survey. Thus, the results raise an issue related to the negative side of Taiwan's development, especially related to the decline of added value of Taiwan IT related industries, which is also echoed by econometric evidence.

Thirdly, in addition to the past development experience and lessons, the challenge of decline industrial added values should not be overlooked. Given the econometric framework of added value we have analyzed and some superficial insight in innovation survey, this leads to the needs for the reform in the allocation of financial resources that provide stronger 'incentive mechanism' to simulate the relationship between technological advancement and industrial development in order to upgrade Taiwan enterprises' innovation activities. For example, government increase monetary rewards of outstanding or good research in industrial technology, including encouraging more active interaction between academics and industry, experts exchange, or the formation of R&D alliances among groups of small- and medium-sized enterprises, particularly those in previously different industries. Therefore, the technology capabilities of Taiwan enterprise can be upgraded through a wide range of policy actions.

The limitation of research should be noted that the report has been separated into two parts of empirical works. Since the survey can provide complementary evidence to the added value model as well as a variety of information in terms of enterprise innovation activities, the study may not fulfill academic rigor in some methodological coherence. From this perspective, what have been reported are some preliminary observations. We hope that these issues can be debated and qualified. Since the empirical studies are more adequate for understanding the current situation where there is a growing need for both strengthening the policy effort for innovation and value creation, the implications of the combined evidence on theoretical development should be interpreted with caution.

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Session-16-#309-3(SS18 & SS20 & SS29)

# An intellectual property service Ecosystem for Chinese small and medium sized enterprises based on Incentive mechanism: A case of Mashan County

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#### Abstract

#### **Purpose/Research Question**:

Small and medium-sized enterprises(SMEs)have faced various difficulties in carrying out innovative activities. There is a lack of capacity for effective planning and management of intellectual property development due to limited resources. It is difficult to raise for the patent R & D and transformation since the restricted scale of operation. The weakness of risk tolerance is caused by the size and level of funding of SMEs, which makes it difficult to sustain the innovation providing the absence of external support. Conditions have become more irritating when coming to accurately grasp the trend in technological development due to the fact that SMEs' access to intellectual property information is narrow. Later, the intellectual property disputes are going to occur and it is difficult to detect even though the infringing phenomenon has happened, which leads to the loss of results. As a consequence, facing the difficulties in the innovation activities of SMEs, this paper take Mashan country as an example, studying how to solve SMEs' problems in the process of innovation with the help of the intellectual property services provided by the government and intermediaries. In this way, SMEs will overcome the difficulties of intellectual property development in the profit process of profit. Furthermore, this paper explores the special demands of SMEs, and build a new model of intellectual property service.

#### **Key literature Reviews:**

The service system of intellectual property is based on patents, trademarks, copyrights and other intellectual property rights system, as well as the relevant laws and regulations. It takes government

departments, agencies, universities & research institutions, services and intellectual property trade association and other organizations as the service carriers, and uses high-tech enterprises innovation of intellectual property rights as the main service objects, to provide agents, assessments, pledges, risk investments, early warnings, exhibitions & trades, licensing, trainings, litigations, rights, information service institutions and social resources for the society. From the perspective of service contents, the service system of intellectual property mainly includes the creation of intellectual property, circulation (using), protection and intellectual property rights of human resources services. Specifically speaking, it can be divided into six aspects, intellectual property agency services, intellectual property information consulting services, intellectual property transaction services, intellectual property financial services, intellectual property legal services and intellectual property talents cultivation(Hong QL,2011).

After 2011, a number of policy documents on intellectual property services in China have been introduced, and the intellectual property service industry has been brought into the category of high-tech services. Intellectual property services have received extensive attention from the public, which have experienced an unprecedented historical development stage. China's intellectual property services to further expand the scope of services extends to intellectual property agents, laws, information, consulting, business, trainings and other fields. Emerging intellectual property business model in the market to accelerate the emergence of the industry has entered a rapid development of the uplink channel. The development of intellectual property services as a whole are also gradually by the social cognition. The contribution of SMEs to GDP, the employment opportunities and the creative ability, make it play an important role in the development of the national economy. Promoting the innovation of SMEs is an important part of building an innovative country in China. The system of intellectual property has an important incentive for innovation, and the good use of intellectual property is the main performance of the innovation ability of SMEs(Mao H & Mao JS,2013).

In the aspects of patents, trademarks, copyrights, technical standards, trade secrets, independent brands, the use of SMEs in China is not as good as large enterprises. In the use of patents, copyrights, technical standards, SMEs has the largest gap with the large enterprises. To patent, for example, 52.7% of large enterprises to apply for a patent, 22.6% of medium-sized enterprises to apply for a patent, and small enterprises to apply for a patent is only 8.8%. Therefore, large enterprises patent application ratio is 2.3 times of medium-sized enterprises, is nearly 6 times of small businesses(Xia W & Liu XH,2010). For SMEs, the use of trademarks, protection of technical secrets, independent brands are better than patents, copyrights and technology standards.

In this regard, the academia has researched of SMEs innovation activities of intellectual property using, protection and other aspects, concluded that SMEs have some shortages of resources in the use of intellectual property. First, the human resources are not strong enough. SMEs are limited, as it is difficult for them to form an independent intellectual property department as large enterprises, causing the lack of effective planning and management of intellectual property development(Xia W & Liu XH,2010). Second, it is lack of funding. SMEs operate in a small scale, so it is difficult to raise the funds for research, development, and transformation. Patent research and development is a certain degree of risk





and external activities. The size of SMEs and the level of capital determines its risk bearing capacity is low. In the absence of external support, innovation activities cannot be sustained. The third point is the lack of information resources. General large enterprises in the development of proprietary research and development activities are often collected the specific filed of information and data to develop programs to avoid patent activities may exist in the infringement. At the same time, in the late stage of the patent maintenance, they will also be actively concerned about the dynamics of the relevant competitors to protect their rights in a timely manner(Mao H&Mao JS,2013;Xia W & Liu XH,2010). SMEs obtain information on intellectual property with a narrow channel, so it is difficult to timely and accurately grasp the trend of Technological Development in the field of late. It is also likely to lead to intellectual property disputes, even when violations are difficult to detect in the late stage, causing loss of results. Meanwhile, there is a lack of effective information communication mechanism between the intellectual property service organizations of SMEs and SMEs. On the one hand, SMEs in patent service has a strong demand, and they need to guide the patent activities by means of external force. On the other hand, patent agencies also have their own development needs. The two sides lack of effective communication in the current intellectual property service system, so that information asymmetry is a common phenomenon.

To sum up, the innovation ability of SMEs is weaker than large enterprises, failed to make full use of the intellectual property system, causing the use of intellectual property in the presence of obstacles. So far, there is still a lack of intellectual property service models for SMEs. Therefore, how to solve a series of problems in the use of intellectual property rights of small and medium enterprises is an urgent problem to be solved.

#### Research design / Research methodology / Approach

This paper use the survey method and case study. We take the science and technology of SMEs in Mashan county as the research object, analysis of the characteristics and special needs of SMEs, combined with the different stages of the development of enterprises' patent, try to build a multi-agent and multi-stage dynamic intellectual property service mode.

**Research design:** In this paper, the patent activities of SMEs are divided into R & D stage, transformation stage and application & maintenance stage.

R&D stage: Intellectual property service institutions should provide professional information analysis services. Through the development of patent retrieval, navigation, providing patent information platform and other services, to enable SMEs to grasp the direction of R & D, based on market demand, in order to make a reasonable planning for R & D. At the same time, we should widen the patent information acquisition channels of SMEs. In view of the limited independent innovation ability of SMEs, fully promote the enterprises and universities, research institutes and other external institutions to conduct joint. Allows multi subject to participate in R & D, to be able to integrate all aspects of the advantages of resources.

Transformation stage: Most of the SMEs lack of funds in the process of patent transformation.

Intellectual property service institutions could guide enterprises to raise the corresponding funds through the intellectual property pledge financing. On the other hand, the intellectual property services could help enterprises to transfer or license the patents which are not transform into product now, to obtain revenue. Intellectual property services usually grasp resources and information of enterprises, so, they can promote SMEs to patent licensing or transfer to the other organizations. In the process of improving, the bargaining power of enterprises will be increased.

Application & Maintenance stage: Through patent navigation services, to guide enterprises to carry on R & D in the core area, and gradually form a patent group in the field, in order to enhance their competitiveness. The intellectual property services help the SMEs to transfer the patent technology into their own intangible assets, and to grasp the new trends in the field of patent and new products. In addition, intellectual property services can also help SMEs to conduct rights of patent infringement in time.

#### **Research Process:**

(a) The effect of multi-agent cooperative of intellectual property service on the innovation of SMEs

Market participants include SMEs and intellectual property services. Science and technology SMEs committed to technology research and development, in order to enhance the innovation capability of the enterprises and the profit level as the ultimate goal. Intellectual property services providing intellectual property information analysis, navigation, early warning, rights and other services. The main source of income of intellectual property services is through guiding the enterprises to develop intellectual property rights, and from the relevant government departments in the project funding. Intellectual property services as the market participants, their ultimate goal is to maximize revenue. Because of the externality of patent activity, the government needs to regulate and control the government through a certain means. The government through the project support, financial assistance and other means to support the enterprises and institutions, the ultimate goal is also to maximize the social benefits.

(b) The effect of incentive mechanism on multi-agent cooperative of intellectual property service

In this paper, we explore the new cooperation mechanism between intellectual property services and SMEs to deepen the cooperation between the two sides. In the new model, the agencies not only can obtain financial support from the government, but also can get a share of the profits by taking risks with the enterprise. There are two benefits to added the agencies into the enterprise's patent activities, on the one hand, can reduce the risk of SMEs, on the one hand, can guarantee the quality of patent services.

#### (Expected) Findings/Results:

According to the characteristics and requirements of SMEs, in this paper, we build a multi-agent and multi-stage dynamic model of intellectual property services. The model is linked to multiple agent (government, finance, science and technology intermediary institutions, scientific research institutions) through incentive mechanism, and adjusted according to the different stages of patent activities of small and medium-sized enterprises. This paper puts forward the intellectual property service model for small





and medium - sized enterprises, and makes suggestions on the development of intellectual property finance and intellectual property service industry, and provides reference for the decision-making of relevant government departments.

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SMEs, intermediaries, universities and scientific research institutes formed by the innovative ecosystem are connected by incentive mechanism, solving multiple problems when SMEs using intellectual property rights. In this new service model, apart from the initial financial supported by the government, participants can also further share the proceeds after the success of innovation. With the market players' feature of profit-driven, the service organization will cooperate with the most potential SMEs and try to make SMEs to optimize the innovative effect, searching for a way to enable government funds allocate rationally and effectively.

Additionally, we would like to note that the innovation of service content in intellectual property has been contained in this paper. The traditional intellectual property services mainly focused on a certain aspect among patent application, information analysis and navigation early warning. Contrarily, this paper has put forward a new model according to the characteristics of different stages of patent activities, which integrates the demands of enterprises and provides dynamic services during multiple stages to suit the patent activities of enterprises.

#### **Research limitations/ Implications:**

Although much progress has been achieved in this paper, we can't deny that there is still some shortcoming in this paper. On account of the fact that the incentive mechanism involved has much to improve and further researches should be conducted regarding the behavior of market players, the practice stage is uncertain. In the following research, we will continue to make up for deficiencies and investigate and analyze the market players' reaction effect to different incentives, exploring a more complete service model.

**Key word:** Small and medium sized enterprises(SMEs); Intellectual property services; Incentive mechanism, knowledge innovation ecosystem

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# An Empirical Analysis for The Application Level of Chinese Internet Big Data Ecology: An Entropy Approach

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#### Abstract

With a Chinese 13th Five-Year plan putting forward the National Big Data Strategy, almost all levels have been developing rapidly in the Internet Big Data Ecosystem(IBDE). The paper attempts to make an extensive definition of Internet Big Data, its ecology. An assessment of Big Data value is also provided based on a managerial point of view. An essential part of the big data ecosystem, the "application layer" directly facing to the public users, resulting in the so-called big data feedback effect from the user side to reach the end of the enterprise and the government. Based on CNNIC reports, an entropy analysis of the statistical data is trying to explain the evolution characteristics of application layer structure in IBDE during the process of its development, and thus reflecting the structure of public users' preference evolution. The paper found that the newborn cluster in the application layer structure contributes to the increment of the entropy through the analysis of Shannon entropy with concatenated substitution method, although the newborn cluster cause the rising of the degree of disorder. However, that the current stage on the left side of an inverted "U" type structure is perfectly aligning with National Internet Big Data innovation strategy and with the development of Innovation Economy Strategy, Public Innovation & Entrepreneurship Strategy, is of vital importance in dialectically and rationally viewing the geographical increase of the system entropy. The government should be encouraged to promote the Internet Big Data industry innovation, to pay attention to the construction of the fundamental level of the ecological system, to pay attention to the alteration of consumer demand level, by means of policy coordination. The appropriate performance assessment to commercial organizations innovation, and positive effects on industrial ecosystem caused by government information disclosure, and guarding against and preventing the abuse of open government information by commerce and individual as well.





**Purpose/research question:** The paper attempts to define the nature and scope of Big Data from the characteristics that currently widely recognized; to make a quantitative description of the value of Big Data; to describe and summarize the application layer of big data ecosystem; to analyze and identify the pattern of structure evolution of the IBDE (Internet Big Data Ecosystem) with an entropy approach; to reflect the structure of public users' preference evolution; to provide suggestions and solutions to the development of China Internet Big Data ecology in a sustainable way.

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[research question] The entropy structure and evolution of the IBDE application layer; the inverted "U" curve of the entropy and its incompleteness; the cause of the inverted "U" curve and the meaning behind it; the solution to a sustainable growth of IBDE.

Key literature review(3-5 papers): China has been starting its implementation of innovation strategy, which boosts productive forces and overall national strength. The core feature of innovation version 3.0 paradigms is innovation ecosystem(LI Wan , CHANG Jing , WANG Min - jie , ZHU Xue - yan , JIN Ai - min, 2014). The concept of innovation ecosystem is based on former studies and comes from the concept of ecology of the nature, which reflects the agglomeration amongst innovative subjects, a relationship transcending the market relationship(Wu Jin-xi, 2014). Paying close attentions to "interdependence between the subjects" emphasized by innovation systems theory and " the subjects' interaction with the environment" emphasized by ecology, it establishes that a "Core - Periphery" fame to contain the components of innovation ecosystem, which reveals the connotations, structure and behavior that innovation ecosystem on different levels contained and the cross-level interactions(ZHAO Fang, ZENG Guo-ping, 2014). Online platform creates online markets that are capable of providing user feedback and iterative innovation. Open online platform means entrepreneurial space for applications which constitute a symbiotic entrepreneurial community around the platform. The revolution of Entrepreneurial Ecosystem occurs primarily on line, while it has been changing the related entities offline simultaneously(Zhao Fuzeng, Wang Shengguang, 2015). The Obama administration announced \$200 million in Big Data research and development initiative, with the aim to advance stateof-the-art technologies, expand the workforce, strength the national security(White House, 2012). Advancements in big data analysis offer cost-effective opportunities to improve decision-making in critical development areas such as health care, employment, economic productivity, crime, security, and natural disaster and resource management (Martin Hilbert, 2016). In statistical mechanics, entropy is a measure of the number of ways in which a system may be arranged, often taken to be a measure of "disorder" (the higher the entropy, the higher the disorder) (Sethna, James P., 2006). Systems tend to progress in the direction of increasing entropy(Simon, Donald A. McQuarrie; John D., 1997). The information entropy, a status function that can be used to describe the complexity and chaos of any system that consists of many factors(Geng Haiqing, 2004). Method of concatenated substitution is an important method to make factor analysis(Wang qi, Zhang Yafen, 2001). Environmental harmony, valueadded in value proposition, sensitive to the new ideas plays a vital role in creative and innovative ecology system(Wu Jin-xi, 2014).

Design/methodology/approach: Shannon's Entropy approach is introduced into information theory, which is used to measure the degree of uncertainty of a random event (Shannon, 1948). In information theory, entropy is the measure of the amount of information that is missing before reception and is sometimes referred to as Shannon entropy (Balian, Roger, 2004). Albert Einstein once described entropy as the first law of the entire universe. Although the concept of entropy was originally a thermodynamic construct, it has been adapted in other fields of study, including information theory, psychodynamics, thermos-economics/ecological economics, and evolution (Brooks, Daniel, R.; Wiley, E.O., 1988). The concept of entropy can be described qualitatively as a measure of energy dispersal at a specific temperature (Lambert, Frank L, 2009). Resource and neoclassical economics focus primarily on the efficient allocation of resources, and less on two other fundamental economic problems which are central to ecological economics: distribution (equity) and the scale of the economy relative to the ecosystems upon which it is reliant (Daly, H. and Farley, J., 2004). Ecological Economics also makes a clear distinction between growth (quantitative increase in economic output) and development (qualitative improvement of the quality of life) while arguing that neoclassical economics confuses the two. The simple definition that sustainability is something that improves "the quality of human life while living within the carrying capacity of supporting eco-systems"(Gland, 1991). The "Circles of Sustainability" method of the UN and Metropolis Association described four components "economics", "ecology", "politics" and "culture" as the main idea of sustainable development(United Nations, 1992). By applying the four components into ecology system of China Internet Big Data, the suggestions come from the idea within. To quantitatively identify each contribution factor, a concatenated substitution method is used.

**Findings/results:** The mapping of public demand into the cyber world that interacts and clusters with the commercial organizations to match resources, is an important external performance of the structure evolution of the Internet Big Data industry.

The rising entropy of the ecology shows an inverted "U" curve with incompleteness, which probably means an initial phased result. In a dialectical view, keeping the ecology system entropy increasing may be a better choice in that newborn clusters contribute to the innovation and sustainable growth within the open coordinative environment. Government should be able to maintain an infrastructure suitable for upper layer ecology system, develop an appropriate performance assessment system, guard against the probable abuse of government open information and data.

**Research limitations/implications:** The paper attempts to analyze and explain the pattern of entropy evolution of China Internet Big Data Ecology system's application layer and the cause of its entropy increment. The ecology system of Internet Big Data industry is not quite clear due to its rapid development, since every physical object carries information that may be collected and calculated, which makes the boundary of Big Data remain open. All things are data/information, such as "all things are numbers" by Pythagoras(C. M. Bowra, 1957), in a mathematical and philosophy view point. However, not everything's information and data can be collected and calculated due to technology limitations and cost-benefit analysis(Jules Dupuit, 1848) in a utilitarian perspective. The traditional concatenated substitution or interlocking substitution method does not consider that different order of the components





brings slightly different impacts of each component's number result. A modified approach using calculus can amend the problem but not be covered in the paper. The consumers layer that above the application layer is not included in the paper which requires a profound knowledge of Maslow and Alderfer theory in psychology.

Keywords (more than three): Big Data, ecology, entropy, evolution, application layer, factor analysis, concatenated substitution

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### June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

Session-16-#321-3(SS23)

SOltmC & RTU 2017

### A novel approach in non-invasive self diagnosis of silent heart attacks using BioElectrics

A Translational Investigation of Transcutaneous Blood Analysis Akash Manoj Class 10, The Ashok Leyland School, Hosur



तमसो मा ज्योतिर्गमय

THE ASHOK LEYLAND SCHOOL

#### Introduction

Could you be having a silent heart attack?

Silent heart attacks, which appear asymptomatic, are alarmingly common and extremely deadly. In these "silent" cases, doctors are unlikely to administer the crucial FABP3 blood test because there is no visible presentation of symptoms to warrant a diagnostic test. As a result, silent heart attacks go unnoticed.

If at-risk patients could test themselves daily for the presence of FABP3 in their blood, they would have higher chances of detectin silent heart attacks as they occur. A method that allows daily self testing would have to be non-invasive, safe, and easy to use.

My project investigated a technique that can potentially be coupled with transcutaneous UV-protein quantification to non-invasively measure the amount of FABP3 in a patient's blood and alert him or her of a silent heart attack.

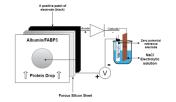


#### Question

is it possible to isolate the negatively charged FABP3 protein from albumin in cardiac-ischemic blood, by applying a small positive electric charge to the demai capillaters in thin skin in order to attract and accumulate the FABP3 on the capillary walls? If so, what is the voltage of the electrode potential at which the FABP3 accumulation on the charged capillares walls areare than that of albumin?

#### Hypothesis:

Because FABP3 is smaller than albumin, and therefore attracts better to lower voltages, FABP3 accumulation in the model will increase as the voltage of the potential is lowered, but the albumin accumulation will decrease as potential decreases.



A Schematic diagram of the prototype

#### **Materials and Methods**

My experiment found that it is possible to transcutaneously detect FABP3, a biomarker of heart attack-associated cardiac ischemia, in the blood through a two-step process.

FABP3 is one of the smallest proteins that can be present in blood, and is also negatively charged (so it attracts to positiv charges). These properties an be used to identify it in blood without puncturing the skin. sitive

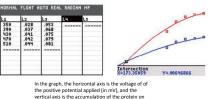
When a small enough positive electric potential is applied to a thin and translucent area of skin (i.e. the external ear), FABP3 is the only protein that attracts to the positive charge because it is the smallest (and therefore the most sensitive) protein that can be present in the blood. As a result, the FABP3 accumulates on the capillary walls in this positively charged skin, while all other proteins pass by unaffected.

When enough of the FABP3 protein has accumulated on the charged capillaries, it can be measured through UV light quantification, in which UV light is passed through the thin skin in which the FABP3 accumulated, and a sensor detects the amount of protein there based on the how much of the light was absorbed. UV protein quantification is already commonly used ex vivo.

I used a model to simplistically resemble FABP3-positive blood in dermal capillaries with several positive electric charges applied. The model consisted of a silicone membrane (representing the dermal capillaries), and a drop of albumin/ FABP3 solution to simulate blood, on top of it. An electrode patch applied positively charged electric potentials of several different magnitudes to the silicone and the accumulation of the FABP3 on the silicone was compared to that of albumin for each potential. The next follows the UV Quantification process to determine the quantity of the protein in the solution.

#### Results

The results showed that, when a 173 mV potential of positive electricity was applied to the model, at this point the accumulation of FABP3 exceeded that of albumin on the silicone. Sightly below 173 mV, albumin accumulation cased altagether, and only FABP3 accumulated at voltages lower than this. This means that it is rue that, if a positive potential of a low enough voltage is applied to thin human skir, only FABP3 will accumulate on the dermal capillaries and become detectable by UV quantification.



In the graph, the horizontal axis is the voltage of of the positive potential applied (in mV), and the vertical axis is the accumulation of the protein on the silicone (in µg). The red line represents albumin and the blue line represents FABP3. The graph shows that when less than 173 mV of positive electricity are applied to the model, FABP3 accumulates on the silicone, but albumin does not.

#### Conclusion

This finding can hopefully be translated into the human model. If a patient is in the midst of a silent heart attack, the FABP3 in his or her bioodstream can be detected in the capilalres of a thin and translucent area of skin like the external ear by applying a positively charged electrode to the skin (as was done with the siltone), and subsequently using UV quantification to measure the amount of FABP3 that amassed on the capillary wall. capillar

Similar to the model in the experiment, if an electrode patch with a positive potential anima to the index in the experiment, if an electrode patch with a positive pole-below 173 mV is applied to the ear and FABP3 molecules are present in the dermal capillaries, the charge should attract only FABP3 to the capillary wall, thus causing accumulate there, while allowing the other, larger protein melecules to pass by with attracting to the charge. sing it to

This conclusion is deduced from the graph in Results that shows that slightly below 173 mV, albumin stops accumulating on the silicone altogether. This means that the other proteins, which are larger than it, should stop accumulating as well at this point.

If this concept is brought to life for human use, the amount of accumulated FABP3 on the capillary walls of the skin can be measured by using a technique called UV light quantification.









Session-16-#321-3(SS23)



# **CURRENT SITUATION IN AGRICULTURE**

Low rain falls

Water getting scare

Depleting underground water

Frequent Power shortages

Manpower shortage



# **MY JOURNEY**

#### My Background

From Korwar, Bijapur Dist., Karnataka

Farmer family; Son of a farmer (Occasional bike mechanic)

Father wanted me to study well and settle

Education: Class 10

We produced food, water problem kept us away from farming

Curious about Technology (electronics) from childhood

Efforts and contribution got recognized by NIF and NABARD

## **MY JOURNEY**

## FATHER

ΜE

Worked for 9 hrs	

Hands got dirty (Grease)

Lot of physical effort

Earned Rs.300 at the end of the day

Worker 1 Hr

No dirty hands

No much physical effort

Earned Rs.500 at the end of the day





RIGA TECHNICA UNIVERSITY

## MY JOURNEY- STORY-1 BORE WELL FAIL

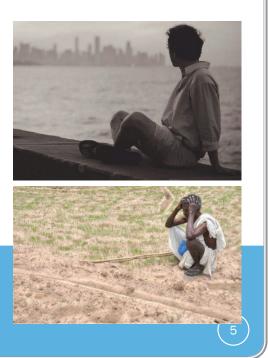
Borewell dug-No water

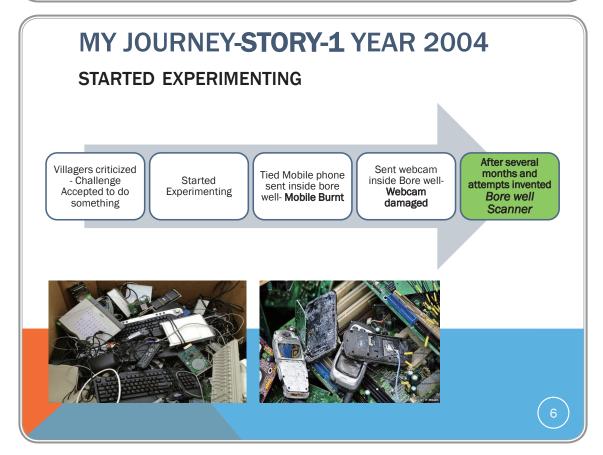
No money or source to irrigate crops

Very Disappointed

Didn't know what to know

Daily Sat near failed borewell

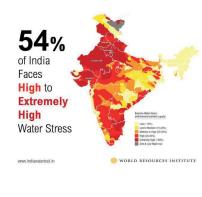






High cost of failure leads to financial burden ; one of the reasons for farmer suicides

Guess work leads to incorrect information









Installation without proper water source

High failure costs

High costs of pump



UNIVERSIT

## **PRODUCT: BORE WELL SCANNER**

Martine has their work in Kadeng all best de tod up, overs an vit

Deciding pumps after drilling bore well

Generates reports which helps decide whether to install a pump or not

Detects the ground water availability, its pressure and temperature.





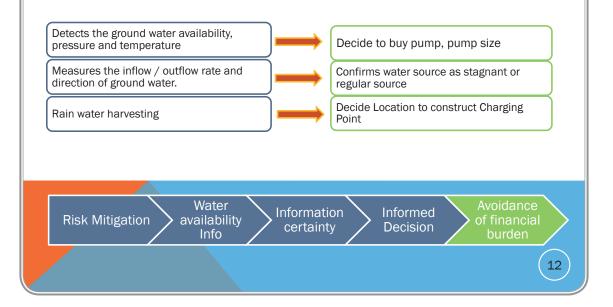
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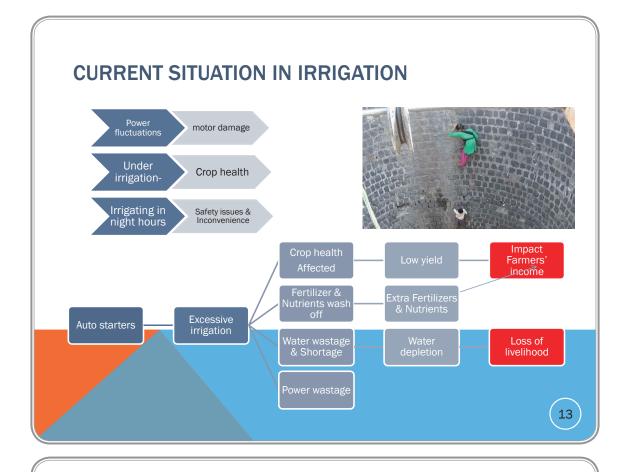
PRODUCT: BORE WELL SCANNER

How it helps:



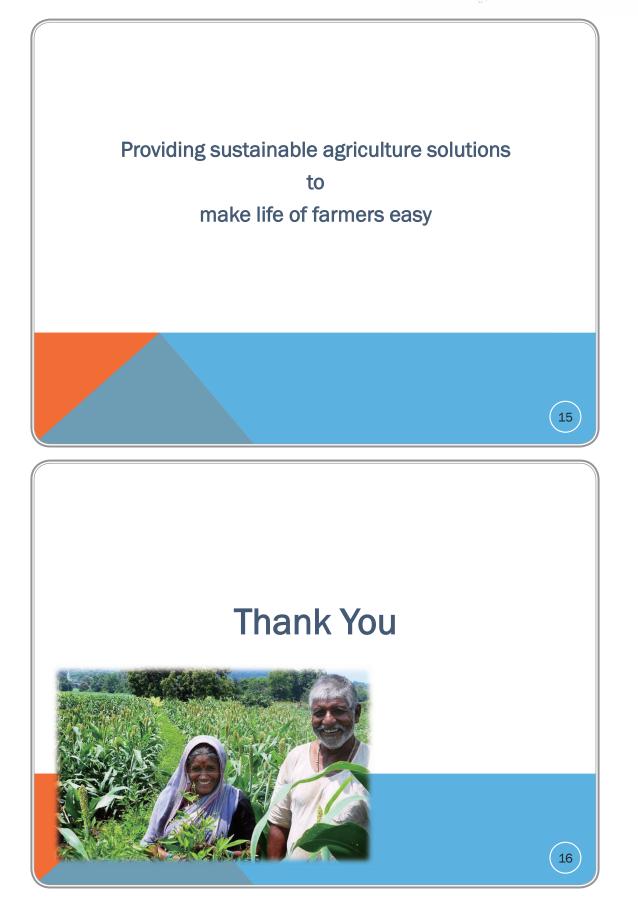






# **OTHER INNOVATIONS IN BRIEF**

Product	Purpose		
Smart irrigation	To optimize water usage in irrigation	Providing complete control of your crops' water needs	
Bird Repeller	To prevent birds from harming crops	An environment friendly solution ensuring more yield	
Solar Toor Daal Trimmer	Cutting excess branches increases yield.	No fuel cost, easily accessible blades, Saves time and effort	
			(14)







Session-16-#321-3(SS23)



#### NATIONAL SECOND - GENERAL UTILITY

Improved wheelchair for the physically challenged and silk reeling cum spinning machine

Nabajit Bharali Dhemaji, Assam

Navajit Bharali (23) is a young innovator from Assam who has come up with two useful innovations namely a spinning cum reeling machine and an electronic chair bike for the specially abled. Troubled by the tedious process of reeling and spinning, Navajit developed an automatic machine which is time efficient and can process different types of silk. Affected by the plight of differently abled, Navajit also developed a hands free electronic chair bike, which works on the simple principle of body pressure.

Being the youngest of three sons, Navajit's had a pampered childhood. He recalls having a radio as their pride possession then. The radio was the new big thing in the village and it brought the community together on countless events. Navajit's father was particularly fond of their radio. He would take it everywhere and after a tiring day in the field, he could be found relaxing in the courtyard while listening to the radio. Navajit recalls that when he was quite young, once his elder brother had switched off the radio when their father was humming along with a song being played on it. This had angered hum much and in a fit of rage he had broken the radio. His brother who had a knack for tinkering with things somehow managed to fix the radio but the broken side panel could not be completely repaired.

Every time someone visited Navajit's they would always notice the broken radio and inquire about it. Soon, many in the village started consulting Navajit's brother to fix their radios whenever a problem arose. The village did not have electricity then and a radio, being an object for entertainment and also listening to the news, mattered a lot. His brother soon mastered the art of fixing the radio and while he worked on the radios, Navajit keenly watched his brother from a distance as he was not allowed to touch anything. Later his brother left home to join his duty in CRPF but not before warning Navajit not to meddle around in his workshop. However, the first thing that Navajit did was to enter the workshop and dismantle everything in his eyesight. Curious by nature, he would open electronic parts and try to configure different mechanisms. Playing



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around in the workshop soon turned out to be his hobby and he started mastering the art of fixing things just like his older brother.

The villagers being unaware of his brother's job would still bring broken radios to their house. Many returned disappointed, however Navajit's first customer trusted him. Navajit fondly recalls the first radio he ever fixed and when asked the fee he took five rupees and bought a big packet of snacks for himself. Soon Navajit became the new radio mechanic in the village. Initially he made mistakes, which he corrected eventually as his experience grew. Through numerous trials and errors, Navajit with time excelled in fixing TVs, Tape recorders, Inverters etc.

Reeling cum Spinning Machine: This is a compact machine for simultaneous spinning and reeling of different types of silk including muga silk and eri silk.

Navajit hails from a remote region in Assam where silk weaving is a traditional practice and every household has looms. His first innovation was in standard 6 when he developed a reeling and spinning machine. His innovation was triggered by his mother who is primarily involved in weaving along with her daily household chores and farming activities. Navajit noticed that the process of reeling silk is time consuming which gave her minimum time to work on other household activities. Being attentive he realized that during the reeling process, winding one bobbin manually took one hour. To simplify this tedious process, he tried replacing the DC motor from his tape recorder. A simple experiment resulted in a remarkable output where winding one bobbin only took 4 to 5 minutes. In about 40 minutes a dozen of bobbins could be prepared. His first modification was to make it automatic, so that the reeling process becomes independent. He imitated the rotating mechanism of the fan to make the reeling machine hands free. He first made different versions of spinning and reeling machine for muga silk, eri silk and the normal silk. His simple machine helped in reducing the work load and time of women in the village.

By the time he was in standard 12, he made 5 machines which included 2 spinning machine, 1 reeling machine and electricity disconnecting machine. Slowly his reeling machine started getting media coverage where his innovation was celebrated by various media outlets. However, popularity only started to irk him. Envious of success, people in the villages started ridiculing him and insulted him and mocked him as the scientist who copied everything. When, his own village who he wanted to help started attacking him, Navajit was disheartened and

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DOIST

he stopped working on any new innovations. Users at Sualkuchi (Kamrup, Assam), famous for silk work, have also found his machine useful in trials. Presently, the machine is being value added at IIIT Manipur with support from IIT Guwahati and National Innovation Foundation.

Electronic Chair Bike: After a long struggle, Navajit finally felt motivated when he came in contact with Honey Bee Network. He received the encouragement that was missing from his life and very soon he started working on his next innovation; Electronic Chair Bike.

Navajit is a social innovator, whose innovations are mainly to aid people in need. Once while visiting the local market in his district, he spotted a differently abled man who was trying to cross a road with the help of a wooden plank attached to wooden wheels. The sloppy road obstructed his movement and the wooden wheels got trapped in a pit. He noticed the man was in distress as he was blocking the traffic and was being taunted by impatient passersby. This incident was followed by a charity event on disability where tricycles were gifted to the differently abled people. Here, Navajit observed that people with disability had makeshift arrangements to move around such as rolling on the ground to travel, use of rubber tubes as bandages to avoid accidents, wearing sandals in their hands to travel etc. Not all could use the tricycles and seeing them leave empty handed deeply troubled Navajit. That is when he came up with the idea of an Electronic Chair Bike which can help people with disability travel. He made his first prototype for rupees 5000 using parts from kid's bicycle. His first prototype was built with 3 wheels which obstructed smooth turning. With

support from NIF, he developed an improved version with four wheels and only a slight body movement of the user (front, back, on either side) can control the movement of the chair. The maximum speed is up to 40 km/ hour. Some parts of the chair are detachable, after which it can easily packed and carried. NIF has engaged IIIT Manipur to develop an improved version of the same.

The Social Innovator: Navajit Bharali, who has been quite innovative since a very young age, is currently pursuing his postgraduate studies in philosophy (his submission to NIF was received when he was in his first year of bachelors in arts). He mentions that when it comes to machinery, he can capture the functioning with a photographic memory. Always inquisitive, he cannot rest until he finds out solutions of any problem. Navajit considers his family to be the biggest support. He owes everything to his mother who has always supported him emotionally and financially through her small savings. She realized his passion at a very young age and no matter what always encouraged his creativity.

Modest by nature, Navajit believes that everyone should have a decent standard of living.



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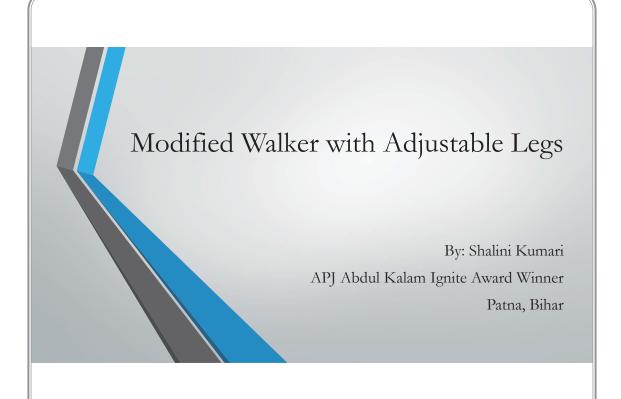
According to him, people in the peripheries of the society need to be uplifted and everyone should progress equally. He is a compassionate human being, who thinks in depth and tries to perceive any situation from another's point of view. He cannot tolerate other's misery and wants to find ways through his creativity to help the economically weaker section.

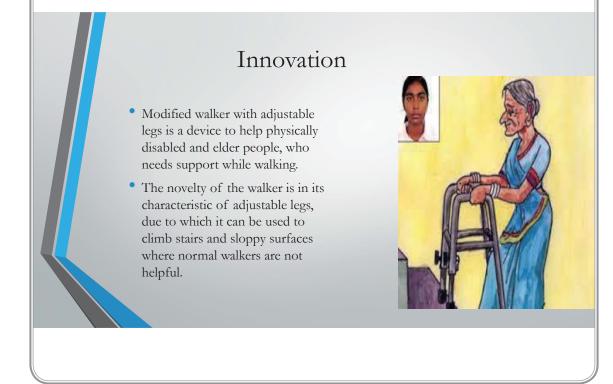


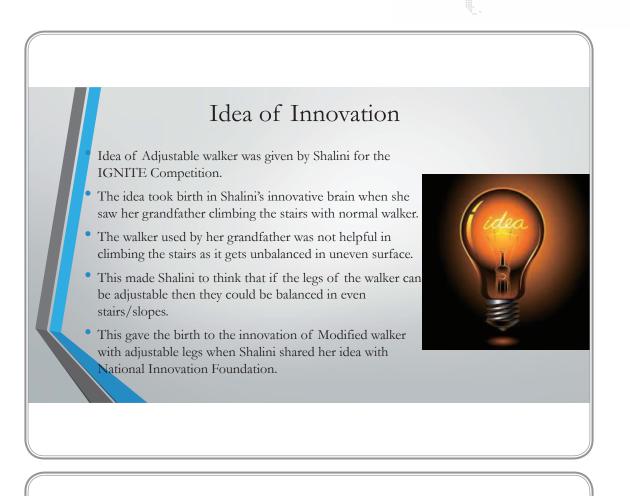


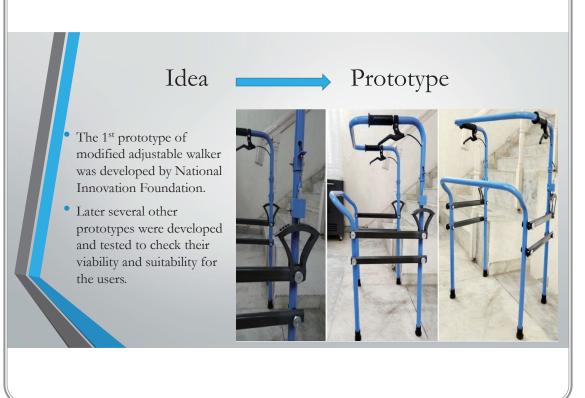


Session-16-#321-3(SS23)





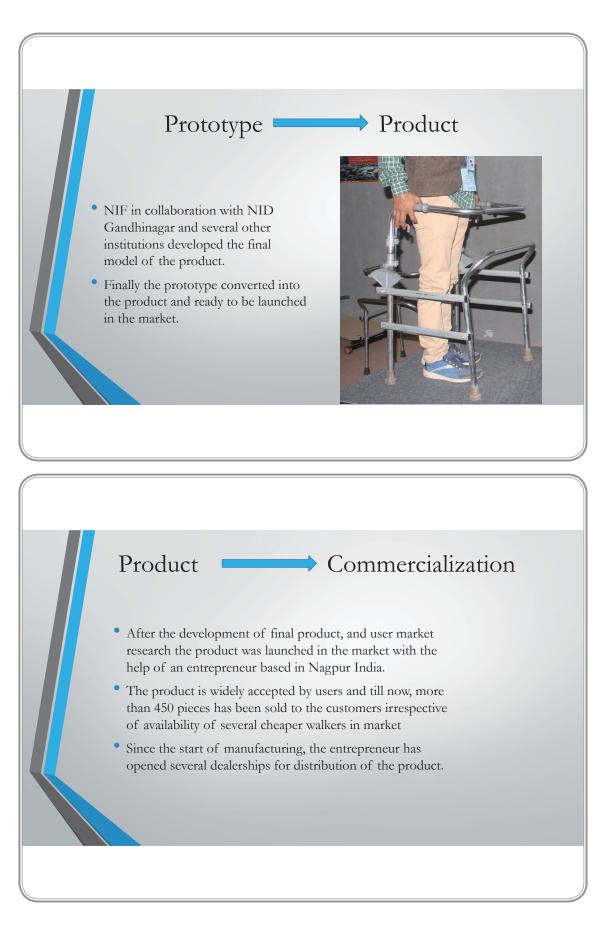


















RIGA TECHNICAL UNIVERSITY



Session-16-#321-3(SS23)

# Farmer Friendly Biogas Compressor Nature of problem solving: Biogas Bottling

#### Ajay Kumar Sharma

B.Sc, Indira Gandhi National Open University, Delhi, India me\_sharmaajay@rediffmail.com

#### Abstract

Objective: In India, the formation of Biogas is huge but there is a big trouble for bottling. Due to lacks of bottling of biogas in cylinders, villagers/biogas plant owners are not able to commercialize the biogas in the market. If these people can do bottling of biogas on their own, then they can earn some money for their survival, this is very important for the farmers.

About the innovation: I have made a portable, energy efficient and cost efficient biogas bottling compressor machine, this machine compress the biogas from 0-200psi in a biogas tank. It operates on electricity, solar energy and manually. This new "Farmer Friendly Biogas Compressor Machine" deals with a new idea with some innovation. We can do bottling directly from biogas plant/digester (after purification) and there is no need to store large volume of biogas to create high pressure for bottling by large tank.

Working:

- 1. There are two types of compressor cylinders installed in this product, one is for manual operation and second is for high-pressure compression on electricity or solar energy. (Note: this operation can be also be done by only one compressor cylinders, manual or electrical both and it depends on consumer needs or source of energy)
- 2. This product saves 50% electricity or input energy. Size is l.b.h. (30"x17"x30")
- 3. There is one AC Motor (1.5hp, 1400 rpm) for 3 hp compressor and a DC motor for Solar energy / power (12-24 V, 1000W, 3000rpm)(Note: there is not compulsory to use two motors, it depends on source of solar energy, if source is DC current from solar then we need DC motor, or we can convert DC power to AC from solar system then we need only one motor i.e. AC motor)
- 4. A few gears are added in the product to increase torque/force and to reduce consumption of electricity/input energy. There is a flywheel (14 inches diameter) installed in the machine to make manual operation easy and minimum input.
- 5. I have design a new cylinder for compressor machine of 4-6 inches stroke at low rpm. This cylinder creates required pressure at low rpm for manual operation. This cylinder works also on electricity (motor driven) and manually.
- 6. This compressor machine is also work without fossil fuels (man powered driven system)
- 7. We can do a modification in domestic cylinder as biogas cylinder. There should be a separate valve in cylinder for bottling and by this modification, we can reduce the size, cost, weight, and energy consumption in compressor machine. (Modification in gas cylinder is not compulsory). I have also





made a small connecting cylinder for direct feeling in cylinders without any changes in cylinders (see the figures).











### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 16 (Friday)

## Session-16-#301-4(SS16 & SS24 & SS25)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 16:40~18:10)

#### "Innovation in Supply Chain Management"

Chair: Anna Svirina (Kazan National Research Technical University, Russia)

Paper 1: "Expert assessment of Kazakhstan economic model: the aspect of global supply chains" by Bozhko L, Zarubina V. & Anna Svirina

- Paper 2: "The innovative approach towards high-speed roads efficiency estimation" by Viktor
   Dubolazov & Temirgaleev Egor
- Paper 3: "Data-driven scenario planning in open innovation: Integrating keyword network and morphological analysis" by Jieun Kim & Jeonghwan Jeon
- Paper 4: "Alliance formation types, network positions, and firm performance in biopharmaceutical industry under open innovation paradigm" by Sanghoon Lee & Jeonghwan Jeon
- Paper 5: "Transforming Government: A Platform Approach" by Sam Youl Lee & Yoon Sang Ha

### Session-16-#303-4(SS4 & SS17)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 16:40~18:10)

#### "Dynamics of Open Innovation, Business and Society"

- Chairs: KyungBae Park(Sangji University, Korea), SangOh Shim(HanBat National University, Korea)
- Paper 1: "Entrepreneurial Cycling Dynamics of Open Innovation The Road to Entrepreneurial State in the 4th industrial revolution" by JinHyo Joseph Yun, KyungBae Park &DongKyu Won
- Paper 2: "Innovative Production Scheduling with Customer Satisfaction Based Measurement" by Sang-Oh Shim, KyungBae Park & SungYong Choi
- Paper 3: "A Study on the Startup Willingness of Science and Engineering Students through Technology Entrepreneurship Education" by JinSook Bang, SungYong Choi, KyungBae Park & Sang-Oh Shim
- Paper 4: "Japan's role for innovation system development in Thai automotive industry: an analysis by a dynamic functional approach" by **Yoshi Takahashi**
- Paper 5: "Innovative Japanese vending business in Russia (case of Dydo DRINCO Inc)" by Sergei SHAPOSHNIKOV







### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 16 (Friday)

## Session-16-#309-4(SS18 & SS29)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 309, Time: 16:40~18:10)

#### "Innovation Ecosystem: Strategy and Policy"

- Chairs: Lei Ma & Zheng Liu(Nanjing University of Science and Technology, China)
   Honor Discusser: Tan Yigitcanlar
- Paper 1: "The Impact of Local Government Policy on Innovation Ecosystem: Case Study of Changzhou, China" by Lei MA & Zheng LIU
- Paper 2: "A framework of Fostering Regional Innovation Ecosystem: A case study of Jiangsu province in China" by Shaowen Zou, Menghang Zhang & Lei Ma
- Paper 3: "Construction of Health Assessment Index System of Regional Entrepreneurial Ecosystem" by **Guo-peng Xiang**
- Paper 4: "The influence of institutional voids on servitization of manufacturing-comparative study on the role of intermediaries between Taiwan and Korea's ICT industries" by Chih-cheng Lo
- Paper 5: "Linking Firm Openness and Innovation: The Moderating Role of External Knowledge Search strategy" by Chunhsien Wang

## Session-16-#321-4

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 16:40~18:10)

#### Chairs: Ustyuzhantseva Olga(Tomsk, Russia) Cho, Deokho(Daegu University, Korea)

- Paper 1: "Discovering innovative potential of people in Russia" by Ustyuzhantseva Olga
- Paper 2: "Grassroot Innovations in Fish Feed and Fertilizers, India" by Shivta Kureel
- Paper 3: "The Characteristics Analysis of Life Satisfaction of Potential Elderly and Elderly People" by Cho, Deokho
- Paper 4: "Blockchain Government" by MyungSan Jun
- Paper 5: "Long-term collaboration network based on ClinicalTrials.gov DB in pharmaceutical industry" by Heyoung Yang

Session-16-#301-4(SS16 & SS24 & SS25)

# Expert assessment of Kazakhstan economic model: the aspect of global supply chains

#### Bozhko L, Zarubina V.

Anna Svirina (Corr.)

Dr. Prof., Head of Economics and Management Department, Kazan National Research Technical University, Russia Email: anna svirina@yahoo.com

#### Abstract

**Purpose/ Research Question**: Kazakhstan is the largest and the most developed country in the Central Asian region that is rich in natural resources. After the collapse of the USSR, Kazakhstan, which experienced significant social and economic crisis, was one of the first in the region which began to form national economic model on the basis of market principles. Large-scale privatization program has been implemented, which also included commodity producers, and thus the country began to actively attract foreign investment.

One of the main features of the private sector functioning and the privatization is the wide participation of the central and regional bureaucracy leading to extra administrative barriers that in many cases do not allow Kazakh economy to insert in global supply chains. The close ties between business with the state apparatus, mainly with the natural resources chapter of the country, make the dominant economic principle of "power-property", reducing the importance of the rule of law.

Moreover, during the recent economic crisis, the state has not only increased the level of administrative intervention in the economy, but also increased its share in the economy. The main tool of this intervention was the Fund "Samruk-Kazyna", which concentrated almost all the economic resources of the public sector, including its stakes in private companies, public pension funds, the assets in the mining, nuclear power, electric power, iron and steel industry, as well as in the field of transport and communication. In 2011 the share of the public sector accounted for about 20% of GDP.

Orientation on raw materials, fuel, metal and semi-finished products demanded by the world market, the active involvement in the economy of foreign capital provided the strong growth (up 10% on the eve of the global crisis), which gave rise to speak about the "miracle of Kazakhstan." However, these same factors have led to a slowdown in growth in the past years (up to 5% in 2011-2012 and 5.5% in 2013.) – the miracle appeared to become just the result of Holland disease. Up to 2018 International monetary fund projected growth rates no higher than 6.2%, thus leading to growing importance to integrate Kazakh enterprises in global supply chains (Mamedova, 2013).

Therefore, despite the relatively high rates of economic growth and the announced policy of creating a socially oriented market economy, the social sphere remains the weak point of the Kazakh model.

Another weak point is its corruption, actually turned into a system-forming factor. According to the Corruption Perceptions Index, Kazakhstan (as Russia, Iran and Honduras) scored 133 place. The fight





against corruption is used not only to eradicate the corruption itself, but for the redistribution of property, which further strengthens the dominance of the state apparatus over the property. It is the high burden of corruption on business and weak protection of property rights and investment activity had a downward effect on the economic freedom index, calculated by The Heritage Foundation, under which Kazakhstan took 68th place and entered the group of countries with a moderately free economies.

A strong and vulnerable at the same time Kazakhstan element model is its raw character, which makes the economy dependent on world prices for raw materials, mainly oil. Raw-material orientation of the economic model appears due to the fact that Kazakhstan is rich in natural resources, especially energy and mineral. By gold reserves Kazakhstan is among the top ten countries in the world, the share of Kazakhstan accounts for almost 8% of world reserves of iron ore, about 20% of the world's uranium reserves. The appeal of raw materials for the development of their production, processing and supply to the world markets has led to a noticeable presence in the country of foreign capital. The total amount of accumulated foreign direct investment in Kazakhstan in 2011 was more than \$ 73 billion; only in 2011 foreign direct investment inflow amounted to 21 billion of US dollars. But as a result of attraction of foreign loans exceeded the external debt to 60% of GDP, and its service is up to 35% of exports (Mamedova, 2013).

In this paper we will evaluate different ways of expert assessment of Kazakh economic model from the point of global supply chain development – the paper compares regional supply chains approach to global supply chain approach and evaluates existing models from both perspectives.

#### Key Literature Reviews:

1. Ojala, L., Celebi, D. The World Bank's Logistics Performance Index (LPI) and Drivers of Logistics Performance. Retrieved from http://www.itf-oecd.org/sites/default/files/docs/ojala.pdf

- 2. Mamedova N. Kazakh Economic Model. World and National Market. #3, 2013
- 3. Kazakhstan Economy Statistics. Retrieved from www.stat.gov.kz/getImg?id=ESTAT099628

#### Design/ Methodology/ Approach:

The paper is based on implementation of comparative study method: it evaluates different expert estimation of Kazakh economy and relates them to internationally recognized supply chains and logistics assessments (i.e LPI index). The paper presents quantitative evaluation of these interrelations, based upon statistical information from official Kazakhstan statistics compared to the dynamics of ranking position of the state. The statistical evaluation is carried out in SPSS statistics software.

#### (Expected) Findings/Results:

The research indicates, that Kazakhstan is being able to provide necessary growth rate within global supply chains in case it uses private-state partnerships. Kazakhstan, seeking to combine the best of the public sector as a developer of long-term plans and advocate for people with the best properties of the private sector as an innovator, operator and innovator. If the project is profitable, by definition, of course, it will attract private investors. If not, private investment will depend on sufficient and reliable long-term government subsidies. The area of low population density and Kazakhstan, as well as sharply continental climate results in a relatively low volume of traffic and transport infrastructure, construction, modernization and maintenance of which are costly.

The quantitative analysis indicates, that (considering the time lag between direct infrastructure investments and payoffs) the best results in terms of Kazakhstan development were shown when the state initiated private-state partnerships in the sphere of logistics, which led to multiplier effect in the national economy. The result was more significant in case the partnerships led to integration into global supply chains.

Keywords: logistics, supply chains, economic growth.





Session-16-#301-4(SS16 & SS24 & SS25)

# The innovative approach towards high-speed roads efficiency estimation

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#### Abstract

**Purpose/ Research Question**: Effective Green Logistics is the name which is easy to understand and remember for the majority of the population. But the more correct is the concept of Sustainable Development. Sustainable development in the system of interaction of the following components: society, economy and environment.

The basic idea of sustainable development is to meet the modern needs of consumption in such a way that future generations have the opportunity to meet their needs, too. Meet the needs necessary respecting the basic principles of sustainable logistics. The basic idea of which is to maximize the efficient use of all resources using modern technology to maximize meet the needs.

Transport is one of the main air pollutants. Its share in the total amount of pollutant emissions from stationary and mobile sources in Russia is about 40%, which is higher than that of any of the industries. The share of road transport in total transport pollution around 85%. Therefore, if it is possible to reduce the degree of adverse effects, it is necessary to do. Today in Russia is quite difficult to explain to the business importance and usefulness of the "Green logistics". But we can try to get their attention, for example, the possibility of obtaining a positive economic effect. This means that the possibility of reducing fuel consumption when the route in sections of high-speed toll road is an important issue.

According to the Transport Strategy of the Russian Federation till 2030 the volume of transit cargo transportation through the territory of Russia by road transport will grow from 1 million tons in 2013 to 3.5 mln. tons in 2030. The Ministry of Transport is planning to increase the length of high-speed toll road in the Central Region, in the Urals and Siberia from 5 to 20 thousand kilometers. The share of Russian carriers in the volume of international road goods transportation will be 50%/ This fact lets us assume the interest of foreign carriers in the information published in this article.

#### Key Literature Reviews:

1. KPMG. Overview of the Russian transport sector. URL:

http://ru.investinrussia.com/data/files/sectors/obzor-rossiiskogo-transportnogo-sektora.pdf

2. Omelchenko I.N., Aleksandrov A.A., Brom A. E., Belova O.V. Basic directions of development of the

logistics of the 21st century: resource conservation, energy and ecology. Humanitarian Gazette 2013, no. 10. URL: <u>http://hmbul.bmstu.ru/catalog/econom/log/118.html</u>

3. Russian Direct Investment Fund. The transport sector: freight transportation, facts and figures. URL: <u>http://ru.investinrussia.com/data/files/sectors/RDIF-Brochure-Transport-Rus-v3.pdf</u>

#### Design/ Methodology/ Approach:

In this article, it is proposed to determine the economic effect of inclusion in the cargo transportation route sections of high-speed toll road. The economic effect is achieved by the fuel economy on the high speed road sections, as on these roads there is less reason for a full stop, for slowing down of the vehicle and the movement of the vehicle with the non-optimal speed. In this regard, of particular interest is the issue of fuel consumption during acceleration of the vehicle. The calculations used the two existing methods for calculating consumption rates fuels and lubricants. Also a new methodology is proposed. This methodology is connected with the injection of quantity of the fuel mixture during acceleration of the vehicle to the desired speed.

#### (Expected) Findings/Results:

To sum up, based on the obtained results it is revealed that the economic benefit depends on the ratio of the number of stops and slowing down of the movement of the vehicle on the relevant sections of high-speed toll roads and free roads. The dependence of the environmental effects on the chosen alternative is also determined.

Keywords: logistics chains, high speed roads, supply chains, innovation, efficiency.





Session-16-#301-4(SS16 & SS24 & SS25)

## Data-driven scenario planning in open innovation: Integrating keyword network and morphological analysis

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#### Abstract

With the advances in web, scenario planning has being open. The advent of futuristic data, a collection of online extracted documents about the future of technology that incorporate large participations of the experts and the public, facilitates the need for data-driven scenario planning. Although morphological analysis is widely used for scenario planning, there is lack of data-driven morphology construction and prioritization. In response, this paper suggests the integrated approach of keyword network and morphological analysis to generate and prioritize scenarios based on futuristic data. This study is expected to contribute to widen the knowledge scope and thus increase the diversity of scenarios in technology foresight.

Keywords: scenario planning, data-driven, keyword network, morphological analysis

#### **1. Introduction**

Recently, scenario planning has become more *open*. Advances in information and communication technologies (ICTs) such as web 2.0 and collective intelligence have facilitated not only experts but general public to discuss and combine foresights of the shape of future technology (Cachia et al. 2007; Haegeman et al. 2013; Schatzmann et al. 2013). The massive data generated by a diverse individuals in online communities are suggested as the basis for a bigger, more creative brainstorming in which future scenarios can be generated, tested, and refined (Haavisto 2014; Schatzmann et al. 2013); we especially call those data as futuristic data. Thus, the effective leverage of futuristic data, or data-driven approach, is becoming a core competence for scenario planning (Kim, Han, et al. 2016; Kim, Park, et al. 2016).

The main purpose of scenario planning is to focus on the uncertain aspects of the future and develop a number of possible states that tell a story of how various elements might interact under certain conditions (Schoemaker 1995). Since foresighting such scenarios of emerging technology associating with societal and political issues is wicked problem that are difficult or even impossible to solve by single actors (Cagnin 2013), multiple alternative perspectives must be accommodated and focus on comprehensive possibility rather than accurate probability.

Accordingly, morphological analysis usually used to generate future scenarios (Eriksson and Ritchey 2002; Ritchey 2009, 2011). Morphology analysis is a tool for systematic combination of solutions to a technology and their impact problem. It is represented as a table (morphological box) of decomposed dimensions of the technological, organizational, and social problem and potential solution

fragments (shapes) for each sub-function. Thus, morphology analysis has been known as effective for modeling complex problems and describing alternatives comprehensively. Moreover, morphology analysis can support both the means generation activity and the integration of the means to form solution; by integrating the values of each dimension, it provides a strong stimulus for the invention of new alternatives. It has been, however, subject to two fundamental limitation in that it usually depend on *subjective knowledge of limited group of experts* and does not focus on *prioritizing alternatives* to elicit the definite promising configurations.

In terms of first limitation, several studies introduced quantitative approach to extract the input of morphology analysis from patent data for technological opportunity discovery (Yoon et al. 2014; Yoon and Park 2005) or WordNet database for creative idea generation (Geum and Park 2016). However, to our knowledge, the attempt to identify proper data and approach to build morphology for scenario planning is rare. In terms of second limitation, scenario configurations generated from morphological analysis are selected by in-depth analysis against several criteria such as desirability, relevance, plausibility and differentiation (Pereverza et al. 2017) or diversity (Lord et al. 2016). However, since the numerous information regarding future conditions can be extracted from futuristic data, a number of such dimensions and values can lead to more than thousands of plausible future scenarios. In this case, in-depth analysis is practically impossible.

#### 2. Proposed Approach

Taken together, this paper suggests an approach to leverage futuristic data in morphological analysis for scenario planning. The core idea of proposed approach is summarized in Figure 1. Since futuristic data are unstructured text, text mining and topic modeling are applied to elicit proper scenario factors and keyword network is constructed to explore the relationship among scenario factors. Topic models are algorithms for discovering the main themes that pervade a large and otherwise unstructured collection of documents (Blei 2012); as a result of topic modeling, keywords are separated or clustered according to semantic context in texts. The relationship among scenario factors are measured based on co-word analysis. The high relationship among two keywords means that they have largely accepted and predicted by foresighters so that their relationship may have large impact in the future.

Then, the results of text mining and keyword network are integrated with process of morphological analysis. As general morphological analysis consists of three steps, i.e., morphological matrix construction, cross-consistency assessment, and solution space identification, we modify each step to be suitable to futuristic data. In constructing morphological matrix, we use the topic-keyword hierarchy to define dimensions and their shapes. In cross-consistency assessment, although generic morphological analysis only considers contradiction or inconsistency among shapes, we utilize the degree of relationships among keywords in network to assess cross-consistency. Since the keyword relationships represent the impact of association among scenario elements, the aggregation of these values in combined scenario configuration can measure the impact of scenario configuration.



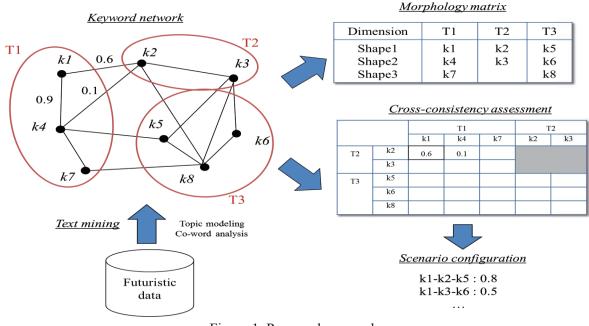


Figure 1. Proposed approach

#### 3. Conclusion

This study proposed the futuristic data-driven scenario planning by integrating keyword network and morphological analysis. Among others, this research is expected to contribute to enhancing information diversity by broadening the range of input by capturing not just technical knowledge from experts but creative opinions from publics. It is expected to gain synergy effects between accuracy and originality in foresight ability.

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Session-16-#301-4(SS16 & SS24 & SS25)

## Alliance formation types, network positions, and firm performance in biopharmaceutical industry under open innovation paradigm

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#### Abstract

The purpose of this study is to understand the influence of network positions and formation types in strategic alliance on firm performance. We used panel data including the information of strategic alliance and financial performance in 937 biopharmaceutical firms from 1984 to 2010. In this study, we examined not only the main effects of the network positions and formation types, but also the interaction effects between them on firm performance. The empirical results suggest that network position in alliances does not lead to sales performance directly and more inter-industry alliances and intra-industry alliances have a negative effect on firm performance in biotechnology segment and pharmaceutical segment, respectively. However, the estimation results of the interaction types moderate the effect of network position on sales performance. Moreover, those effects are opposite depending on the segment. The reverse impact between pharmaceutical and biotechnology segments offers notable implications to policy makers and managers when they locate firms in alliance network.

*Keywords: alliance formation type, biopharmaceutical industry, network position, panel regression, strategic alliance* 

#### 1. Introduction

To sustain their competitive advantages, firms obtain resources and capabilities by acquiring knowledge of other firms through strategic alliances. Especially in R&D-intensive industry such as biopharmaceutical industry, knowledge transfers through strategic alliances develop firms' competences. For example, biopharmaceutical firms have carried out strategic alliances to acquire specialized technologies to enhance internal capacity and expand their pipeline portfolios (Nicholson et al., 2003). Moreover, partnerships between them are important because biotechnology firms have specialized

knowledge regarding novel approach to drug development while pharmaceuticals have capitals, labors, and know-hows to commercialize that knowledge.

Previous studies analyzed alliance structure and formation, especially from the network perspective (Barley et al, 1992; Walker et al., 1997). They enable us to understand evolution of biopharmaceutical industry structure by exploring the dynamics of alliance networks (Gay and Dousset, 2005, Roijakkers and Hagedoorn, 2006). Furthermore, some studies have examined the effect of alliance on firm performance, which shows controversial results: positive or negative effects (Lerner et al., 2003; Nicholson et al., 2003; Shan et al., 1994; Stuart et al., 2007).

Therefore, we need an additional factor on the relationship between strategic alliance and firm performance. Although some studies have considered firm's network position (Guan and Zhao, 2013; Powell, 1996), they have ignored alliance formation types and not compared the alliance networks of pharmaceutical and biotechnology firms even though their purposes are different. Consequently, our understanding of the effects of strategic alliance on biopharmaceutical firm's performance is still limited.

To fill this gap, we examine alliance formation types, i.e. intra-industry and inter-industry alliances. Findings show not only the main effects of the network positions and attributes, but also the interaction effects between them on firm performance. In addition, we compare pharmaceutical and biotechnology segments to identify how different their determinants affecting firm performance are.

The research questions and hypotheses are as follows:

*Question 1*: How do the network positions of biopharmaceutical firms in strategic alliance affect firm performance?

*H1a. The central position of firms in alliance network are positively related to their financial performance.* 

H1b. The peripheral position of firms in alliance network are positively related to their financial performance.

Question 2: How do the alliance formation types affect firm performance?

H2a. Inter-industry alliances are positively related to its financial performance.

H2b. Intra-industry alliances are positively related to its financial performance.

*Question 3*: Do the alliance formation types moderate the effect of network position on firm performance?

H3a. When firm has more inter-industry alliances, the central or peripheral position of firms affects more positively their financial performance.

H3b. When firm has more intra-industry alliances, the central or peripheral position of firms affects more positively their financial performance.

The remainder of this paper is organized as follows. The following section present data and methodology. Section 3 discusses the empirical results, followed by conclusion in section 4.

#### 2. Data and methodology

For empirical analysis, we combined two types of datasets on 982 biopharmaceutical firms (543 pharmaceutical and 439 biotechnology companies). First, we collected the strategic alliance data of biopharmaceutical firms from the Thomson Reuters' SDC Platinum database. This database has been widely used due to its usefulness to investigate firms' alliance activities. Consequently, we collected



3,154 strategic alliances, and calculated each firm's centralities through network analysis using Pajek, a well-recognized network analysis software. Second, we used Compustat database and annual reports to obtain firms' financial and accounting information, respectively. Finally, combining these datasets, we obtained the panel data of 10,210 observations including the information of firms' alliances and performance from 1984 to 2010.

To compare the determinants between pharmaceutical and biotechnology firms, we divided the firms into two segments by the standard industrial classification code: pharmaceuticals (2834) and biotechnologies (2836). Table 1 shows composition of the total observations and change in portion of each segment by year.

	Table 1. Observations					
Year	Total	Pharmaceutical	%	Biotechnology	%	
1985	140	100	71.4	40	28.6	
1986	155	111	71.6	44	28.4	
1987	167	114	68.3	53	31.7	
1988	184	124	67.4	60	32.6	
1989	194	132	68.0	62	32.0	
1990	226	157	69.5	69	30.5	
1991	254	166	65.4	88	34.6	
1992	287	183	63.8	104	36.2	
1993	318	198	62.3	120	37.7	
1994	338	207	61.2	131	38.8	
1995	377	220	58.4	157	41.6	
1996	399	229	57.4	170	42.6	
1997	411	233	56.7	178	43.3	
1998	455	262	57.6	193	42.4	
1999	483	279	57.8	204	42.2	
2000	485	279	57.5	206	42.5	
2001	505	287	56.8	218	43.2	
2002	540	302	55.9	238	44.1	
2003	551	308	55.9	243	44.1	
2004	562	307	54.6	255	45.4	
2005	569	299	52.5	270	47.5	
2006	573	307	53.6	266	46.4	
2007	563	304	54.0	259	46.0	
2008	514	267	51.9	247	48.1	
2009	498	260	52.2	238	47.8	
2010	462	231	50.0	231	50.0	
Total	10,210	5,866	57.5	4,344	42.5	

Total 982 firms = 543 pharmaceutical firms + 439 biotechnology firms

Then, we select variables to analyze in this study. First, a dependent variable is sales as a proxy of corporate performance. Second, independent variables are firms' centralities. We use degree (central position) and betweenness (peripheral position) centralities that define different location characteristics and roles in network. To obtain the value of firms' centralities, we employed the Pajek program for the

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social network anlaysis. Another independent variable is alliance formation type. We counted the number of inter- and intra-industry alliances each firm had. Third, control variables include firm size, R&D expense, and marketing expense. For the empirical analysis, we used the panel model as follow:

 $Y = \alpha + \beta 1$  Degree Centrality +  $\beta 2$  Betweenness Centrality +  $\beta 3$  Inter-industry alliances +  $\beta 4$ Intra-industry alliances + Control variables +  $\epsilon$ 

where Y is the firm performance as a dependent variable, are the estimated parameter and is the error term. And the descriptive statistics and correlation coefficients of the variables are shown in Table 2.

Table 2. Descriptive statistics and correlation												
Variable	Mean	Stdev	Min	Max	1	2	3	4	5	6	7	8
1 Sales	888.269	4419.86	0	67791	1.0000							
2 Degree	0.195	0.87	0	24	0.2099*	1.0000						
3 Betweenness	19.512	248.47	0	10280	0.0731*	0.6706*	1.0000					
4 InterL2	0.075	0.43	0	12	0.1453*	0.3538*	0.1725*	1.0000				
5 IntraL2	0.163	0.70	0	12	0.2584*	0.4515*	0.2532*	0.5142*	1.0000			
6 Firmsize	2.748	12.05	0	122.2	0.9192*	0.3109*	0.1405*	0.2203*	0.3435*	1.0000		
7 Advexp	19.155	162.33	0	4000	0.6451*	0.1680*	0.0420*	0.1010*	0.1871*	0.5994*	1.0000	
8 R&Dexp	2970.626	2411.35	1	7448	0.1319*	0.0632*	0.0301*	0.0293*	0.0695*	0.1373*	0.0919*	1.0000
* <i>p</i> ≤0.05												

#### Table 2. Descriptive statistics and correlation

#### 3. Empirical Results

We estimate the coefficients for all firms and for each segment using fixed effect panel regression (Table 3). The findings show that firm size and marketing expenses exert a positive influence on sales, whereas the effect of R&D expense is insignificant.

Table 5. Results from the panel data analysis				
	All	Pharmaceutical	Biotechnology	
Deserves sectors lites	-16.60	-24.17	-4.676	
Degree centrality	(14.77)	(23.86)	(4.348)	
Potwoonnoog controlity	-0.00817	-0.0256	-0.00312	
Betweenness centrality	(0.0421)	(0.0734)	(0.0130)	
Inter industry allience (time leg 2)	15.62	28.97	-28.51***	
Inter-industry alliance (time-lag 2)	(22.69)	(36.12)	(6.990)	
	-55.43***	-73.01***	1.091	
Intra-industry alliance (time-lag 2)	(14.48)	(22.48)	(4.731)	
Degree centrality	-3.832	-8.817	56.60***	
x Inter-industry alliance (time-lag 2)	(9.150)	(12.65)	(6.209)	
Betweenness centrality	0.0207	0.0345	-0.153***	
x Inter-industry alliance (time-lag 2)	(0.0299)	(0.0408)	(0.0345)	
Degree centrality	24.73***	27.90***	-13.61	
x Intra-industry alliance (time-lag 2)	(5.220)	(7.234)	(4.241)	
Betweenness centrality	-0.0727***	-0.0734***	0.00864	
x Intra-industry alliance (time-lag 2)	(0.0132)	(0.0183)	(0.0186)	

#### Table 3. Results from the panel data analysis

	Society of Open Innovation Technology, Market & Complexity	DOVIST	RIGA TECHNICAL UNIVERSITY	
E:		111.4***	110.8***	152.2***
Firm size		(4.696)	(6.185)	(4.598)
Markating avnances		4.945***	4.974***	19.26***
Marketing expenses		(0.187)	(0.243)	(1.234)
		-0.000284	-0.000687	-0.000247
R&D expenses		(0.00471)	(0.00834)	(0.00113)
Constant		1381.5***	2115.4***	411.2***
		(8.760)	(14.86)	(2.181)
Adj. R <sup>2</sup>		0.126	0.130	0.332
Observations		6,857	4,019	2,838

Standard errors in parentheses.

\*p < 0.10; \*\* p < 0.05; \*\*\* p < 0.01

The estimation results reveal that the main effects of centralities are insignificant in both segments. This implies that firms' central and mediating positions in alliance network are not related directly to sales. In addition, the coefficients for inter-industry alliance in biotechnology segment and intra-industry alliance in pharmaceutical segment are negative and significant. That is, the more alliance biotechnology firms make within industry or the more alliance pharmaceutical firms make across industries, the less sales outcome the firms achieve.

The estimation results of the interaction terms between the centralities and alliance formation types provide an intriguing argument. As they have more inter-industry alliances, biotechnology firms located in central position achieve higher sales performance ( $\beta$ =56.60, p<0.01), while those located in mediating position achieve lower one ( $\beta$ =-0.153, p<0.01). However, those interaction effects for pharmaceutical segments are insignificant. In case of intra-industry alliance, as they have more intra-industry alliances, pharmaceutical firms located in central position achieve higher sales performance ( $\beta$ =27.90, p<0.01), while those located in peripheral position achieve lower sales performance ( $\beta$ =-0.0734, p<0.01). However, those interaction effects for biotechnology segments are insignificant. Therefore, it can be argued that the effect of network position on firm performance depends on alliance formation type. Furthermore, the results that degree centrality shows a positive effect, whereas betweenness centrality shows a negative impact on sales in both segments suggest that central firms are dependent in alliance network, whereas peripheral firms are relatively detached. This is because core-periphery structure may result in preferential attachment.

#### 4. Conclusions

This study examines the moderating effect of alliance formation types on the relationship between network position and firm performance using large samples of biopharmaceutical firms. The empirical results suggest that network position in alliances does not lead to sales performance directly in both pharmaceutical and biotechnology segments. Also, it shows that more inter-industry alliances and intraindustry alliances have a negative effect on firm performance in biotechnology segment and pharmaceutical segment, respectively. However, the estimation results of the interaction term between network positions and alliance formation types show that the alliance formation types moderate the effect of network position on sales performance. Moreover, those effects are opposite depending on the segment.

The reverse impact between pharmaceutical and biotechnology segments offers notable implications to policy makers and managers when they locate firms in alliance network. For example, when a biotechnology firm has many inter-industry alliances, locating in central position rather than peripheral position in alliance network will produce higher revenue, and when a pharmaceutical firm has many intra-industry alliances, the central position rather than peripheral position will also produce higher sales performance.

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## **Transforming Government: A Platform Approach**

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### Abstract

A series of recent events show that there is malfunction in both proactive and posterior risk management system of Korean government. Such policy vacuum occurred because the current administrative model driven by traditional bureaucracy based on hierarchy cannot provide with appropriate and timely solutions to current complex policy problems. Since administrative environment changes too rapidly and becomes more complex and inter-related, Korean society requires a new type of government model to meet the challenges.

This study proposes 'platform government', the administrative application of platform-based business ecosystem with 'unbundling' of traditional government functions. Platform Government is a government that enhances flexibility, innovativeness, and responsiveness by dividing the task of government by functions and producing policies collaboratively with public and private entities as platform-based company ecosystem does. This research shows several examples for the application of platform government in areas such as public transportation, education and administrative work and suggests policy recommendation. Platform government is a form of government focusing on data-driven and data-centered administration which accelerate and facilitate the integration of private entities or non-profit organizations in the action of government. It is different from out-sourcing or privatization since it makes the agent as a part of government, not a contractor and government owns the entities as long as it is necessary.

Policy recommendations include setting up of data-based platform, facilitation of 'contract based cooperation' between government and private entities, increased investment in the social innovation ecosystem and establishment of M&A system for internalizing social ventures.

Keywords: unbundling, platform government, government innovation, public-private partnership

Session-16-#303-4(SS4 & SS17)

### Entrepreneurial Cycling Dynamics of Open Innovation The Road to Entrepreneurial State in the 4<sup>th</sup> industrial revolution

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#### Abstract

This study was initially motivated by the current capitalistic trend of consistently decreasing economic growth despite the increase of R&D investment. In addition, the authors were also interested in the globally escalated economic uncertainty in the period of stagnant economic growth. By focusing on these economic trends, this study aims to propose a new economic model and analysis that specifically focuses on the following matters:

What is the structure and mechanism of a modern capital economy system dynamics under the growth limits of a capitalist situation?

To tackle this fundamental question, the following were undertaken. First, theories, and previous researches on economic dynamics were reviewed. Second, a novel entrepreneurial cycling dynamics model is proposed in order to understand the stagnant economic growth and the uncertain economic dynamics of nowadays. Third, a causal loop is established to optimize the accuracy of the Entrepreneurial Cycling Dynamics of Open Innovation for specific situations, with concrete logics of fostering and impeding the cycling of the model. From this, 3 conditions are simulated by Entrepreneurial Cycling Dynamics model, and find out additional implication from this model. Fourth, from analyses of 3 cases, we acquire practical validation of Entrepreneurial Cycling Dynamics Model. Fifth, based on an implicative analysis of the optimized Entrepreneurial Cycling Dynamics of Open Innovation, the minimum conditions for model activation and layers for cycling were broadly discussed. Last, a future research direction on mathematical modeling was proposed.

**Key words**: Entrepreneurial Cycling Dynamics, Open Innovation, Closed Innovation, Social Innovation, New Combination





Session-16-#303-4(SS4 & SS17)

## Innovative Production Scheduling with Customer Satisfaction Based Measurement

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### Abstract

**Purpose/ Research Question**: In this paper, we focus on the scheduling problem in the ear of the 4th industrial revolution. In terms of the open innovation, the innovative production scheduling can be defined as the one used by using Big data, cyber-physical system problems, internet of things and cloud computing. Under this environment, one of the most important things is to develop efficient and effective scheduling algorithm for the quality, cost, delivery and flexibility.

There are various types of workstations according to the physical flows of manufacturing lot or product and one of them is flexible flowshop (also known as hybrid flowshop). In the flexible flowshop, there are serial workstations with multiple machines or equipment which can process multiple lots simultaneously and most manufacturing systems such as semiconductors, glasses, liquid crystal display(LCD), steel, solar cells, paper, aircraft and so on, have flexible flowshops. Therefore, it is very important to schedule jobs/products effectively and efficiently for the quality, cost, delivery and flexibility.

In this paper, flexible flowshop scheduling problem is considered with the property of sequencedependent setup and different process plans of jobs. Two methodologies for improving production firm are suggested based on the dispatching rules and optimized production technology. A simulation study is conducted for the performance evaluation on the randomly generated problem instances and results show that our proposed methods perform better than existing ones.

Key Literature Reviews (About 3~5 papers): In the field of flexible flowshop scheduling problem, since these kind of problem are known as NP-hard, there have been lots of paper for developing meta-heuristics, such as simulated annealing, genetic algorithms, taboo searches (Gupta and Tunc; 1998,

Gelders and Sambandam; 1978, Khouja et al.; 1992). On the other hand, to maximize customer satisfaction like meeting the due dates of customers' order, usual researches use the tardiness measurement (Guinet and Solomon; 1996, Chen and Gupta; 1989). Also, according to the complexity of the problem, in which can be classified by the number of serial workstations (or stages), several heuristic algorithms are developed to find near optimal solution.

**Design/ Methodology/ Approach**: To solve the problem considered here, we need to decide the size of lot or product to process at the shop and the scheduling scheme. In the proposed method, when a machine/equipment becomes idle, a job to be processed is selected according to the its priority, which is determined by the devised method here, and is processed at the machine. With the information about the due dates and processing times as well as setup time, we develop the methodologies based on the combination of dispatching rules, which are used for scheduling jobs, and optimized production technology, which is modified after solving the lot sizing problem for the objective of minimizing total tardiness of jobs. Here, the tardiness is defined as difference between completion time and due date of job.

(Expected) Findings/Results: To evaluate the performance of the suggested methodologies, these are compared with the existing ones which are used in the practical field. For each problem instance, we use the evaluation performance measure, relative deviation index (RDI), which is defined as (A-B)/(W-B), where A, B, W are the solution values of algorithm A, the best algorithm and the worst algorithm, respectively. Simulation study is conducted on randomly generated instances in which the real production situation can be reflected. The results show that the proposed methods outperform the existing ones.

**Research limitations/ Implications**: In the era of 4<sup>th</sup> industrial revolution, sustainability and open innovation is becoming more necessary and important. Especially, in the manufacturing level, they are becoming more important for the mass customization which is one of the important demands. A smart factory, which represents 4<sup>th</sup> industrial revolution, is one way of the sustainability, and innovative production scheduling with customer satisfaction based measurement is considered here since the quantity, quality, and customer's satisfaction are effected by scheduling results in the operational level. Therefore, an effective and efficient scheduling is one of critical success factor for the smart factory.

There might be a limitation on this research since this scheduling problem is specified in the lower level of production hierarchy of the manufacturing firms. Therefore, for the higher level such as production strategies and policies of the company, one may need to give an effort to develop production plans. Also, it may need more tests on various range of parameters to obtain more general results.

Keywords: fourth industrial revolution, scheduling, due date based measure, flexible flowshop, heuristics





Session-16-#303-4(SS4 & SS17)

# A Study on the Startup Willingness of Science and Engineering Students through Technology Entrepreneurship Education

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### Abstract

**Purpose/Research Question:** The purpose of this study is to examine the effect of entrepreneurship education satisfaction on entrepreneurship intention of science and engineering college students. More specifically, we measure technical entrepreneurship education in four aspects: contents of education, method of operation, content of learning, motivation for participation, and then examine how these elements of the technology entrepreneurship education affect the satisfaction of the education learners. In addition, we will carry out an empirical analysis on how the satisfaction of learners affects entrepreneurship competition are analyzed as control variables. We also analyze the effect of additional exogenous variables on the entrepreneurial intention considering the perceived alternative employment prospects.

**Key Literature Reviews:** Technology entrepreneurship is the creation of an organization with new products, service resources, organizational forms, etc. based on the knowledge of technology, experience,

and expert know-how, and the ability to create new wealth. Innovative actions to input existing resources, threats or uncertainties and the pursuit of profit by discovering business opportunities in the context (Sternberg and Wennekers, 2005). Entrepreneurship education explores business ideas and teaches the knowledge, skills, and attitudes necessary to successfully run a business plan specifically(Mok and Choi, 2012; Kim and Yang, 2012). In this paper, contents of technical entrepreneurship education will analyze and analyze the satisfaction of students.

**Design/Methodology/Approach:** The purpose of this study is to investigate the effects of enrollment of technical entrepreneurship education and satisfaction of education on actual entrepreneurship intention of science and engineering college students who have a willingness to start. In order to accomplish this research purpose, the research model and the hypotheses were analyzed empirically through offline research after preliminary preliminary research through online.

**(Expected) Findings/Results:** It is expected that students who are satisfied with the education through technical entrepreneurship education will be more willing to start. In addition, the researchers found that university students who participated in entrepreneurship clubs and entrepreneurship contests will have a high probability of participating in entrepreneurial entrepreneurship training and high satisfaction, and will show a strong commitment to entrepreneurship.

**Research limitations/Implications:** The potential weaknesses of this study are the lack of an analysis of the entrepreneurship and actual entrepreneurship due to lack of longitudinal research on actual entrepreneurship. Nevertheless, this study by cross-sectional analysis has a sufficient contribution and significance as a basis for future extension to longitudinal research.

**Keywords:**technology entrepreneurship, entrepreneurship education, entrepreneurship intention, business incubation clubs and entrepreneurship competition







Session-16-#303-4(SS4 & SS17)

# Japan's role for innovation system development in Thai automotive industry: an analysis by a dynamic functional approach

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### Abstract

**Purpose/ Research Question**: The present study aims at investigating the recent development of innovation system in Thai automotive industry, especially focusing on the roles of Japanese private and public sectors that have made efforts to support local suppliers especially in process innovation. A specific research questions are whether and how the achievements and consequences of Automotive Human Resource Development Program (AHRDP) were supported by Japanese private and public sectors. So as to answer the questions, the study takes a modified dynamic functional change approach, by which we can identify the sustainability of effective interactions of the functions within the system.

**Key Literature Reviews (About 3~5 papers):** Literature review consists of two parts. Firstly, two studies on sectoral level of innovation in Thailand are reviewed. Regarding Thai automotive and hard disk drive industries, Berger & Diez (2008) concluded local firms were more active in innovative activities but MNC affiliates contributed to the advancement of local firms through interactions such as enhancing upgrading efforts by creating crises, direct/indirect assistance, and improving the science and technology infrastructure and the human capital basis. Intarakumnerd and Chaoroenporn (2013) investigate the roles and capabilities of both public and private intermediaries in Thailand in the case of hard disk drive (high-tech), automotive (mid-tech) and frozen food processing (resource-based) industries. According to their analysis, for automotive industry, government agencies with a clear mandate and budget and insightful local industrial associations may act as 'resource providers' and supported local firms. Regarding the division of labor between public and private intermediaries, the formers should play leading roles in producing 'public goods' such as policy formulation, human resource development and infrastructure provision. The latters should play an active role with industry-or firm-specific issues, such as promoting trust and diffusing technological know-how and information among members, assisting them with upgrading their capabilities and so on.

In our case, AHRDP, Japanese private and public sectors played highly active roles in developing industrial human resources directly and the system for sustainable learning and ultimately process innovation. These contributions were not extensively introduced in Intarakumnerd & Chaoroenporn (2013). Moreover, the degree of private sector involvement was significantly high, compared with the results of Berger & Diez (2008). This is partly because the program was implemented in the context of

economic partnership between two countries, providing technical assistances from Japan and tariff reduction for luxury cars from Thailand. We have a room to be investigated concerning the effects of factors above.

Next, we move on to the literature on analytical framework development. The present study reviews two articles on functions of innovation systems, because their scopes reflected the common understanding of researchers in terms of functions. Hekkert et al. (2007) proposed a framework with a number of processes for well performing innovation systems, called as functions of innovation systems. The framework consists of seven functions, namely, entrepreneurial activities, knowledge development, knowledge diffusion through networks, guidance of the search, market formation, resource mobilization and creation of legitimacy/counteract resistance to change. Those functions are considered to be interacted for effective operation of the system in order to result in technological change. Among the functions, guidance of the search and entrepreneurial activities are expected to be starting points as motors of change. Bergek et al. (2008) operationalized their previous work on a functional approach to analyzing innovation system dynamics into a practical scheme of analysis for policy makers. They showed seven functions mostly similar to those mentioned in Hekkert et al. (2007). In addition to identify the functions, Bergek et al. (2008) provided six steps of analysis; 1. Defining the technology innovation system (TIS), 2. Structural components, 3a. Functions, 3b. Achieved functional pattern, 4. Assessing functionality & setting process goals, 5. Inducement & blocking mechanisms, 6. Key policy issues. This is more comprehensive than the framework of Hekkert et al. (2007) that explicitly described only the third step explicitly. The main application of their framework is the identification of "system failures" or weaknesses, expressed in functional term.

This dynamic functional approach to innovation system was developed for environmental technologies in particular. Hence, we have to modify the framework in order to match with our case, process innovation of local suppliers in Thai automotive industry, which is discussed in the section below.

**Design/ Methodology/ Approach**: For the purpose of developing a modified framework, we should exclude legitimacy/counteract resistance to change and market formation in both Hekkert et al. (2007) and Bergek et al. (2008) from the system. In Hekkert et al.'s (2007) discussion, entrepreneurial activities directly change the functions excluded while allocation of resources is affected by entrepreneurial activities through legitimacy/counteract resistance to change. Due to removal of two functions, we should link entrepreneurial activities and allowance of resources. In terms of the steps for analysis, we can follow those suggested by Bergek et al. (2008).

(Expected) Findings/Results: The following discussions will be along with the six steps of Bergek et al. (2008)

### 1. Defining the innovation system in focus

The focus of this study is on AHRDP and succeeding programs by the initiatives by Thai side. AHRDP was implemented to upgrade skill and competency and consequently to improve productivity of local automotive parts makers, mainly through trainer's training as well as curriculum and institutional development. For this purpose, related actors, trainees, trainers and others in the industry should effectively utilize and diffuse knowledge and skills acquired by trainees. Subsequently knowledge and skills are applied for problem finding and solving in their workplaces, which enhances innovations in the





industry. In this regard, the program is understood as the intermediary for developing sectoral innovation system. For AHRDP, four leading Japanese automotive companies have provided their internal training courses for use in this project. These training curriculums include the Mind Management and Manufacturing Skill, the Skill Certification System, the Advance in Mold & Die Development, and Lean Production, mostly relevant to process innovation as their ultimate targets. Japanese experts who are dispatched from these well-known and large Japanese companies teach Thai people their practical skills, knowledge and know-how in the automotive field to develop human resources in Thailand. 2. Structural components

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Actors are Japanese experts, their counterparts in Thailand working as master trainers in the succeeding programs, trainees including those who become trainers, others in the industry. Network formations are anticipated especially among master trainers and other trainers. Thailand Automotive Institute (TAI), Thai German Institute (TGI) and National Institute for Skill Development (NISD) are major institutions involved in the program.

3a. Functions & 3b. Achieved functional pattern

During AHRDP, the motor of change was guidance of the search by Japanese experts rather than entrepreneurial activities. In the Hekkert et al.'s (2008) framework, it affects knowledge creation. However, at that stage, knowledge were transferred from Japanese experts and so without the function of knowledge creation, knowledge was diffused to trainees. Thanks to this knowledge diffusion, more participation in the program as entrepreneurial activities are enhanced directly and indirectly through more positive expectations. Allocation of resources increased consequently and then more knowledge diffusion are expected. The program could have a virtuous cycle of functions, as indicated by the achievement of quantitative targets in the number of trainees. Initiatives were taken by Japanese experts but they made efforts to reduce their involvement over time.

After AHRDP, or even later stage of AHRDP, those who learned from the program initiated their entrepreneurial activities enhanced by knowledge development (including both knowledge creation and diffusion). It should emphasized that its process is different from the earlier stage of AHRDP. Through the application of originally learned knowledge and skills, they created new knowledge for improving processes. Some trainers are actively training within their firms. More conspicuously, some participating firms for lean production program organized the group for interactive learning by having seminars and invited non-participating firms to join the group.

4. Assessing functionality & setting process goals

Judging from the results for the third step, active local suppliers are regarded at "the growth phase". However, considering all the local suppliers and other firms intending to be suppliers, coverage of the sectoral innovation system is quite limited. In this sense, we should understand the industry is still at the formative phase.

### 5. Inducement & blocking mechanisms

According to the analysis, the strongest inducement is likely to have a results in improving something explicitly. Quality, cost, delivery or any other visible betterment will be the driver for a virtuous cycle. Effective practices are process innovations without doubt. Among sub-programs, lean production is more likely to be linked to improvements. That may be a reason why the voluntary group was established only by the participants of the sub-program. On the other, many firms faced difficulty to send their good employees to trainings, because they are the core figure in the firm and workplaces are afraid to have

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more trouble if they leave for trainings. Then human resource mobilization is very hard.

6. Key policy issues

Direct subsidies for training is to have positive effects on increase of trainees while this is not sufficient, with considering the discussion so far. Advocacy with successful cases for process innovation may be more promising in order to promote innovation based on learning.

**Research limitations/ Implications**: Process innovation is still major part of innovation by local suppliers in Thai automotive industry. In this regard, AHRDP is a good case for investigation. The present study dared to analyze its contribution to innovation system development rather than from the perspective of more straightforward HRD. This is because HRD or learning should contribute to better performance especially through innovation. This definition of the innovation system in focus itself is meaningful. By having the broader scope, we can have the prescription for improvement of the program in a more comprehensive way. However, there must be more strict discussion in terms of the link between HRD and innovation. It is necessary to conduct in-depth case studies on applications of knowledge and skills learned from HRD programs.

Car assemblers in Thailand have started R&D activities. Local suppliers with the status of second or third tiers are also necessary to involve more into design of their products. Because of this trend, after the end of AHRDP, Automotive Human Resource Development Institute Program (AHRDIP) was started by Japanese technical assistance in 2011. It expanded the scope into part of research and development activities, along with the demand from local firms and government. However, there was a problem to inhibit interactive learning among the trainees. Because of the nature of R&D, participating firms are more reluctant to share the information on their own projects. Innovation system development may have more difficulty for this level. Further comparative analyses between process and product innovation may create some more useful implications for improving both systems.

Keywords: innovation system, functional analysis, dynamics, automotive industry, Thailand, Japan

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Session-16-#303-4(SS4 & SS17)

## Innovative Japanese vending business in Russia (case of Dydo DRINCO Inc)

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### Abstract

Russian vending market is still an emerging one. There are many difficulties and at the same time market is full of opportunities. Another evidence of growing opportunities in Russia is the limited penetration of vending machines in comparison to the number of potential clients. The Russian vending market attracts global players and DyDo DRINCO Inc. is the first Japanese vending company in Russia has started operations in Moscow in 2014, and established the wholly owned subsidiary DyDo DRINCO Rus, LLC. The main responsibilities of the company are marketing and distribution of beverages and vending machines. Jointly with Avalon Distribution, DyDo installs their own vending machines in business centers, shopping malls, metro, universities, gasoline stations. By the end of 2016 there are 550 vending machines installed in Moscow and assortment line contains 25 products.

The main aim of this research is to identify the uniqueness of the Japanese innovative vending business and its applicability on the emerging Russian vending market. The research is based on the case of DyDo as this company can be defined as an innovative company in the vending business as derives a significant portion of sales and profits from products/ solutions introduced recently. The company constantly creates new beverages to satisfy the changing customer's preferences. At the same time DyDo has unique techniques and business model to compete successfully in Russia.

Upon their introduction, vending machines created a new era of consumer choice and convenience and to be competitive in today's market companies have to rapidly adapt to survive. In case of DyDo we found at least ten strategic principles that are based on innovate approaches for the emerging vending business in Russia.

- Differentiation- there are many companies offering similar products and DyDo is able to offer choices clients cannot get elsewhere. DyDo is able to achieve it based on the substantive product line.
- Focus on quality- the main principle of DyDo is the highest quality of vending machines and beverages. Company uses natural ingredients and strictly controls production. The reputation is very important for the company.
- Reliable equipment- DyDo's vending machines can operate up to -35 C. In Russia only DyDo's vending machines can be installed outside and operate.
- Unique equipment- DyDo's vending machines in Russia can store and sell hot and cold beverages simultaneously.

- Ease of buying- DyDo's vending machines do not allow to see real products only samples, and client have to press only one button and only once to get a certain product. This innovative simplicity allows to reduce a number of malfunctions which is also a part of the concept of quality.
- Supply chain technology and execution- Routeman is a specific system used by DyDo to serve vending machines and to implement sales.
- Adaptation- seasons and locations of vending machines have a significant influence on the assortment line of DyDo beverages. DyDo's vending machines have anti-vandal protect that is important for Russian market.
- Energy-safe standards- all DyDo vending machines are energy-saving machines.
- Stay in tune with what customers want- DyDo constantly monitor the market to meet clients needs and expectations.
- Vending is fun- DyDo turns the buying process into a game.

In Japan DyDo applies additional innovative technologies as touch screens, however in Russia they are not applicable due to a high level of vandalism.

The Japanese vending business in Russia is not well explored field and sources are quite limited. The main primary sources are interviews with top managers in Japan and Russia and DyDo DRINCO Corporate Reports. The article is based on descriptive and applied types of the research and demonstrates the importance of innovative approaches for Russian vending business.

Keywords: DyDo DRINCO Rus, innovative vending business, russian vending business .





Session-16-#309-4(SS18 & SS29)

## The Impact of Local Government Policy on Innovation Ecosystem: Case Study of Changzhou, China

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### Abstract

Purpose/ Research Question: Business nowadays is more and more relying on collaboration and network. Through open invention and coordination, companies attract the participation of a diversity of external contributors to create knowledge collectively (Chesbrough and Appleyard, 2007). This happens not only to leading western firms such as Intel, Google and Apple, but also to SMEs (small and medium enterprises) in emerging countries including China. Traditionally, China is known for its strong manufacturing capability. With the government promoting original design, creativity, product development and knowledge creation, firms are now seeking to upgrade towards high value-added activities. Large firms collaborate extensively with supply chain partners on new product development. Meanwhile SMEs also gather together, learning and sharing resources with research institutions, gradually forming a network based innovation ecosystem. The concept of innovation ecosystem is built upon business ecosystem, innovation and open strategy. In China, a typical innovation ecosystem consists of companies, universities and research institutions in a region or cluster, with service infrastructure supported by the local government (Ran and Liu, 2014). So far researchers have explored technology and production innovation from micro-level perspectives of firms, in particular in the hightech industry such as mobile computing. However, the impact of policy on nurturing ecosystem, particularly in areas previously lack of innovation capability is unknown. Thus the main objective of this paper is to find out the linkage between local government policy and innovation starting from limited resource towards a matured ecosystem. The key research question is "what is the impact of government policy on the development of innovation ecosystem". With emphasis on interaction mechanism, an indepth case study on Changzhou, China, a recently fast-growing region based on collaborative innovation, is conducted. It specifically aims to identify:

- Key activities of how innovation ecosystem is formed, developed and expanded.
- Role of local government policy in each stage of innovation ecosystem process.
- Interaction mechanism among industry, university and research in the ecosystem.

Key Literature Reviews: Current literature has covered the areas of innovation, business ecosystem and

policy management. In terms of innovation, exploration refers to the searching and creating of new possibilities, technology breakthroughs, sometimes with risk (March, 1991); whereas exploitation innovation means the expanding, enriching and strengthening of existing knowledge (March, 1991). Traditionally, innovation mostly takes place closely within companies based on ownership and control. The concept of open innovation emerges as firms collaborate with each other in developing new products and services (Chesbrough, 2003). Companies need to coordinate in a flexible way in the open approach (Chesbrough & Applevard, 2007). By conducting in-depth case study on Nokia, Dittrich and Duysters (2007) find that innovation network effectively helps companies to adapt to the changing market conditions and strategy opportunities. Inter-firm collaboration, collective learning, open strategy bring in novel business models, as external resources, innovation communities, surrounding networks and ecosystems are all involved (Chesbrough & Appleyard, 2007). Business ecosystem is regarded as the combined feature of strategic alliance, open innovation, supply chain with diverse products and broader collaboration range. It is a dynamic process starting from existing collaboration network to expansion, convergence and renewal (Moore 1993). Iansiti and Levien (2004) suggest that resource sharing with external partners can result in innovation. Adner and Kapoor (2010) emphasize the co-innovation among supply chain partners, and propose the concept of innovation ecosystem. To further capture the dynamic feature of innovation ecosystem in China, there are studies on ecosystem growth mechanism (Lyu, Lan and Han, 2015), its coupling relations with technology population (Zhang, 2015), multi-level environmental factors (Xu and Li, 2014) and innovation efficiency (Liu and Chen, 2015). From the perspective of policy, it is found that network-based strategy of growth is suitable for companies in planned economies in transition such as China (Peng and Heath, 1996). To foster technology development infrastructure, government can use both mission-orientation and diffusion-orientation policy mechanism. In particular mission-orientation policy can develop technology leadership and create standards, whereas diffusion-orientation policy incrementally builds service capability by encouraging wider participants (Yu, Yue and Ping, 2012). However, current research on the influence of local government policies on building and enriching innovation ecosystem in emerging areas with inadequate knowledge resource is still limited. Thus this research will contribute to the theory of innovation ecosystem from this angle.

**Design/ Methodology/ Approach**: Most researchers choose qualitative method to explore key issues of innovation ecosystem (Zhao and Zeng, 2014). This is due to the fact that the theory of innovation ecosystem is still at early stage (Zen, Gou and Liu 2013), and limited findings on China cannot generate hypothesis for theory testing. The nature of this research requires for a theory-building approach with qualitative methodology, which can provide a deep understanding on significant issues which have not been explored (Yin, 2003). In particular, in-depth single case study is selected as the method to explore insightful details of innovation ecosystem and its interaction with local government policy. The case of Changzhou is specifically chosen. This region is located in Yangtze River Delta of China, original lacking universities and knowledge resources. During 2001 and 2005, privately owned enterprises in Changzhou started to approach the local government, seeking help on science and technology resources. From 2006 to 2010, with series of polices issued, the "Changzhou model" was developed, combining science and education, and linking industry with university on public service platform provided by the government. With innovation ecosystem gradually matured, during 2011 to 2015, the Changzhou model





was continuously enriched by internationalization, aggregation of global resources, and participation of financial capital intermediaries. The growth strategy of Changzhou region and its detailed process can potentially be implemented in other Chinese regions, which are seeking for network based innovation advancement. Our data collection includes document review and interview. Archival data was collected from Changzhou government statistics report and industry report, to capture series of local policies and events related to innovation from 2000 to 2015. Meanwhile, semi-structured face-to-face interviews were conducted to 3 officials of Changzhou Science and Technology Bureau, with questions on the background and prioritized concerns of issuing each policy, institutional and macro-environmental factors, interaction activities with the ecosystem, and strategic decisions of Changzhou innovation from university, industry and research institution perspectives.

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(Expected) Findings/Results: Based on this in-depth case study, our expected findings include a staged model of Changzhou innovation ecosystem with key events and policies; structure of the innovation ecosystem; and interaction mechanism among different players in the ecosystem. Changzhou innovation ecosystem experienced three main stages. Stage One (2001-2005) was the early formation stage. Since Changzhou had few universities and firms, policy was the key driver and initiator. The local government launched the "economy-science-education" project, attracting 5 colleges, SMEs and 100,000 experts with capital support and favorable terms. While universities can share research resources together, education programs were launched jointly by universities and companies for collective learning. A special admin office was formed to coordinate activities in Changzhou. In Stage Two (2006-2010), the innovation ecosystem was further improved. There was a clear business model integrating industry, university and research (Figure 1). By collaborating with China Academy of Sciences and other universities, 14 research centers and 20 R&D bases were launched, which further nurtured 700+ high-tech and start-up companies. With no boundaries among university, R&D centers and companies, hardware facilities and information were shared freely. 40 public service platforms were co-developed to create IP and solve technology-related problems together. At this stage, local government policies continuously facilitated the innovation ecosystem which in return provided feedback for policy improvement. Stage Three (2011-2015) was the extension of innovation ecosystem after reaching maturity and self-management. The Changzhou business model was implemented in other regions of China. Meanwhile, the local government assisted companies and R&D centers to collaborate with international partners by issuing new polices and reward system.

### Table 1: Key policies and events in the development of Changzhou innovation ecosystem

Stages	Background in	Concerns from	Key events/policies	Innovation
	Changzhou	government		outcomes
Stage One	Lack of	Looking of the	1) Science and technology infrastructure	400 industry-
(2011 - 2005)	innovation	approaches to	development: Enterprise technology centers,	university-
Formation	resources,	combine	engineering technology centers, postdoctoral	research
	including	university, industry	workstations; 2) SME technology centers; 3)	interaction
	personnel,	and research $\rightarrow$	Establishing science and technology forum; 4)	activities; 2000
	technology, fund	integrating	Issuing policies "Changzhou manufacturing	collaboration
	and innovation	resources in the	information engineering pilot implementation",	projects; 31.3
	awareness.	province;	"Promoting the progress of science and	billion RMB
		introducing	technology," reward system on "science and	technology
		external resources.	technology"; 5) Establishing IPR bureau; 6)	based trading;
			Creating learning atmosphere; 7) Launching	112 service
			education programs; 8) Forming collaboration	centers.
			between universities and research centers.	
Stage Two	The original role	Forming new	1) Establishing "higher education park" for	4.13 billion
(2006 - 2010)	of the	"Changzhou	personnel training; 2) Technology transfer and	RMB national
Development/	government is	model" with	transformation; 3) Transferring from	fund (543
Maturity	not strong, lack	policies and	"university city" to "science city"; 4) Issuing 40	projects), 9.56
	of policy and	research	policies on innovation; 5) Attracting talents	billion RMB
	capital	collaboration $\rightarrow$	through the "1000 overseas talent" project; 6)	provincial fund
	investment.	co-development of	Industry upgrading: e.g. forming the PV	(2514
	Firms have not	university, industry	industry chain; 7). Providing subsidies to	projects); 90%
	yet become main	and research	support independent innovation products; 8)	R&D
	innovation	centers;	Development of VC, PE, risk compensation	investment,
	players; the	establishing 3-	fund, specialized science and technology	80% experts,
	upgrading of	levels of	financial centers to provide service for SMEs;	60% patents
	traditional	innovation	9) Development of science and technology	came from
	industrial sectors	platform; attracting	oriented service industry	industry;
	are slow.	external resources.		annual growth
				rate of patent
				application was
				45.6%; national
				and provincial
				prizes
Stage Three	More regional	Enriching	1) Upgrading the industry-university-research	National and
(2011 – 2015)	innovation based	"Changzhou	park through "3211","4+1" projects; 2)	provincial
Extension	competition,	model"	Internationalization: Sino-US science and	prizes; In year
	lacking of	(reconfiguration	technology Park, German innovation center,	2014 alone,
	independent IPR,	and service	"APEC 2014 Changzhou declaration" etc. 3)	300 projects,
	brand and high-	enhancement) $\rightarrow$	Identifying leading enterprises on innovation,	70 key
	value added	collaborating with	transforming towards innovative city; 4)	technology
	products.	global resources;	Establishing innovation evaluation methods;	breakthroughs;
		internationalization	promote patents; linking industry with financial	1000 patients,
			institutions; 5)"518" Internet platform project;	10 billion RMB
			6) Focusing on 10 main industry chain	revenue; 3.5
			development, inviting national research	million RMB
			institutions; 7) HR management, e.g. "323	revenue from
			entrepreneurial talent training plan".	service sector.



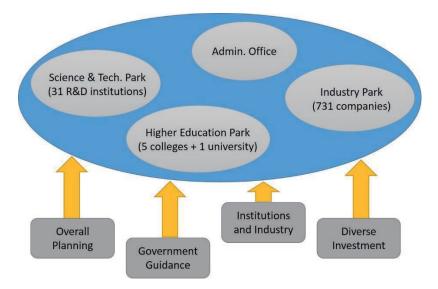


Figure 1: Business model of Changzhou innovation ecosystem

Key events and local government policies at each stage of Changzhou innovation ecosystem is summarized as Table 1. The interaction mechanism of industry, university and research in the innovation ecosystem is identified in Table 2.

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Interaction	mechanism	amona	1nductry	11mit/orcity/	and recearch
Table 2: Interaction	incentariisin (	annong	muusu v.	university	and itstatti
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Players	Roles and activities (interaction with government)	Other observations		
University	- HR training and development.	In addition to technology transfer and		
	- Scientific research.	technology service revenue, there are also R&D		
	- The transformation and industrialization of	investment from government, technology shares		
	scientific research to companies.	and stock option. If a company is to be founded,		
	- Education and research improvement through	science and technology personnel are		
	industry feedback.	encouraged to share or hold stock.		
Industry	- Encouraging companies to carry out research	The Science and Technology Bureau helps		
	collaboratively with fiscal and taxation policies.	companies to apply for national and provincial		
	- Helping firms to select cooperative projects.	science and technology projects.		
	- Encouraging innovation and entrepreneurship.			
	- Promoting companies to expand existing			
	innovation outcomes.			
Research	- Collaboration with university.	These R&D institutions mainly get revenue		
	- Collaboration with China Academy of Sciences.	from the market. The government helps to build		
	- Establishing R&D centers jointly with external	laboratories and provide talent subsidies. The		
	partners.	government also gives funds to large R&D		
	- Establishing bases for technology transfer,	projects.		
	transformation and incubating enterprises.			

Research limitations/ Implications: This study aims to investigate the interaction between local

government policy and innovation ecosystem. By reviewing key events during 2000-2015 in Changzhou Science and Technology Bureau, we have built a staged model of Changzhou innovation ecosystem; analyzed the impact of policy at different stages; and identified the interaction among players in the ecosystem. The research contributes to the theory of innovation ecosystem, by exploring institutional and policy factors, especially when the original knowledge resources are limited. We suggest that at early stage, local government should issue policies to attract talents and research resources. Collectively learning is important. During the development and enrichment stage, policies continuously facilitate sharing and problem-solving among industry, university and research, and these players give feedback to policy makers in return. Gradually the ecosystem can reach self-management with government infrastructure support. Finally, policies can help the innovation ecosystem to expand towards internationalization and upgrading to high-value added activities. Apart from theoretical contribution, we believe that the staged model can be valuable for policy makers in other regions of China to learn from Changzhou model and promote dynamic innovation ecosystem. As for the limitations of this research, single case study from one country may not be comprehensive; data sources are mainly from documents and interviews with government officials. More primary studies into other players such as companies and universities can enrich the findings. Also the unique social structure of China has made government policy important in nurturing innovation ecosystem, which may not be the same in other countries. The collective impact of policy, national culture and institutional factors can be one of the future research areas.

### Keywords: Innovation Ecosystem, Policy, China

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## A framework of Fostering Regional Innovation Ecosystem A case study of Jiangsu province in China

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### Abstract

**Purpose/ Research Question:** Innovation paradigm 3.0 is the competition between the innovation ecosystem instead of a single organization. Jiangsu province in China has ranked first in regional innovation capability in consecutive 7 years, this is closely related to its good innovation ecosystem. Through the study on ecological system in Jiangsu province, this article built a "multi-cure—community" fostering framework by using ecosystem theory to provide reference for theory and practice.

### **Key Literature Reviews:**

With Moore (1993) put forward the concept of business ecosystem, the academic community launched a lot of research and achieved a wealth of results. While the innovation ecosystem was explicitly suggested by the U.S. Council on Competitiveness in a study entitled" Innovate America : Thriving in a World of Challenge and Change " (2004). The report pointed out that since 21st Century, the international pattern, the main innovation, innovation paradigm and innovation environment have emerged some new changes, There is a new competition situation between the state and the different innovation subjects. Therefore, there is a need for a new relationship between firms, governments, educators and workers to form a 21st century innovative ecosystem(Fuquan Sun,2012).Since then, more and more researches on regional innovation systems have been done through ecological theories and perspectives,The United States President's science and Technology Advisory Committee published the "*Innovation Partnerships between Universities and the Private Sector*" to further elaborate: This ecosystem includes a range of actors from academia, industry, foundations, scientific and economic organizations and governments at all levels(PCAST,2008). At present, the academic circles have not yet formed a consensus on the basic concepts and other related issues,different scholars have defined according to their own research from different angles. The main points are as follows. Adner (2006)





analyzes the innovation ecosystem from the perspective of mechanism integration and shared knowledge,Luoma-aho etc. (2010), Xie-lin Liu et al. (2015) defined the innovation ecosystem based on an open perspective, *Russel* etc. (2011), ShakerA.Zahra &Satish Nambisan (2011) defined the concept of innovation ecosystem from the perspective of creating value, Yunsheng Zhang (2008) and Lifei Zhang (2009) and Xiaoyong Zheng (2010) defined the innovation ecosystem based on the technology innovation ecosystem. This paper uses Wan Li et al. (2014) to define the innovation ecosystem. The innovation ecosystem is an open and complex system of symbiotic competition and dynamic evolution which is formed between the various innovation communities and the innovation environment through the material flow, the energy flow and the information flow.This definition embodies the view of openness, cooperation and symbiosis.

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The basic characteristics of the innovative ecosystem are mainly diversity symbiosis, self-organization evolution and open coordination. Diversity symbiosis: The diversity of innovative species refers to the research, development and application of the three major groups of innovative species through the knowledge, technology, human resources, capital as the main link to form a complex value network, competitive symbiosis in the evolving development of the system balance(Wan Li,2014).Diversity symbiosis is an important basis for maintaining an exuberant vitality of an innovative ecosystem and a fundamental premise for continuous innovation.Self-organization evolution:The healthy innovation ecosystem continues to evolve and stay close to the dynamic optimal goal, and species, populations and communities of the internal factors of the system are constantly evolving and changing, and even changing with each other. The government decides the evolution direction of the system in the evolution of the innovation ecosystem. Government innovation governance is one of the keys to system evolution. Open collaboration: In the context of globalization, the innovation ecosystem of a country or region is no longer an isolated ecological circle, but is related to the innovation species in the external environment. With the constant introduction of exotic invasive species, the phenomena of species competition and community succession occurred in the innovative ecosystem. Research community, development community, application community, service community maintained close ties with the outside world. Enterprises gradually break through the geographical boundaries, relying on the entire innovation chain, industrial chain and value chain through collaboration to achieve innovation.

Estrin (2010) pointed out that research, development and application of the three communities are present in the innovation ecosystem, the positive balance among the three communities determine the sustainability of the innovation ecosystem. The types of innovation ecosystem have different classifications because of different research objectives. For example, it can be divided into the macro level of the regional innovation system, middle level industrial innovation ecosystem and the micro level of enterprise innovation ecosystem. It also can be divided into three types of innovation ecosystem, which are technology oriented (For example, the innovation ecosystem formed by the 3G Technology Patent Alliance), product oriented (Innovative ecosystem formed by intelligent electronic consumer products of Xiaomi) and platform oriented (The innovation ecosystem formed by Apple's smartphone manufacturing chain or Innovation ecosystem based on Internet platform).

It is generally believed that the innovation ecosystem is evolved from the innovation system. However,

the openness, symbiosis and other characteristics of the innovation ecosystem determine the difference between them. Therefore, clarifying the relationship between the innovation system and the innovation ecosystem is the key to study and cultivate the innovation ecosystem. Firstly, the concept of innovation ecosystem reflects the transformation of research paradigm. Scholars' concerns shift from focus elements of the system to focus the dynamic process between elements, between the system and the environment, it is emphasized that the combination of production and research with the four helix (Estrin, 2010). For example, from a system point of view, the enterprise is no longer a member of a single industry, but a part of the ecosystem that spans multiple industries. In an ecosystem, companies continue to develop and enhance their ability to innovate. They rely on cooperation and competition for production, to meet customer needs and ultimately continue to innovate. While the concept of innovation system related to the innovation of the ecosystem is more concerned about the role of internal coordination, coordination within the system and the elements of the link mechanism. The innovation system emphasizes that the enterprises are the main body of innovation, and it is relatively closed. Secondly, from the space, the innovation ecosystem can cross the region, not limited to a certain region, It can cross different range from country to country, province to province, and city to city. It's an open system which emphasizes openness; Innovation system is more concerned about the internal elements of the system through the contact and coordination to enhance innovation, such as the regional innovation system emphasizes the internal allocation of resources and coordination. Thirdly, the innovation policy should focus on resource sharing and utilization, especially the demand-side and environment-side policies. The innovation system is more concerned with the formulation of supply-side policies, especially technological innovation policies (Li Wan, 2014). In short, scholars focus on the theory of innovation ecosystem and innovation system are different. In policy formulation, the innovation ecosystem should pay more attention to the dynamic process between factors, systems and environment. The focus of policy formulation is on the demand side, and the policy mix should be used flexibly.

In summary, there are many researchers discussing the basic rules of the innovation ecosystem, but how to cultivate the regional innovation ecosystem is still insufficient, so this study provides a gap, therefore, this study selected China Jiangsu Province as a case study to explore the regional innovative ecosystem approach or methods.

**Design/ Methodology/ Approach:** The research method of single-case in-depth analysis is adopted to help refining the law by using case data, developing theories, and existing theories (Eisenhardt , 1989 , Yin, 1994) to buid the analysis framework of fostering eco-system in Jiangsu province.

Jiangsu province is located in Chinese Yangtze River Delta Region, which is the eastern economical developed provinces of China. China Science and Technology Development Strategy Research Group conducts a comprehensive evaluation of innovation capacity in Chinese provinces (excluding Hong Kong, Macao and Taiwan) from five aspects : knowledge creation, knowledge acquisition, business innovation, innovation environment, and innovation performance. According to < The report of China Rational Innovation Capacity 2015>, Jiangsu province ranked first and has been the "The strongest





national innovation capacity" for consecutive 7 years, which has the strongest innovation vitality, the most innovation achievement, the strongest innovation culture, it has great significance to select the ecosystem in Jiangsu province. This study will select the data of Jiangsu innovation and development from 2006 to 2015.

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In this case study process, through face-to-face interview, telephone interview, site observation, seminar, the meeting of related governments, enterprises, research institudes, etc, our research group got the first-hand data, we conducted in-depth interviews with Science and Technology Management of Jiangsu Province, some city Science and Technology management departments, supplemented information, confirmed the public information, answered the questions that are difficult to determine in public information, and other issues we concerned, so that we can make this case to achieve a further improvements. One of the authors of this article, presided over the Jiangsu provincial government science and technology innovation research topics, are more familiar with policies and practices in Jiangsu innovation in recent years. The research group also collected and collated secondary data such as website information, news reports, professional magazines and internal data, and obtained as much detailed information as possible through repeated verification and comparison.

(Expected) Findings / Results: It is found that Jiangsu fosters the innovation ecosystem mainly with the existing hi-tech park (science and technology park) as the core; develops the research, development, application of the three communities of ecosystems; constructs points, lines, and spaces--Enterprise Innovation Ecosystem, Industrial Innovation Ecosystem, Park Innovation Ecosystem intertwined coexist which makes Jiangsu Innovation Ecosystem healthy, prosperous and competitive, which constructs a "Multi-core—Community" innovation ecosystem cultivation framework.

### **Research limitations/ Implications:**

This study also has some shortcomings, by selecting Chinese economical developed province for research, there are limited significance to Chinese underdeveloped areas for Chinese vast region and unbalanced economic development. In addition, the case of a long period of regional innovation ecosystem evolution needs to be followed continuously to conduct in-depth study, and improve the research conclusions constantly.

This study will provide theoretical support and forward-looking policy recommendations for China to cultivate and develop regional innovative ecosystems.

Key words: Open innovation, Innovation ecosystem, Innovation Policy

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### Construction of Health Assessment Index System of Regional Entrepreneurial Ecosystem

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#### Abstract

**Purpose/ Research Question**: Currently, entrepreneurial ecosystem research is mainly focused on the analysis and descriptive statistics of system elements (Mack and Mayer,2015; Isenberg,2011; Mason and Brown,2014; Amorós, Bosma and Levie,2013). Among them, the culture of respecting entrepreneurs, entrepreneurial orientation and without fear of entrepreneurial failure can promote more potential entrepreneurs to participate in entrepreneurial activities (Saxenian, 1994;), the government agencies guide other systems to work better, coordinate with other subjects to build good relations in the early stage of entrepreneurial system (Fuerlinger, Fandl and Funke,2015). Colleges and universities play a main role of fostering entrepreneurial thinking and transforming scientific and technological achievements (McKeon, 2013; Diaconu and Duţu, 2015). Entrepreneurial policies stimulate entrepreneurial activities effectively (Kantis and Federico;2012;). The research on the components of entrepreneurial ecosystem is relatively abundant but there is little research on the comparative analysis of the health degree of entrepreneurial ecosystem.

Key Literature Reviews (About 3~5 papers): Since Spilling (1996) proposed the concept of entrepreneurial ecosystem, it has received more and more attention (Neck, et al 2004; Cohen, 2006; Isenberg, 2010,2011; Vogel, 2013; Mack and Mayer, 2015). Entrepreneurial ecosystem research is of great significance because it is helpful to promote economic growth, increase employment opportunities and improve the happiness index (Mason and Brown,2014; Bernardez and Mead,2009). It can also alleviate the employment pressure (Vogle, 2013,) improve the success rate of Entrepreneurship (Mason and brown, 2014; Vogle, 2013; Suresh and Ramraj, 2012). So far, the concept of entrepreneurial ecosystem remains controversial to scholars (Xiang Guopeng, et al., 2016; Cai Li, et al, 2016). It can be divided into two kinds of views including the network perspective and ecological perspective after carding the relevant research.

First is the ecological perspective represented by Spilling, Vogel and Lin Song. Spilling (1996) thought that the regional economic development is a complex process and should take relevant elements into consideration. We should pay more attention to infrastructure, public structure and mutual relations instead of just focusing on the number of regional enterprises. He described the entrepreneurial ecosystem as a kind of environment which has decisive effects on related subjects in a certain region. And this kind of environment has three parts. Vogel (2013) based on the unemployment situation after the financial crisis, think to build entrepreneurial ecosystem to assist to carry out entrepreneurial activities successfully. He pointed out that entrepreneurial ecosystem consists of interactive





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entrepreneurial communities in certain regions, including various interdependent participants (entrepreneurs, government agencies, etc.) and influencing factors (market, infrastructure, supporting environment and entrepreneurial culture, etc.). Lin Song (2011) took natural ecosystems for reference and compared with it, summarize the components of entrepreneurial ecosystem. He thought the entrepreneurial ecosystem is a dynamic balancing system consists of start-ups and their essential ecological environment. They depend on and influence one another. Besides, is the network perspective represented by Cai Li, Neck, Cohen, Mason and Brown. Neck (2004) described the entrepreneurial ecosystem through a two-phase study and found it contains two parts by using the taxonomic methods. The first part is agencies related to incubator, including promoting indirect derivative start-ups, direct derivative start-ups and potential derivative start-ups. The second part contains formal network, infrastructure and community culture which consist of universities, governments, professional support services, capital services, intellectual resources and large companies. Cohen (2006) through the case study emphasized the network relationship, infrastructure and cultural environment are the core elements of the entrepreneurial ecosystem. He also put forward the function of entrepreneurial ecosystem in building a sustainable competitive advantage. Mason and Brown (2013, 2014) thought that entrepreneurial ecosystem has obvious differences in the characteristic of the natural ecosystem, which showed significantly for richer information environment, the core position of large enterprises, encouraging entrepreneurship, free and open cultural environment, and the capital of meeting entrepreneurs and growth, etc. They thought entrepreneurial ecosystem should be a network of entrepreneurs and resource providers which closely connected, and it interacts with the entrepreneurial environment. In view of the system, they also believed that policy makers should pay attention to the establishment of an effective evaluation system to assess the strengths and weaknesses of each part, and continue to monitor the effectiveness of the interaction. Cai Li et al. (2016) thought that entrepreneurial ecosystem is an organic whole which composed of start-ups and external entrepreneurial environment. It is designed to improve the success rate of entrepreneurial activity through the complex connection between each main body.

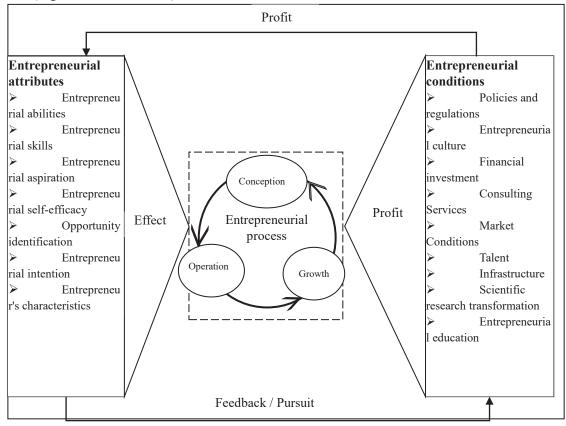
From the above, entrepreneurial ecosystem is a complex network with the interaction of multi-agent. Entrepreneurs and entrepreneurial institutions act on the entrepreneurial process together and aim to improve the situation of entrepreneurship, increase the start-ups with high potential and growth.

**Design/ Methodology/ Approach**: Entrepreneurial ecosystem has the regional features (Motoyama et al,2014; Saxenian,1994; Pitelis,2012) and regional differences are very large (Bernardez and Mead,2009; Kshetri,2014; Qian, Acs and Stough,2012). How to construct scientific and systematic assessment system is very urgent now (Cohen, 2006; Vogel, 2013). National entrepreneurial ecosystem concerns elemental variance in entrepreneurial ecosystem within countries, compares different system utilities among nations (Ács, Autio, Szerb,2014), the project of Global Entrepreneurship Monitor analyzes the Entrepreneurial conditions within different countries and influences on individual business, it also analyzes the environmental elements conditions related to entrepreneurship completely (Reynolds et al,2005; Amorós, Bosma and Levie,2013; Hechavarria and Ingram,2014), Global Entrepreneurial abilities and aspirations. Currently, the quantitative study of entrepreneurial ecosystem mainly concentrated on macro level and the measurement methods are descriptive analysis, which failed to build a scientific evaluation

system and the comparison evaluation of regional entrepreneurial ecosystem.

Entrepreneurial ecosystem has the characteristic of entrepreneurial theory and natural ecosystem (Neck, 2004; Lin Song, 2011). Use VOR (the most commonly used model of natural ecosystem) for reference (Liu et al, 2015) to quantitatively evaluate the health of regional entrepreneurial ecosystem. It plays an important role in making and adjusting the policy and improving the quality of regional entrepreneurial activities. Considering the concept and characteristic of entrepreneurial ecosystem, we think the health assessment of entrepreneurial ecosystem should include: start-ups represented by entrepreneurs, the essential factors of entrepreneurial ecosystem represented by government, finance, consulting services, education and scientific research institutions. They act on the dynamic process of entrepreneurship through the interaction of the complex relationship and use the integrity, dynamics and elasticity of the organizational elements of the structure as the evaluation object.

Integrated the concept of entrepreneurial ecosystem and the theory of natural ecosystem health, the health assessment of entrepreneurial ecosystem should start from the following three aspects: (1) The effect of entrepreneurial environment represented by entrepreneurial participants on entrepreneurial process and entrepreneur behavior, entrepreneurial environment provide various entrepreneurial resources for start-ups, affect the success rate of entrepreneurial activity. Also the entrepreneurial environment will affect the entrepreneurial propensity of potential entrepreneur. Good social and cultural environment will be good for the development of entrepreneurial activity as well (Fig.2 'Profit' arrow). (2) Start-up behavior represented by entrepreneur behavior determines the paths of entrepreneurial process (Fig.2 'Effect' arrow). (3) The interaction between entrepreneur and entrepreneurial environment elements (Fig.2 'Feedback' arrow).







### Fig.2 Interactive Mechanism of Entrepreneurial Ecosystem

In summary, to assess the health of entrepreneurial ecosystem comprehensively, this research build the health assessment of entrepreneurial ecosystem based on the interaction mechanism of entrepreneurial ecosystem, also measure the quality of regional entrepreneurial ecosystem. The content mainly includes four aspects: first is the evaluation of entrepreneur behavior, realizing the situation of regional entrepreneurs; second is the evaluation of the difference of the integrity and quality of the regional entrepreneurial resources, so that can lay the foundation for improving the entrepreneurial environment in the future; third is the analysis of interactive relationship between various entrepreneurial participants, entrepreneurial elements and the entrepreneurial elements; forth is comparing the differences between entrepreneurial elements and the entrepreneurs' relationship in different stages of entrepreneurship, so that can provide quantitative reference for understanding and making policies.

(Expected) Findings/Results: Through the above analysis, the followings are the conclusions about what we have done. Firstly, understand the importance degree of the relationship between the main body of a variety of entrepreneurial ecosystems from the point of quantitative view, provide accurate reference for the development of regional entrepreneurship policy. Secondly, clarify the relationship between entrepreneurs and participants of entrepreneurial ecosystem so that facilitate the integration of resources. Thirdly, clarify the three levels: participants of entrepreneurial ecosystem, entrepreneurs and entrepreneurial environment. At last, understand the health status of regional entrepreneurial ecosystem health assessment.

**Research limitations**/ **Implications**: The evaluation results will provide scientific reference for building a balanced regional entrepreneurial ecosystem and also have a reference for optimization of other provinces and cities.

**Keywords**: Entrepreneurial ecosystem, Health assessment, Combination weighting method, Analytic hierarchy process, Fuzzy comprehensive evaluation method

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Session-16-#309-4(SS18 & SS29)

# The influence of institutional voids on the appropriability regime of servitization of manufacturing--comparative study on the role of intermediaries between Taiwan and Korea's ICT industries

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### Abstract

Due to the rapid development of digital convergence and service, such as mobile devices and cloud computing, both Taiwan and Korea's information communication and technology (ICT) manufacturing industries have been upgrading of servitization. The purpose of this paper is to investigate how institutional voids of appropriability regime based on manufacturing-based production influence the industrial upgrading of ICT servitization by comparing the development of Taiwan and Koreas' ICT industries and policies, and what the role of intermediaries deploy to cope with formal or informal institutional voids of appropriability regime. In theoretical contribution, this paper investigates how the concept of institutional voids is understood on the perspective of appropriability regime, and what the role of intermediaries may work in the voids, and finally what institutional voids challenges may be confronting the servitization of manufacturing in Taiwan and Korea's ICT industry.

In addition, previous literature has shown different points of view related to the influence of Institutional voids on the development of industries. On one hand, institutional voids may negatively influence innovation moderated by type of networks and systematic failure. On the other hand, institutional voids offer entrepreneurs with the opportunity to create the appropriablity of innovative business models. With this, we will employ a qualitative research approach by In-depth interviewing with governmental officials, entrepreneurs, research institutes from both Taiwan and Korea. Finally, we construct the contents of interview by the method of structure analysis developed by Professor Godat for more/further observations in both newly emerging economies. In a word, this paper will contribute the conceptual development of servitization of manufacturing by exploring the role of intermediates, and in turn provides an insightful learning for policy makers for the economic transaction.

Keywords: Servitizaion of manufacturing, appropriability regime institutional voids, ICT industries, inter mediaries





### **Purpose/ Research Question**

The transition economies are used to be characterized as the underdeveloped formal institutions. An uncertainty and risk void in the emerging market are usually used to be filled by informal institutions. For example, Khanna and Palepu's study (2013) explained how the absence of intermediary organisations, such market research firms and credit card systems, affect the connection with buyers and sellers efficiently which create obstacles for operation in emerging markets. Thus, with the more understanding of the institutional voids, the influence of formal and informal voids on the development of specific industry could be comprehensively understood.

Several studies have shown that the formal institutions that are so supportive for entrepreneurship in developed economies are sorely inadequate in transition economies like Russina and China (Golenkova & Igitkhanian, 2008; Puffer et al, 2010). Institutional voids are regarded as one of sources of market opportunities by refining market architecture or legitimating new market actors when supportive institution or policy are absent or weak (Mair et al., 2013). In the other hand, the formal institutional void may create an environment in whichformal institutional voids could be destructive, or if that informal institutional voids supports piratical behaviours, then in turn piratical organizations as the role of intermediary may be involved with new market opportunities. Similarly, the transition, when countries need to upgrade their industrial development, has shown similar characteristics we could further justify the argument from above perspective of institutional voids. Consequently, while boundaries between ICT's manufacturing and services have become gradually unclear and the source of appropriability derive from intangible assets and services, leading to the trend towards the servitization of manufacturing.

With the rapid development of digital convergence and service, such as mobile devices and cloud computing, both Taiwan and Korea's information communication and technology (ICT) manufacturing industries have been upgrading of servitization. For example, Taiwanese ICT producers have shown some characteristics that used to related mainly to their role in global production networks(Chen, 2004), such as Original Equipment Manufacturer (Chu, 2009). Both Taiwan and Korea as newly industrial countries are therefore the best cases while both countries have improved their manufacturing-based innovation system toward servitization. Thus, this study contributes to the literature on the perspective of the institutional void. This study would further highlight how their relationship in Asia countries differs from those in developed economies.

### Current understanding and research questions

While the formal institutional void has resulted mostly from weak intention to develop institutions, institutional voids may move forward Institutional Interfaces between market institutions and local institutional arrangements (Mair et al., 2013). For example, Khanna and Palepu (2010) explores the unique institutional contexts for the outsiders' (foreign firms) strategies in an individual emerging market. Due to the institutional arrangement are not easily to change when facing challenges from outboard in the first place, outsiders are required to navigate around or in the market's voids and look for opportunities elsewhere to fill institutional voids. Since both Taiwanese and Korea have strong ICT infrastructure and formal institutions, Korea has expanded to some of the software sector, particularly in the online game industry. These lead to the main question in this project-why Taiwan' ICT industries

did not expand their competitiveness into software industry when Korean develop complementary sectors of ICT industries, is there any institutional voids existed in Taiwan?

In addition, previous studies have shown that modern manufacturing are interesting in servitization either adding services to or integrating services into their main products (Lightfoot et al, 2013; Neely, et al., 2011; Vandermerwe

& Rada, 1988). In search of manufacturing of servitization, the transformational issues facing with manufacturers are especially acute for delivering advanced service in Information, Communication, and Technology (hereafter as ICT) industries. For example, Ceci and Masini (2011) has demonstrated that balancing specialized and generic capabilities are vital for information technology sector when delivering servitization. This is also true in defence industry when offering effective delivery of integrated product and service (Datta and Roy, 2011). For ICT industry, the operations of the manufacturer in ICT industry, such as Acer in Taiwan, demands different capabilities to those of production in the past model. A transformational failure used to be occurred when related capabilities related to servitization are not in place.

#### **Research contribution**

This study has set out to investigate how institutional voids influence servitization of manufacturing by comparing Taiwan and Koreas' Information, Communication and Technology (ICT) industries, and what strategies ICT industries deploy in order to deal with formal or informal institutional voids they encountered. This study investigates how the concept of institutional voids is understood, what the role of intermediary organizations are in place and how they works, and finally what institutional voids challenges may be confronting the servitization of manufacturing in Taiwan and Korea's ICT industry through the perspectives of governmental officials, entrepreneurs, research institutes will be interviewed for more and further observations in both newly emerging economy.

The first research question is: "What intermediaries and their interactions have taken place in the transformation of appropriability regime in the ICT industry in Taiwan and Korea ?" To answer this, secondary and documentary data analysis will be conducted. These data include legal documents, international trade information, patenting activities information etc. An interview method may be employed before analysing in- depth case studies for which longitudinal data is available. Through Interviews the information that is required to

develop the case studies and establish more in-depth understanding can be found out.

In addition, the second research question: "What characteristics and nature of policy network in terms of intermediaries involving Taiwanese industries emerge from institutional voids?" is raised. We construct the contents of interview by the method of structure analysis developed by Professor Godat for more/further observations in both newly emerging economies.

This paper employs structural analysis which intends to identify the inter-relationships between considered variables in the process during servitization of manufacturing. These variables may correspond to the attributes of the internal and external environment of innovation system both in Taiwan and Korea, while variables selections are conducted on the basis of their role as key driving forces in ICT servitization.





With those key variables of the system, both internal and external, we can capture the driver of the system's future states and the 'influence-dependence' relationships among a set of selected variables (Stratigea,

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2013). In doing so, we employ the MICMAC module developed by Godet (2011) based on structure analysis in order to discover the key variables of the study area/problem in both Taiwan and Korea, and in turn formulates the basic framework in terms of institutional voids as to their future states. Such implication of comparative study between Taiwan and Korea is very insightful for policy-makers in order to define innovation policies that can lead to the successful transformation from manufacturing based ICT industries to manufacturing of servitization.

#### **Preliminary Findings**

To begin with, the paper draws attention to the role of intermediary organisations in the point of view

of institutional voids. For example, with the institutional voids related to Intellectual property rights protection, Taiwanese firms in the ICT sector develop a production strategy that focuses on producing complementary products to Brand within the existing standards. This broad development strategy has been adopted by Korea, to improve their manufacturing and production capabilities in order to export their products to advanced countries.

Secondly, this study highlight the importance of an industries-specific of intermediary organisations in the institutional voids to create appropriability regime. ICT Industries characterised by cumulative technologies utilize the role of patent protection in different ways. In particular when "time to market" in the ICT industries of Taiwan is considered as an important factor for appropriating rent from inventions, the role of appropriability regime has been recognised as a strategic tool or a defensive mechanism in competition. While competing with products from developing countries, the commonly seen "razor-thin profit" situation became worse. Therefore, both Taiwan and Korea faced the issue in terms of how to progress toward the high value added service and innovation-based industrial growth to ensure appropriability. For example, the institutional voids of enforcement mechanisms turn out to be the different appropriability strategies with a major intermediary organisation, Industry Technology Research Institute (ITRI).

Finally, the institutional voids of the transformation of manufacturing servilization have many surprising outcomes and a large amount of confusion in the appropriability regime. Both Taiwan and Korea in terms of Trade structure of institutional voids are complex issues to analyse due to the mix of technological problems with the misleading use of innovation policy.

### Conclusion

The contribution of this study, in general, is related to two strands in the literature. Firstly, the issue examined here extends the scope of the research on the optimal form of appropriability regime in relation to institutional voids. Secondly, the study seeks to extend and integrate the empirical findings from structure analysis and institutionalism in highlighting the role of intermediary organisations in the process of servitization. In particular, this study takes a comparison study between Taiwan and Korea from both newly industrialised countries, to illustrate the influence of the appropriability of intuitional voids in both countries on the development of servitization. This leads to the implication of theoretical framework of the linkage of innovation policy from the transformation of ICT industries servitization.

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## Linking Firm Openness and Innovation: The Moderating Role of External Knowledge Search strategy

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#### Abstract

Traditionally, firms are striving to the closed methods for innovation process, but it connection with the market environment is quite limited. In recent year, external knowledge sourcing has become a vital part of firm's innovation strategies. In order to access external knowledge, firms collaborate with multiple partners for multiple technologies that would lead to the diversification of their technological knowledge. Moreover, the organizational innovation is considered to be highly important for a firm's competitiveness. The purpose of this study is to examine the relationship between the technology diversity and organizational innovation in terms of how to drive the innovation performance based on the open innovation perspective. The analysis is based on a sample of 2381

Taiwanese firms active in innovation activities taken from the Community Innovation Survey (CIS) 2012, survey by the Taiwan Ministry of Science and Technology. Finally, we use Tobit regression analysis to tests the hypotheses and the relationship among open collaboration diversity, organizational innovation and innovation performance. We found open collaboration has an inverted U-shaped and significant effect on the firm innovation performance, and that this relationship is positively moderated by organizational innovation. In addition, the empirical result also found that the organizational innovation has a positive and significant effect on firm innovation performance.

Keywords: Open innovation; organizational innovation; open collaboration diversity; innovation performance

#### Purpose

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A starting point for the openness strategy is that a single firm cannot produce all knowledge and technologies in isolation. In this view, firms have collaborated with different types of partners to acquire knowledge and capabilities across organizational boundaries (Chesbrough, 2003; Laursen & Salter, 2006). It is relevant to explore how external knowledge resources influence the firm innovation outcomes. The different partners have different knowledge, technologies, and capabilities to complement in-house innovation deploying. In this regard, the collaboration relationships among external actors for accessing of knowledge, technologies, and capabilities have become more and more important because of continuous technological change, shorter product life cycles and increasing speed

of the development of products and services. Such external partners increase the available innovation resources to acquire exchange, assimilate, and internalize for internal innovative resources. In the case of open innovation era, firms continuously monitor the external environment and seek external partners in order to determine when to engage in innovation. Therefore, openness strategy perspective is increasingly appearing on strengthening firms' incentives to increase their reliance on external knowledge for in-house innovation.

In the multiple and open collaboration partners context, open collaboration diversification and its implication for firm performance has recently attracted attention in the literature on innovation activity (e.g., Garcia-Vega, 2006; Laursen, & Salter, 2006; Rodan & Galunic, 2004). As noted Rodan and Galunic (2004), for example, firms access to external heterogeneous knowledge and technology is important for increasing innovation performances. Consequently, under these empirical evidences, it might be expected that firms are more open collaboration diversified can have certain advantage in acquisition from external collaborators. Especially, the increasing competitive pressure in highly innovative markets, technological change, and the rate of imitation are sources of economic obsolescence for the firm's technology. To overcome these barriers, firms engage in technological diversity may access advanced technologies in their R&D, because the diversification in their internal innovation deploying tends to reduce the risks inherent in the R&D activity. There is evidence that best performing firms can create more complex and developed products by through wide spectrum of technological capabilities in which possibly allows them to increase competitiveness (Gambardella & Torrisi, 1998).

In addition, previous empirical studies mostly focused on the effect of technological innovation and ignored the importance of non-technological innovation activity, especially, organizational innovation. Organizational innovation refers to implementation of a new organizational method in the firm's operational practice, workplace, management control, and external relationships (OECD, 2005). Since organizational innovation is one of most important and sustainable sources of competitive advantage for the firms (Hamel, 2009). Most studies of organizational innovation focus specifically on the interaction between technological innovation and organizational innovation (Evangelista & Vezzani, 2010; Ganter & Hecker, 2013; Tether & Tajar, 2008), which is relative to get a comprehensive innovation framework. Given the importance of organizational innovation on the innovation, the difficult task for firms is to explore how organizational innovation to drive open collaboration partner in order to capture the benefit from external collaboration partner sources. Importantly, these literatures also highlight the existence of important firm and organization context factors that impact on the innovation of the firms. However, prior literature has still lack of conceptual and methodological contributions to deal with investigating organizational innovation. Drawing on innovation perspective of the firms, the organizational innovation may substantially enhances the potential performance gains through innovation striving. Mol and Birkinshaw (2009), for example, suggested that the previous studies of organizational innovation showed little empirical evidence of the relationship between the deployments of new management practices and firm performance.

While the argument on the effect of organizational innovation on the firms' innovation is still ongoing,





it is worth addressing the open collaboration diversity from open innovation perspective which is nevertheless major way in innovation efforts. This study, therefore, focus on explore the relationship between the open collaboration source diversity and organizational innovation how to drive the performance of the based on the open innovation perspective. First, we introduces the empirical evidences of innovation survey at firms level in Taiwanese that have focused on the innovation activities from large-scale firms survey activities, which was established to facilitate innovation policy across different types of industries. Second, we explored the place the concept of open collaboration diversity in the open alliance context which may directly impact on innovation performance. Third, we examine the organization innovation effects on the firms' innovation outcomes and further explore its role play between open collaboration diversity in open innovation context investigating the adoption of external collaborative partner resources in different industries in emerging Taiwanese region.

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#### 2. Theoretical and hypotheses development

Open innovation studies addresses that external partners from different knowledge domains and countries are crucial for in-house innovation. Diverse knowledge strengthens firm creativity and generates new perspectives and insights into a problem solving for innovation outcomes. Along with an open innovation perspective, the primary concern is how firms' use external knowledge, technologies and ideas of external multiple partners in boosting their internal innovation deployment processes (Chesbrough, 2003). Diverse knowledge can create new opportunities and synergies through multiple knowledge sources of external collaborators, and in turn increase their innovation by through external inter-firm alliances. Therefore, diverse knowledge and technological resources can complement firm internal innovation and provide an opportunity to make novel linkages (Cohen and Levinthal 1990). A broad variety of sources, including competitors, suppliers, customers and universities, and labs may are helpful in the exchange of diverse technological knowledge for rapidly improving innovation outcomes. Prior research emphasizes collaboration partner diversification are very important for firms in the skills, technologies and knowledge incorporating into the possibilities of new combinations of internal knowledge through integration and learning (Inkpen, 1998).

Furthermore, from the knowledge-based view (KBV) of the firms (Grant, 1996; Kogut, and Zander,

1992), the heterogeneous knowledge sources and the values for the firms enhances the probability of rise of innovative ideas through novel combinations, and integration diverse knowledge when engaging in collaboration with diverse types of partners. Focal firms can achieve appropriability benefits obtained from their higher level diversity level of cooperative partner such as accessing more technological opportunities, knowledge sharing and exchange from their open alliance portfolio. When knowledge and technologies exchange share the timely and newly generated knowledge that may facilitate new combination of resources from partners and exploitive possible synergies and then recombines them into new products and services, thus firms can achieve superior innovation performance (Belderbos et al., 2007; Duysters & Lokshin, 2011; Nieto & Santamaria, 2007). In the similar vein, focal firms collaborate with multiple partners may obtain a performance advantage because they provide a firm with an access to valuable knowledge through its interactions with external partners (Grant & Baden-Fuller, 2004).

However, these positive effects may decrease and even become negative effect if collaborative partners are too large to be handled. First, excessive collaborative partners may have unfavorable impact on firm performance in terms of the increasing complexity of partners and management costs. Diverse collaborative partners also raise the potential integrative costs of different knowledge and technologies from various partners when transferring in their innovation. Because greater variance of the technological knowledge being integrated increases the level of complexity, and thus the difficulty and costs of coordinating these technologies in which the integrative cost can be increased (Argyres, 1996). As Jiang and colleagues (2010) indicate, firms engage in diverse their cooperative partners increases managerial complexity and is finally harmful for firm performance.

According to the above discussion of the benefits and risks of open collaborative partner diversity impact on the firms innovation activity, we proposes that there is curvilinear relationship between open collaborative partner diversity and firm innovation performance. As Huang and Chen (2010) found that technological diversification form diverse collaborative partners to firm performance rise up to a threshold, beyond which the cost of coordination, integration, and learning outweighs the benefit of diversity. As a result, both theoretical arguments and empirical study suggest that open collaboration partner diversity of a firm is beneficial for the innovation outcomes but only up to the high point. However, at high levels of open collaboration partner diversity, management and control costs is likely to causing the net benefit to decrease.

#### Organizational innovation and innovation performance

Traditionally, there is few studies address organizational innovation in terms of how to affect the performance of the firms. To date, there is no widely accepted definition of organization innovation in management and business fields. Some empirical literatures proposed that most studies are only one category of innovation, such as technical innovations (Damanpour & Evan, 1984) to examine its effects on the firm performance. However, there is an agreement that a relatively accepted concept based on the organizational innovation activity in the literature, i.e., Damanpour and Evan (1984). According to the work on organizational innovation (Damanpour & Evan, 1984), innovations at the organizational level may involve the implementation of a new technical idea or a new administrative idea. Considering the organizational innovation level, an innovation may be considered as having been adopted once the holistic perspective about adoption innovation behavior and activity has been made. Thus, an organizational innovation refers to the implementation of an internally generated or a borrowed idea in which pertaining to a product, device, system, process, policy, program, and service that was new to the organization at the time of adoption. (Damanpour & Evan, 1984).

Of interest in this study is open innovation in the context of organizational innovation. In this study, we link the organizational innovation to openness innovative strategic for acquiring and searching diversity external resources, exploring how organizational innovation in diverse collaboration strategies are among external partners influence their ability to achieve different levels of innovative performance. Accordingly, the open innovation focus helps deepen our understanding of specific facets of organizational innovation. Additionally, by targeting the firm level, we can provide a practical basis on





which managers can build comprehensive multi-dimensional frameworks and systems perspectives that would enable open innovation perspective to be embedded on in this study.

Extending on organizational innovation, we propose that generating and implementing new ideas, methods, or behaviors in firm's business practices and external linkages that may have positive consequences for their innovation performance. That is, organizational innovation constitutes the introduction of a new management system, managerial process, or staff development program (Damanpour et al., 1984). Although, organizational innovation cannot directly provide a new product/service, but it indirectly affects the production of products and services as well as the processes of them (Kimberly & Evanisko, 1981). Accordingly, the introduction of organizational innovations may reduce the administrative expenses and transaction costs, improve workplace satisfaction, gain access to non-tradable assets (such as non-codified external knowledge) or reduce costs of supplies (OECD, 2005).

Empirical studies verified of organizational innovation providing benefits can be found, for example, in Camisón and Villar-López (2014), who demonstrate that the organization innovation does indirectly impact on firm performance if that relationship is mediated by product and process innovation capability. Empirical studies that look at the impact of top management team of firms on the organizational innovation, for example, Qian, Cao and Takeuchi (2013), argue that the impact of top management team functional diversity on organizational innovation depends on the beneficence of a firm's institutional environment. In essence, top management team diversity enables the organization to differentiate its innovation management and changes what the organization face to the outside world rapidly changing. In addition, Ballot et al. (2015) explores the relationships among product, process and organizational innovation, which found that there is complementarities-in-performance between these forms of innovation, of organizational innovation. Taken together, organizational innovation is more likely to result in concrete innovative outcomes.

In summary, whereas high (vs. low) organizational innovation strengthens the positive effects of open collaboration diversity by further improving the efficiency of innovation resources acquisition, it also enhances the negative impacts of open collaboration diversity by aggravating overemphasize innovation costs issues. Therefore, we predict that organizational innovation strengthens the inverted U-shaped relationship between open collaboration diversity and firms' innovation performance.

#### 2.2 Data collection

The database used in this paper is the Taiwanese Community Innovation Survey III (CIS III), well-

defined dataset with detailed firm-level matching information on firm innovation behavior, alliance and collaboration and other firm characteristics. The survey provides the firm's innovation information and activities go into detail during the period 2010-2012 throughout different industries that with traditional manufacturing industries, high-tech industries and knowledge-intensive business service, and service- oriented firms. The CIS III questionnaire survey was developed under the guiding principles of the Oslo Innovation Manual (OECD, 1992), the survey aims to collect data on innovation from a firm perspective, rather than exclusively examining the invention process. The CIS III lists different kinds of information sources of innovation at firm level that includes their external alliance and collaboration partners. The questionnaire has eleven pages that comprise all of the necessary settings in order to minimize the response subjectivity. The raw data consist of a representative sample of 13842 firms based on a combination census and random sampling without subject replacement used for all other firms. In order to disentangle the open collaboration diversity effect of firms across different industries, we screen the original dataset to extract the useful and available sample in which suit the current research purposes.

#### **Empirical Results**

Since firms' insufficient internal knowledge hardly support their R&D activities, firms have changed their strategy from closed to open for grasping more valuable knowledge they need from outside the boundaries. This study explored the relationship between open collaboration diversity and innovation performance. Besides, we considered the moderating effect of organizational innovation on open collaboration diversity and innovation performance. Base on previous researches, we developed the hypotheses about the impacts on innovation performance of open collaboration diversity and organizational innovation. We used the CIS III survey database of Taiwan firms for testing our hypotheses. Despite a growing collaboration diversity literature, a few researches have contributed to the effects of collaboration diversity on both innovation performances (firm novelty and market novelty). The results of firm-level data analyses suggest that the relationship between open collaboration diversity and both firm novelties and market novelties are inverted U-shaped as in previous researches (Duysters & Lokshin, 2011; Laursen & Salter, 2006). Moreover, the results suggest that the moderating effect of organizational innovation would increase the risk from extreme high level of collaboration diversity on both innovation perform the benefits from collaboration diversity. The results also point out the important of firm's managerial practices and their organizational innovation strategy.

On the whole, this study found some critical outcomes among open collaboration diversity, organizational innovation and innovation performance, and our major findings are discussed as follows. Prior researches argued that firms should collaborate with a wide range of diverse actors that would assist firms to reproduce and redesign their new products and services by combining knowledge form external sources (Escribano, Heimeriks & Lokshin, 2012; Inkpen, 1998; Von Hippel, 2007). However, open collaboration diversity may increase the complexity of knowledge and firms' cooperative relationship with external partners, and further increase the costs of coordination, monitoring and communication (Bapuji, Loree & Crossan, 2011; Combs & Ketchen, 1999), and would decrease firm's innovation outcomes. In this study we also found the relationship between open collaboration diversity and innovation performance is an inverted U-shape, which points to further increase the diversity of collaborative partners may lead to overcome the benefits on innovation performance. Open collaboration diversity has enhanced on firm novelty which means products and services are only new to the firm and have other substitutes in market. That is, a focal firm diverse their collaborative partners would reinforce the market shares of their new-to- firm products even if there are other product/service substitutes in market. At the same time, open collaboration diversity also has enhanced on market novelty which means products and services are new-to- market and without substitutes in the market. A focal firm has high level of collaboration diversity would assist them to become the earlier entrant compare to their competitors.

On the other hand, our study also revealed that both innovation performances have presented excess





open collaboration diversity may lead to negative effects on innovation performance, and the results of our empirical analysis show that the coefficients of square open collaboration diversity is negative. Thus, firms have to manage their collaborative portfolios for coordinating the relationship with external actors and organizing the knowledge from external sources, and find the optimal configuration. Therefore, our study considered the moderating effect of organizational innovation on the relationship between open collaboration diversity and innovation performance.

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#### **Conclusion and limitation**

To conclude, the present study is preliminary research on open collaboration diversity and innovation performance, and its relevance to organizational innovation research can also be seen. we derive several contributions.

First, the present findings contribute to the field's understanding of the various forces acting on the focal firms' innovation activities. One such force in our study is the impact of open collaboration diversity. The present findings confirm previous evidence that the relationship between various collaborators (e.g. customers, suppliers, universities, research institutions and so on) and innovation performance (firm novelty and market novelty) which presents that can strengthen and improve the focal firm's products and services not only in firm but also in market. Furthermore, firms should construct their own managerial mechanism for managing their partnership of external actors because a firm's alliance portfolio on its innovation performance is not set in stagnation but can be changed by conscious managerial actions.

As mentioned, secondly, a related issue concerns the effect of organizational innovation. Organizational innovation means involving the implementation of new technical ideas or new administrative ideas into a firm's innovation process. We hereby contribute to the organizational innovation literature which often be ignored, and firms engage in administrative actions can turn a negative effect of open collaboration diversity into a positive effect. However, as the scale of a firm's collaboration enlarges, the firm inclines to depend on more organizational procedures for managing and controlling diverse types of alliance. The overemphasized innovation investment will exacerbate the benefits from organizational innovation. Our findings would give an insight into future relevant researches and suggest firms should build a complete managerial mechanism for monitoring the partner diversity of their alliance portfolio and conforming external knowledge of different disciplines.

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### Discovering innovative potential of people in Russia

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#### Abstract

There is one question, which the Russians often asks in response to the prominent achievements of Russian science, technology and innovation, demonstrated by Russian TV channels: «If we are so smart, why are we so poor?» Being the rhetorical one, the question reflects the very essence of the Russian innovation development. This is exclusion of people of Russia from innovation development of the state, from goals of innovation development, placed by the government, and from the results of innovative activity of the stakeholders of formal innovation system of Russia.

There are plenty of research papers and monographs devoted to innovation development of Russia. There are a few institutions, which work on this theme. National Research University Higher School of Economics (Gokhberg L., Kuznetsova T., Zaichenko, S., Meissner D.) and the Russian Presidential Academy of National Economy and Public Administration (Leonard C., Mau V.) are the most visible in terms of number of publications and expertise they provide for state bodies and agencies of innovation development in Russia. They stay mostly within innovation system framework (see Freeman 1987; Lundvall 1992, 2010; Nelson 1993) and investigate innovation system, innovation policy and economic development of Russia based on the evolutionist approach. Most of the publications cover the issues of innovation system configuration and transition from state planning system to effective national innovation system, but with government, industry and academia as main stakeholders. Theme of social inclusion in innovation development of Russia also appears in research focus of Russian scholars, but reflects general gap in its exploration at academic and expert levels. For example, Gokhberg et.al (2016) provides cases of 15 Russian universities and their impact on inclusive innovation in Russia. But understanding social inclusion is narrowed there to inclusion of disabled people in education process, or providing public awareness on science activity. It means all measures are mostly duplicated in these universities and have low impact on local society and society in general in terms of their real everyday problems and needs. Tomsk is a good example of this situation. Tomsk is a town in Siberia with 500,000 population and six universities, three of which are the platforms for promotion of social inclusion' through 'social innovation ideas' of students and young scholars. For all the years of this activity there were implemented not a single innovative solution for improving life of local society, as, for example, slippery surfaces of the town (it leads to around 4,000 injuries of Tomsk habitants for 3-4 months of winter yearly), or physical accessibility of most campuses of Tomsk universities for immobile people, etc. Society and its real needs is a matter of nominal interest of innovation policy of the state. As soon as the state is all-pervasive and dominant actor of Russian innovation system, academia and industry perform activity for providing social inclusion in the same nominal way.





Main objective of this paper is mapping society in national innovation system of Russia, to identify its specifics and role in innovation development of the country, and perspectives of becoming innovative society.

Paper contains multi-dimensional analyses of inventive activity of Russian society from historical, cultural and political perspective. It identifies the segments of society (social groups and 'places' of innovative activity of people), which perform innovative activity nowadays in Russia, and provides insights on the prospects and limitations of innovative potential of Russian society. References

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### Grassroot Innovations in Fish Feed and Fertilizers, India

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#### Abstract

Indian fisheries and aquaculture are the major source of employment and food security for costal states in India. India has a coastline of 8129 km and more than fourteen million fishers are employed in fisheries sector. India holds second position in aquaculture production after China. It contributes 6.3% to the globa fish production and the sector contributes 1.1% to the national GDP and 5.15% to the agricultural GDP. Indian aquaculture has been continuously progressing, it has been contributing more than 50% to total fish production since 2000 and from 2010 its contribution has increased to approximately 60%. The share of inland fisheries and aquaculture has gone up from 46 percent during 1980's to over 85 percent in recent years. However, even today Indian aquaculture is largely dependent on semi – intensive practices. Semi-intensive fish production includes use of fertilizers and supplementary feeds as a means to produce low-cost fish which contributes to national food security and fulfilling major nutritional needs. Nevertheless, price of fish in nation and international markets have been increasing rapidly. Organization for Economic Co-operation and Development (2011) explained that world fish price is increasing due to stagnant capture fisheries production and increase in feed cost for aquaculture. It also reported that by 2020, price of cultured fish will increase by 50% along with increase in fishmeal price by 43% over 2008-10 prices. It is supported by

Rana *et. al.*, (2009) who reported that price of fishmeal has already increased by 55% since 2005 and in order to sustain aquaculture production there is still requirement of considerable amount of fertilizers and feed (FAO, 2014). As feed and fertilizers are crucial and incurs high cost, they should be efficiently used. Organic alternate that are environmental friendly must be promoted against the use of commercial feed.

The problems that are associated with natural fertilizers ought to be understood and proper knowledge and methods of rational use of fertilizers should be developed in order to reduce chemical alternatives. Keeping this premise in mind a study was conducted to document grassroot level innovations on feed and fertilizers in fisheries sector and their appropriateness was analyzed by





fisheries scholars. Twelve grassroot innovations namely fertilization using fermented cow dung and paddy straw, bamboo frame enclosure for feeding fish, innovative fish feeding frame, crib method for manuring pond, plastic bottles as fish feeding device, multi level feeder, feed consumption indicating device, organic slurry as alternate to processed feed, use of rope for feeding fish in natural environment, locally formulated feed for spawns, viscid solution as alternate to probiotics and efficient use of organic fertilizer were documented and verified using triangulation method. Their appropriateness was tested by 149 fisheries scholars (89male and 60females) using "Innovation Appropriateness Scale". Innovation appropriateness scale comprise of 6 parameters, that are 1) Economic advantage i.e economical in terms of the cost of input in relation to output, 2) Ease of use that is the degree to which an innovation is perceived as relatively easier to understand and use. 3) Sustainability i.e. ability to continue over a period of time, causing little or no damage to the environment or help in preventing environmental damage. 4) Replicability i.e. ease with which an innovation can be repeated in another location or time. 5) Uniqueness i.e. being the only one of its kind and 6) Scientific value i.e. whether an innovation might have a scientific explanation or not. Coefficient of stability for Innovation appropriateness scale is 0.71, suggesting good reliability. Five point likert scale was used for scoring the innovations according to set parameters. Mann Whitney U test showed that there was no statistical difference found between the opinion of male and female respondents in judging the appropriateness of grassroot innovations. The results indicated that all grassroot innovations on feed and fertilizers were perceived to be appropriate. Two grassroot innovations namely "Viscid solution as alternate to probiotics for aquaculture" and "Fertilization using fermented cow dung and paddy straw" were found to be overall most appropriate according to data. Fisheries is a multidisciplinary sector in India which not only provides cheap and nutritious food but also provides employment to large sector of economically backward people. It was observed that the grassroot innovations documented on feed and fertilizers are

leading to economical saving, are easy to use and replicate. Also they are efficiently contributing to routine work and are environmentally sustainable. However, a detailed scientific validation for these innovations is recommended. Therefore, with renewed call on blue revolution in India and lot of resources being invested to recognize and upscale grassroot innovations, a ready platform is already created for development and inclusive growth of Indian economy, fisheries and innovation potential.

Keywords: grassroot, innovation, fisheries, feed, fertilizers

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## The Characteristics Analysis of Life Satisfaction of Potential Elderly and Elderly People<sup>\*</sup>

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#### Abstract

Life satisfaction has often been referred to as one of the most powerful factors in establishing senior citizens' welfare policy. The main purpose of this study is to analyze the life satisfaction of elderly people (65 and over) and potential elderly people (55-64) in order to establish adequate welfare policies. This study uses the ordered logistic model because the Korean Retirement and Income Study Panel Dataset are composed of the ordered category data. The results revealed that, first, health, economy and housing variables in both potential elderly and elderly people groups are commonly fundamental to the life satisfaction. Hence the Korean government should focus more on giving some policy priorities with health of elderly people being at the top of the list, irrespective of age levels. Secondly, economic issue is also important for these people. Thus, a pension policy which stabilizes the economic status for the senior groups should be established. Thirdly, housing reflects the dwelling instability due to high housing price and lack of rental housing for the poor and elderly. Based on these findings, the Korean government needs to come up with several strategies which aim at addressing such challenges in establishing the elderly welfare policy.

Keywords: Potential Elderly Household, Life Satisfaction, Cross-Sectional Ordered Logit Model, Marginal Effect.

#### 1. Introduction

Korea has recently reported the highest number of suicides in the world, which, in 2013 reached to a level of 29.1 in 100,000 people. This number is more than two times that of OECD-Members (Hungary), which reached to 12 (Yong, Kang, and Hwang, 2016). Life satisfaction is the way persons evaluate their lives and how they feel about their directions and options for the future. It is a measure of well-being and may be assessed in terms of mood, satisfaction with our relationship to others and with achieved goals, self-concepts, and self-perceived ability to cope with daily life. It is having a favorable attitude of one's life as a whole rather than an assessment of current feelings. Life satisfaction has eventually been

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measured in relation to economic standing, amount of education, experiences, and residence, as well as many other topics (<u>https://en.wikipedia.org/wiki/Life\_satisfaction</u>).

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Measuring individual feelings can be very subjective but it is nonetheless a useful complement to more objective data in comparing quality of life with different groups such age, location, income and even countries. Subjective data can provide a personal evaluation of an individual's demographic characteristics, education, income, and other social conditions (Cho and Park, 2014). The Korean Retirement and Income Study Panel Data surveyed by the Korean government contains life satisfaction data including housing, family, and other social variables notably the demographic variables. Surveys, in particular, are used to measure life satisfaction and happiness. Life satisfaction measures how people rather than their evaluate their life as whole current feelings. ล (http://www.oecdbetterlifeindex.org/topics/life-satisfaction/).

This study aims to figure out the factors which influence the life satisfaction of elderly (65 years old and over) and potential elderly people (55-64) (Cho, 2016b). To this end, we begin in the following sections by situating our research within the relevant literature and illustrating our hypotheses. We then go on to describe the experiment that we conducted to test hypotheses, and we conclude with a discussion of our findings and their implications for research and theory.

#### 2. Review of Literature

Quality of life is an elusive concept approachable at varying levels of generality from the assessment of societal or community wellbeing to the specific evaluation of the situations of individuals or groups (Felce and Perry, 1995). There are three major philosophical approaches to determining the quality of life (Brock, 1993; Diener and Suh, 1997). The first approach describes characteristics of the good life that are dictated by normative ideals based on a religious, philosophical, or other system. The second approach is based on the satisfaction of preferences. Within the constraints of the resources they possess, we assume that people will select those things that will most enhance their quality of life. The third definition is based on the experience of individuals. If a person experiences her life as good and desirable, it is assumed to be so. In this approach, factors such as feelings of joy, pleasure, contentment, and life satisfaction are paramount.

Quality of life has been a passive word in housing policy until 1998 in Korea. After that, the price ceiling system on housing for sale was deregulated and housing designers were willing to insert their images of quality of life in the site and architectural planning. It is believed that it was the start of meeting quality of life and housing welfare (Park, 2006). Borthwick-Duffy (1992; Felce and Perry, 1995) has presented three perspectives on quality of life: (a) quality of life defined as the quality of one's life conditions, (b) quality of life defined as one's satisfaction with life conditions, and (c) quality of life defined as a combination of both life conditions and satisfaction. Life satisfaction is an assessment on how much an individual is satisfied with his or her life and it has a similar concept with the quality of life, subjective well-being, and happiness (Yong, Kang, and Hwang, 2016). Lee (2010) examines the life satisfaction and citizen life satisfaction in this dissertation. He tries to find out the factors affecting the citizen life satisfaction depending on Maslow's hierarchy of needs and to construct a structural equation model to explain the relationships with factors.

As an important dimension of human well-being, life satisfaction refers to an individual's subjective evaluation of his or her quality of life (Borglina, Edberga, and Hallberg, 2004; Boyraz, Waits, & Felix,

2014; Cho and Park, 2015). Life satisfaction is related to several different factors such as family life, human relations, health, food, job, housing situation, and household income along with demographic factors (Moon, 2010; Zhou, et al., 2014). The rapid economic development has gradually improved people's living standards in China. However, in the transformation period, problems of pollution, food safety, the rising cost of housing and CPI (Consumer Price Index), as well as the other social problems, have led to concerns about the food, health, and household conditions. They argue that public satisfaction with daily life is related to a country's economic development using the example of China economic growth. Kheokao, Yingrengreung, and Krirkgulthorn (2014) analyze the daily life satisfaction in daily life related to housing, annual income, health, family, food, human relations, and work among Thai people living in urban areas and to compare the level of satisfaction with daily life among Thai people living in urban areas based on personal and socioeconomic data. In other aspects, most studies of life at older ages have found that a person's health is associated strongly with their quality of life (Blane, Netuveli, Montgomery, 2008)

As the above description, the concept of life satisfaction is often used with quality of life. This paper also does not distinguish the life satisfaction with the quality of life. Life satisfaction of elderly varies from the socio-demographic variables such as education, age, and sex and so on, to the relationship with neighborhood, economy, health, and job and so on.

#### 3. Data and Analysis Methods

#### 3.1. Data Construction

The Korean government has surveyed the Korean Retirement and Income Study Panel Data every two years since 2005. These datasets are constructed by the National Pension Security Institute. They include demographic information of household members, housing status, household expenditure, income, saving, assets and debts (Park, 2006; Lee, 2010; Kreis, 2016). However, this study uses data from year 2011 which is the most recent data for the cross-sectional ordered logit analysis. The previous data set has some limits in merging it for panel logit analysis because there are so many missing values. This paper also distinguishes the elderly group from the potential elderly group. It selects the overall life satisfaction as the dependent variable, which is the ordered category variable, in order to figure out the differences of life satisfaction between the potential elderly and elderly people. This dependent variable is composed of five categories whereby satisfaction levels range between 1-5 with 1 being very bad and 5 being very good. Based upon the theoretical background and data availability, it also chooses a total of thirteen independent variables which include five demographic variables along with eight ordered category variables. Specific explanations on the variables are summarized in Table 1.

		Variable Name	Explanation of Variable
Dependent variable		Overall Satisfaction(lslife)	Satisfaction level of life(five categories)
In Ve	Der Cha	lssex	Sex of householdhead
Independent variables	)emographic haracteristic	lsage	Age of householdhead
end	,rap teri	lsedu	Education of householdhead
lent	phic istics	lsspo	Spouse existence of householdhead
	01	lsarea	Location of householdhead(Seoul, metropolitan city,

Table 1. The Variable Lists of Potential Elderly and Elderly Households





		province
0 V2	lshousing	Satisfaction on housing (five categories)
Ordered variables	lsneighborhood	Satisfaction on neighborhood (five categories)
red	lseconomy	Satisfaction on economy (five categories)
	lsfriend	Satisfaction on friend (five categories)
	lsfamily	Satisfaction on family (five categories)
cat	lscouple	Satisfaction on spouse (five categories)
category	ls <b>jo</b> b	Satisfaction on job (five categories)
ry	lshealth	Satisfaction on health (five categories)

#### 3.2. Analysis Methods

The ordered logit or probit model can be used in case that the dependent variable is an ordered category variable (Lee et al., 2005; Min and Choi, 2012 and b). If the order does not have the meaning, the multinomial logit model can be used. The difference between two models depends on the assumption on probability which selects the specific choice. This study uses the cross-sectional ordered logit model because data set includes the cross-sectional category data. The representative example of the ordered choice is satisfaction evaluation like this data. Actually this data has five categories from very bad (1) to very good (5).

In order to model these ordered variables, the latent variable  $y_i^*$  exist and we assume that the explanatory variables are presented as the linear function (Min and Choi, 2012a).

$$y_i^* = \alpha + \beta x_i + e_i \quad (1)$$

In other words, we can assume that the observed dependent variable  $y_i$  is as follows:

 $y_i = 1, \ y_i^* \le \delta_1 \text{ in case (very bad)}$   $y_i = 2, \ \delta_1 < y_i^* \le \delta_2 \text{ in case (bad)}$   $y_i = 3, \ \delta_2 < y_i^* \le \delta_3 \text{ in case (normal)}$   $y_i = 4, \ \delta_3 < y_i^* \le \delta_4 \text{ in case (good)}$  $y_i = 5, \ \delta_4 < y_i^* \text{ in case (very good)}$ 

Here  $\delta_1$ ,  $\delta_2$ ,  $\delta_3$ ,  $\delta_4$  are the cutoff points and parameters which should be estimated in the model. Cutoff points are four numbers if five choices of dependent variable are possible. The choice probability of j by individual (i) in the ordered choice model is estimated as follows:

$$Pr(y_{i}=j)=Pr(\delta_{j-l} < y_{i}^{*} \leq \delta_{j})$$

$$=Pr(\delta_{j-l} < \alpha + x_{i}\beta + e_{i} \leq \delta_{j})$$

$$=Pr(\delta_{j-l} - (\alpha + x_{i}\beta) < e_{i} \leq \delta_{j} - (\alpha + x_{i}\beta)) \qquad (2)$$

$$=F(\delta_{l} - (\alpha + x_{i}\beta)) - F(\delta_{l-l} - (\alpha + x_{i}\beta))$$

 $F(\cdot)$  is cumulative distribution function (CDF) of error term  $e_i$ . In general the ordered logit model assumes the logistic distribution of error term but the ordered probit model does the normal distribution of error terms. In Eq.2 estimation coefficient  $\hat{\beta}$  does not mean the marginal effects of explanatory variables. The marginal effect which the explanatory variable  $x_i$  affects the choice probability can be defined as follows:

$$\frac{\partial \Pr(y_i)}{\partial x_i} = \frac{\partial F(\delta_j - x_i\beta)}{\partial x_i} \cdot \frac{\partial F(\delta_{j-1} - x_i\beta)}{\partial x_i} = \beta [f(\delta_{j-1} - x_i\beta) - f(\delta_j - x_i\beta)] \quad (3)$$

 $f(\cdot)$  is the probability distribution function (PDF) which is the first order derivative function of F( $\cdot$ ). Odds in the ordered model can be defined as follows.

$$\Omega(x)_{j} = \frac{\Pr(y > j|x)}{\Pr(y \le j|x)}, \ j = 1, 2, 3, 4$$
 (4)

And then the odds ratio in the ordered logit model can be defined like E.Q. (5) because of F(x)=1/[1+exp(-x)] in the logistic distribution.

$$\Omega(\mathbf{x})_2 = \frac{1}{\exp(\delta_2 - x_i \beta)} \qquad (5)$$

And then  $\ln\Omega(x)_2 = -\delta_2 + x_i\beta$ . In other words, the natural log of odd is the linear function of explanatory variable  $x_i$ . The odds ratio, which notes the change of odds if  $x_i$  increase one unit, can be as follows:

$$\frac{\Omega(x+\Delta x)_2}{\Omega(x)_2} = \frac{\exp(\delta_2 - x_i\beta)}{\exp(\delta_2 - (x_i + \Delta x_i\beta))} = \exp(\beta)$$
(6)

#### 4. Analysis Results

The dependent variable in the 2011 data set on the Korean Retirement and Income Study Panel Data is composed of five response categories from very bad to very good on the question of overall life satisfaction. If we assume that the data set is cross-sectional data and the dependent variable is the ordered choice, this model is the cross-sectional ordered logit or probit model. The ordered logit model can be used if we assume the logistic distribution of error term (Min and Choi a and b, 2012). This paper also distinguishes the potential elderly (55-64) with elderly people (65 or over) because they have different demographic and socio-economic characteristics even if potential elderly become the elderly groups gradually. Each age group also requests probably different policy alternatives because the potential elderly usually have jobs and implement their economic activities in their social communities. The ordered probit model also follows the exact same process. However this study focuses on the cross-sectional ordered logit model because this paper assumes the logistic distribution of error term.

4.1. The Estimation Results of Cross-sectional Ordered Logistic Model for Potential Elderly People

Table 2. Descriptive Statistics of Five Category Responses on the Overall Life Satisfaction

Satisfaction Category	Response of Potential Elderly on Overall Life Satisfaction			Response of Elderly People on Overall Life Satisfaction		
Category	Frequency	(%)	Cum	Frequency	(%)	Cum
1	10	0.75	0.75	42	1.80	1.80
2	114	8.51	9.26	320	13.73	15.54
3	619	46.23	55.49	1,239	53.18	68.71
4	569	42.49	97.98	712	30.56	99.27
5	27	2.02	100.00	17	0.73	100.00
Total	1,339	100.00		2,330	100.00	

The numbers of total observations are respectively 1,339 and 2,330 for the potential elderly and for the elderly people. 55.49% of potential elderly are less than or equal to the normal response but the 68.71 of



elderly people are less than or equal to the normal response. It means that the overall life satisfaction of elderly people is decreased after retirement. These results might reflect the weak welfare system for the elderly people. The Korean government should concentrates on the establishment of solid welfare system. In individual level, the potential elderly should also prepare the elderly life before the retirement in order to improve the overall life satisfaction.

4.2. Overall Life Satisfaction of Potential Elderly Household

Ordered logistic r	Ordered logistic regression				Number of obs. = 1339			
				LR chi <sup>2</sup> (12) = $1350.82$				
				Prob. > c	chi <sup>2</sup> =	0.0000		
Log likelihood =	Log likelihood = -724.35349				R2 =	0.4825		
lslife	Coef.	Std. Err.	t	P> t	[95% Cor	nf. Interval]		
lssex	.4131	.1941	2.13	0.033	.0327	.7936		
lsage	.0719	.0188	3.81	0.000	.0349	.1088		
lsedu	.1473	.0693	2.12	0.034	.0113	.2832		
lsspo	1346	.1982	-0.68	0.497	5232	.2539		
lsarea	.1443	.0932	1.55	0.121	0383	.3270		
lshousing	.9461	.1124	8.41	0.000	.7257	1.166		
lsneighborhood	.1390	.1208	1.15	0.250	0977	.3757		
lseconomy	1.155	.1098	10.52	0.000	.9403	1.3709		
lsfriend	.7057	.1291	5.46	0.000	.4526	.9589		
lsfamily	.5409	.1068	5.06	0.000	.3314	.7503		
lscouple	4563	.0.876	-5.21	0.000	6279	2846		
lsjob	.1657	.0485	3.42	0.001	.0706	.2609		
lshealth	1.386	.1103	12.57	0.000	1.169	1.602		
cut1	12.46	1.419		•	9.687	15.25		
cut2	17.00	1.452	1		14.15	19.85		
cut3	22.57	1.547	1		19.53	25.60		
cut4	29.12	1.676	1		25.83	32.41		

Table 3. The Results of Cross-sectional Ordered Logistic Regression for the Potential Elderly Household

Four cutoff points are estimated because the categories of dependent variable are 5. In case of potential elderly people, coefficient of age variable shows 0.0719. This means that the probability of  $Pr(y_i=5)$  is increased and that of  $Pr(y_i=1)$  is decreased according to the increase of age. In other words, the negative opinion on the overall life satisfaction is decreased and the positive opinion is increased according to the increase of age. This interpretation can be applied to other explanatory variables. Especially this analysis shows the order of policy alternatives on the potential elderly following the lshealth, lseconomy, lshousing and so on, depending on the level of coefficients of variables.

#### 4.3. Overall Life Satisfaction of Elderly Household

	•			NT 1	C 1	2220	
Ordered logistic re	egression					2330	
				LR chi <sup>2</sup> (13) = 2187.43			
		Prob. > c	$chi^2 =$	0.0000			
Log likelihood = -	Log likelihood = -1420.5165				R2 =	0.4350	
lslife	Coef.	Std. Err.	t	P> t	[95% Conf.	Interval]	
lssex	.1199	.1746	0.69	0.492	2224	.4623	
lsage	0024	.0091	-0.27	0.786	0204	.0154	
lsedu	.1307	.0467	2.79	0.005	.0390	.2223	
lsspo	.3397	.2232	1.52	0.128	0978	.7773	
lsarea	.1444	.0692	2.09	0.037	.0088	.2801	
lshousing	.9590	.0828	11.57	0.000	.7966	1.121	
lsneighborhood	.5904	.0803	7.35	0.000	.4329	.7479	
lseconomy	1.020	.0787	12.96	0.000	.8665	1.175	
lsfriend	.1405	.0692	2.03	0.042	.0049	.2762	
lsfamily	.2490	.0603	4.13	0.000	.1308	.3672	
lscouple	.1271	.0566	2.25	0.025	.0162	.2381	
lsjob	.1191	.0335	3.55	0.000	.0533	.1850	
lshealth	1.399	.0767	18.23	0.000	1.248	1.549	
cut1	7.672	.9044			5.899	9.445	
cut2	11.40	.9148	1		9.614	13.20	
ut3	16.60	.9626	1		14.71	18.48	
			1				
ut4	23.31	1.080	1		21.19	25.43	

Table 4. The Results of Cross-sectional Ordered Logistic Regression for the Elderly Household

Four cutoff points are estimated because the categories of dependent variable are 5 like Table 3. In case of elderly people, coefficient of age variable shows -.0024. This means that the probability of  $Pr(y_i=5)$  is decreased and that of  $Pr(y_i=1)$  is increased according to the increase of age. In other words, the negative opinion on the overall life satisfaction is increased and the positive opinion is decreased according to the increase of age. This interpretation can also be applied to other explanatory variables. Especially this analysis shows the order of elderly welfare policy priority following the lshealth, lseconomy, and lshousing and so on. The interesting findings are similar to those of the potential elderly in terms of the level of coefficient of related variables. However, elderly household decrease the overall life satisfaction according to the aging of elderly people.

Table 5. Comparison of Life Satisfactions between the Potential Elderly and Elderly People

Variable	PEOLOGIT	EOLOGIT
lssex	0.430**	0.120
lsage	0.072***	-0.002
lsedu	0.149**	0.131***
lsspo	-0.012	0.340



lsarea	0.146	0.144**
lshousing	0.943***	0.959***
lsneighborhood	0.132	0.590***
lseconomy	1.152***	1.021***
lsfriend	0.701***	0.141**
lsfamily	0.530***	0.249***
lscouple	0.044	0.127**
lsjob	0.165***	0.119***
lshealth	1.384***	1.399***
_cut1	12.652***	7.673***
_cut2	17.177***	11.407***
_cut3	22.742***	16.602***
_cut4	29.304***	23.316***

legend:\*p<.1; \*\*p<.05; \*\*\* p<.01

Table 5 notes the coefficients of independent variables of potential elderly and elderly people models. Most of variables present the expected results. The health, economy, and housing variables in both potential elderly and elderly people groups are key variables ordinarily for the life satisfaction. However, priorities of specific variables are different slightly between age groups. Elderly people have more concern about health and housing compared to those of potential elderly group. On the other hand, potential elderly have more concern on the economy. These results can offer several policy lessons for the building of elderly welfare policy. At first, health is the most important issue for the elderly people and the Korean government should give policy priority on the health of elderly people irrespective of age levels. Secondly, economic issue is another important factor for the elderly. It might reflect the weak pension system in Korea. Therefore, the Korean government should establish the pension policy which stabilizes the economic status for the senior groups. Thirdly, housing is also an important variable for these elderly people. It also reflects the dwelling instability because of the high housing price and lack of rental housing for the poor and elderly. The other variables can be explained as in the above description.

Table 6. The Marginal Effects after the Estimation of the Logit Model for the Potential Elderly.

Adjusted predictions			Number of obs. =	1339
Model VCE :	OIM			
Expression :	Pr(lslife==4), predict(outco	ome(4))		
at :	1.lssex = .7221	(mean)		
	2.1ssex = .2778	(mean)		
	lsage = 58.76	(mean)		
	lsedu = 3.296	(mean)		
	lsspo = 1.250	(mean)		
	lsarea = $2.306$	(mean)		
	lshousing = 3.401	(mean)		
	lsneighbor~d = $3.448$	(mean)		

		lseconomy	= 2.929	(mean)			
		lsfriend	= 3.527	(mean)			
		lsfamily	= 3.582	(mean)			
		lscouple	= 2.802	(mean)			
		lsjob	= 2.482	(mean)			
			= 3.318	(mean)			
	Delta-method						
		Margin	Margin Std. Err. t			[95% Conf. I	nterval]
lssex	1	.3172	.0224	14.13	0.000	.2732	.3612
	2	.4164	.0405	10.28	0.000	.3371	.4958

The marginal effects are estimated for both models in this paper. Under the condition which other variables are located in their mean values, we can estimate the marginal effect which is the change of the choice probability of each category by change of value of explanatory variable. Table 6 notes the marginal effect of category of each variable. The probability which the female chooses 'good' is 41.6% but that of male is 31.7%. It means that female has relatively a friendly view on the life satisfaction comparing with male. The difference of 9.9% between male and female notes the marginal effect that sex variable affects the Pr(yi=good). Eventually the marginal effect of sex variable on Pr(yi=good) are considerably high in potential elderly model. This method can apply to other variables.

Adjusted predictions				Number	of obs. =	2330
Model VCE :	OIM					
Expression :	Pr(lslife==4), p	redict(outc	ome(4))			
at :	1.lssex =	.5922	(mean)			
	2.lssex =	.4077	(mean)			
	lsage =	73.03	(mean)			
	lsedu =	2.508	(mean)			
	lsspo =	1.420	(mean)			
	lsarea =	2.448	(mean)			
	lshousing =	3.313	(mean)			
	lsneighbor~d =	3.408	(mean)			
	lseconomy =	2.783	(mean)			
	lsfriend =	3.327	(mean)			
	lsfamily =	3.340	(mean)			
	lscouple =	2.196	(mean)			
	lsjob =	= 1.378	3 (mean)			
	lshealth =	2.855	(mean)			
	D	Delta-method				
	Margin	Std. Err.	t	P> t	[95% Co	onf. Interval]
lssex 1	.1504	.0132	11.35	0.000	.1244	.1764
2	.1664	.0175	9.51	0.000	.1321	.2007

Table 7. The Marginal	Effects after the Estima	tion of the Logit Model for	the Elderly.
$\mathcal{O}$		2	2





Marginal effect is estimated to figure out the change of choice probability of each category. Under the condition which other variables are located in the mean value, we can estimate the marginal effect which is the change of the choice probability of each category by change of value of explanatory variable. Table 7 notes the marginal effects of category of each variable. The probability which the female chooses 'good' is 16.6% but that of male is 15.0%. It means that female has relatively a friendly view on the life satisfaction comparing to male but the difference is not high. The difference of 1.6% between male and female notes the marginal effect that sex variable affects the Pr(yi=good). The marginal effect by sex of potential elderly is relatively higher than that of elderly people. This result notes that the female of potential elder group has relatively high satisfaction on their life.

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#### 5. Conclusion and Policy Implications

The life satisfaction of senior citizens is one of the key factors to establishing the elderly welfare policy. Korea, most especially, has a unique experience as a consequence of the World War II (Japanese Colonization) and the Korean War. This unique situation generates two different baby boomer groups. This study analyzed the life satisfaction of elderly (baby boomers after the World War II) and potential elderly people (55-64 years old, who are baby boomers after the Korean War) (Cho, 2016 a and b). To analyze the life satisfaction of these two age groups, this study used the year 2011 data of the Korean Retirement and Income Study Panel Data which is the most recent data for the cross-sectional ordered logit analysis. This paper also distinguishes the elderly group with the potential elderly group. It selects the overall life satisfaction as the dependent variable, which is the ordered category variable, in order to figure out the differences of life satisfaction between the potential elderly and elderly people. This dependent variable is composed of five categories whereby satisfaction levels range between 1-5 with 1 being very bad and 5 being very good. Using total thirteen independent variables which include five demographic variables along with eight ordered category variables, this study implemented the cross-sectional ordered logit analysis about overall life satisfaction of two different age groups.

Analysis results noted that health, economy, and housing variables in both potential elderly and elderly people groups are key variables ordinarily for the life satisfaction. However, priorities of specific variables are slightly different between age groups. Elderly people had more concern about health and housing compared to the potential elderly group but potential elderly had more concern on the economy. These results can offer several policy lessons for the Korean elderly welfare building. Eventually, health is the most important issue for both age groups and the Korean government should give some policy priorities on the health of elderly people irrespective of age levels. Economic issue is also the second important factor for these people. It might reflect the weak pension system in Korea. Therefore, the Korean government should establish the pension policy which stabilizes the economic status for the senior groups. Moreover, housing is the third important variables for these elderly people. It also reflects the dwelling instability because of the high housing price and lack of rental housing for the poor and elderly. Based upon these analysis results, the Korean government should consider these key factors in establishing the elderly welfare policy. Especially to make more effort in solving the basic needs such as economy and housing which are the key factors in the welfare policy for two different age groups. Friend and family variables were also presented as important factors for the potential elderly whereas elderly people consider neighborhood and spouse variables as important in their life satisfactions.

This paper noted the marginal effects of potential elderly. Under the condition which other variables

are located in their mean values, it estimated the marginal effect which is the change of the choice probability of each category by change of value of explanatory variable. The probability which the female chooses 'good' is 41.6% but that of male is 31.7%. It means that female compared to male has relatively a friendly view on the life satisfaction. The difference of 9.9% between male and female notes the marginal effect that sex variable affects the Pr(yi=good). In case of the elderly people, the probability which the female chooses 'good' is 16.6% but that of male is 15.0%. It means, comparing female to male, female has relatively a friendly view on the life satisfaction but the difference is not high. The difference of 1.6% between male and female notes the marginal effect by sex of potential elderly is relatively higher than the one of elderly people. The female of potential elderly group have also a relatively high satisfaction on their life.

This paper can conclude that the priorities of welfare policy for both age groups are orderly health, economy, housing and so on. However, it also has some limitations. It implemented cross-sectional logit analysis to analyze the life satisfaction problems for the elderly and potential elderly groups for the first time. However it should implement the panel logit analysis in order to figure out them cross-sectionally and longitudinally using panel dataset. It should tests the assumption of parallel regression of ordered logit model in order to figure out the more robust output of this ordered logit model.

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Session-16-#321-4

## **Blockchain Government**

#### MyungSan Jun

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#### Abstract

#### Purpose/ Research Question:

Today, over than hundred blockchain projects aiming to innovate the government system are being conducted in more than thirty countries. What make the countries to jump into the blockchain projects? What's the relationship between government and blockchain?

#### Key Literature Reviews (About 3~5 papers):

1) Don Tapscott Alex Tapscott, 《Blockchain Revolution》, Penguin Random House UK, 2016,

2) Mark Walfort, 《Distributed Ledger Technology: beyond block chain》, A report by the UK Government Chief Scientific Adviser, 2015

3) Julie Maupin, "The G20 Countries Should Engage with Blockchain Technologies to Build an Inclusive, Transparent, and Accountable Digital Economy for All", <2017 G20 Summit>, March 25, 2017

#### Design/ Methodology/ Approach:

First, I reviewed the projects led by governments globally.

Second, I introduced theoretical resources which can explain the inner factors of the relationship between blockchain and government.

Third, I clarify the essence of the characteristics of government that adopt blockchain technology.

#### (Expected) Findings/Results:

The reason governments around the world are going to embrace blockchain technology is because blockchain is a technology directly related to the social organization. Unlike other technology, there lies the consensus mechanism in the core of blockchain. Traditionally consensus is not belongs to machine but to mankind, however blockchain works on consensus algorithm with human intervention. And once the consensus made, it cannot be modified or forged. Following Laurence Lessig who suggested the proposition 'Code is law', I suggest that blockchain makes 'absolute law' that cannot be violated. This characteristic of blockchain makes it possible to implement social technology that can replace exiting social apparatus including bureaucracy. In addition there are close resemblances between blockchain and bureaucracy. First, both of them are defined by the rules and execute pre-determined rules. Second, both of them works as information processing machine of the society. Third, both of them work as trust





machine of the society. So I think it is possible to replace bureaucracy with blockchain system and moreover it is unavoidable. In conclusion, I suggest 5 principles that should be adhered when we replace bureaucracy with blockchain system. 1) Introducing Blockchain statute law. 2) Transparent disclosure of data and source code, 3) Implementing autonomous executing administration 4) Building a governance system based on direct democracy. 5) Making Distributed Autonomous Government (DAG).

#### **Research limitations/ Implications:**

The discourses of blockchain today is somewhat contained technical perspective, but this article reveal the social and political aspect of blockchain technology, so this article is expected to help not only understanding the blockchain technology but also to guide how we can harness the potential of blockchain technology to innovate the government and society.

#### Keywords:

Blockchain, Government, Smart Contracts, bureaucracy, Blockchain statute law, Distributed Autonomous Government

Session-16-#321-4

## Long-term collaboration network based on ClinicalTrials.gov DB in pharmaceutical industry

#### **Heyoung Yang**

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#### Abstract

**Purpose/**Research Question: Due to the improvement of quality of life and global ageing phenomenon, the need for new drug development is growing rapidly, and many pharmaceutical companies and research institutes are making efforts to develop new drugs. However, the cost of R&D investment in the pharmaceutical industry field is increasing, and the productivity is stagnant. For this reason, the demand for innovation is increasing in the pharmaceutical industry. According to the recent study estimating the cost of new drug development, it has been reported that in increased from 800 million dollars (2000 dollars) to 2.87 billion dollars (2013 dollars) (DiMAsi et al, 2016). A key part of the cost increase is clinical trial studies, particularly the cost of performing phase II and phase III is growing rapidly (Orloff et al, 2009). Productivity crisis is a frequently occurring research topic in pharmaceutical industry in this decade (Pammolli et al, 2011), some study supposed that the stagnancy may reflect the limitation of the current R&D model (Munos, 2009). There is widespread recognition that pharmaceutical research and development, despite increasing R & D costs, is stagnated and faced with a productivity crisis. As a way to overcome this productivity crisis, open innovation is a very important hot issue in the pharmaceutical industry, and open innovation in the field has been studied in various ways.

The purpose of this study is to see if clinical trial database helps to observe status of open innovation in the pharmaceutical industry by analyzing long-term collaboration network based on clinical trial database from ClinicalTrials.gov with Social Network Analysis method. We examine characteristics of structure and evolution mechanism of clinical trial collaborative networks and search insights for understanding open innovation of the pharmaceutical industry.

Clinical trials database would help us to understand the current state of pharmaceutical sector in a few aspects. First, in order for new drug to be introduced into the market, it must undergo a clinical trial beforehand. Regardless of clinical trial success, information of clinical trial study should be registered into the system of clinical trials prior to the first patient enrollment. There for clinical trials database is one of information source with the widest coverage for new drug development. Second, clinical trials database include information on the development of generic and biosimilar drugs, which are increasing in importance in the pharmaceutical industry. Generic and biosimilar are replication medicine. Original drugs have patents on discovery and development. Sometimes there is a publication about the development of new chemical materials. However, the replication medicine is basically a medicine that has the same effect as the existing drug but lower the price, so the academic importance is low. Nevertheless, market importance of generic and biosimilar is increasing. Recently, generic and





biosimilars have exceeded the market share of original drugs, and even drug makers with original drugs are fostering the development of generic and biosimilar drugs. This means that without the generic and biosimilars, the current activity of the pharmaceutical industry cannot be understood properly. Third, clinical trial study data can provide insight to improve productivity for new drug development. Because clinical trial studies, especially phase II and phase III, are the largest parts of the cost increase for new drug development, these clinical trial stages are where the greatest effort if require in order to improve productivity and reduce risk. Forth, clinical trials database is 'an underutilized source' (Glass et al, 2015). For the three reasons described above, the clinical trials data is a very importance information source, and a large amount of data is accumulated (there are now over 230,000 clinical trials data from 195 countries). Nevertheless, it has not been adequately analyzed and examined. There are some previous studies like correlation analysis between ClinicalTrials.gov and publication in biomedical journals and study on characteristics of trend in clinical trials database. In particular, there have been few studies on collaborations of clinical trials.

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**Key Literature Reviews (About 3~5 papers)**: Glass et al(2015) argued that ClinicalTrials.gov is still underutilized, despite being an important source of information to understand the entire clinical trials. Research on ClinicalTrials.gov data is limited to investigations of clinical trials and publications, understanding the taxonomy of ClinicalTrials.gov, the registration trends and trial attributes. In particular, ClinicalTrials.gov contains a wealth of data on partnerships and clinical trial data from over 195 countries. Glass et al derived yearly statistical data for ClinicalTrials.gov data, and mentioned that incomplete site information is not more than 3%. Therefore ClinicalTrials.gov data could be a valuable research source. They also presented various research topics for in-depth research and explain the need for future studies.

Califf et al(2012) examined characteristics of 96,346 interventional clinical study data in ClinicalTrials.gov in 2004~2010. Primary purposes, intervention types, regions, anticipated enrollments and so on were examined for each time period of 2004~2007 and 2007~2010. They also studied clinical trial attributes by therapeutic areas, i.e., oncology, cardiovascular and mental health. They concluded clinical trials were dominated by small trials and contain significant heterogeneity in methodological approaches.

Roumiantseva et al(2013) studied clinical trial design characteristics according to sponsorship in ClinicalTrials.gov. They analyzed 108,315 trials registered in ClinicalTrials.gov as of June 11, 2011, comparing interventions and medical conditions by sponsor type. They found out that industry-sponsored studies differ systematically from government-sponsored studies in study type, choice of interventions and conditions studies.

Even though corporate annual reports, publications and interviews provide useful information, these data have limitations. First, publication data is often not published for corporate strategy protection even if it is a scientific result. Therefore, it is hard to consider publication data as an information source that shows the dynamics of research of private firms. Corporate annul reports have similar limitations. The company's annual report basically aims to attract investors' attention, so then there exists some possibility for annual reports to be decorated beautifully.

Design/ Methodology/ Approach: In this study, we will use the ClinicalTrials.gov DB to analyze the

pharmaceutical network of collaborations. We apply Social Network Analysis to sponsor-collaborator relationship data of ClinicalTrials.gov, about 230,000 trial studies. We construct collaboration networks in each decade and examine network properties, community features, characteristics trends from time series analysis. This study is the first longest-term analysis of clinical trial database. We analyze the characteristics of the collaborative network of clinical trials and identify the network parameters and major players of a network for each decade. We examine partnerships of major players and their movements on the networks.

(Expected) Findings/Results: This study on the long-term collaboration network based on ClinicalTrials.gov DB could provide abundant understanding for the relationship and its mechanism among pharmaceutical companies, research institutes and universities. We figure out major players by each time period in pharmaceutical industry from the collaboration network of clinical trial studies. We also study process of constructing, splitting and reconstructing collaborative communities in time series.

**Research limitations**/ **Implications**: We understand their collaborative strategy and change of structure for partnerships by each time period. The understanding from this study could be helpful to find any clue for the productivity in pharmaceutical industry. Meanwhile incomplete data and huge numbers of node (institutes and companies having been participating clinical trial studies) could be obstacles to network analysis. Data cleansing process of collaborator list could be a difficult task and the accuracy of the results may be affected.

**Keywords**: ClinicalTrials.gov, collaboration network, collaborative strategy, pharmaceutical industry, clinical trial study.







### SOItmC & RTU 2017 June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 16 (Friday)

## Session-16-#301-5(SS24 & SS25)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 18:20~19:50)

### "Uncertainty and innovation policy making"

- Chair: SamYoul Lee(Yonsei University, Korea)
- Paper 1: "Why uncertainty is unequal without government's precaution action?: the case of toxic humidifier disinfectant" by Young Jun CHOI & Mi Sun JEON
- Paper 2: "Effect of Art Enjoyment on the Perception of Inequality" by Yoon Kyung Lee & Sam Youl Lee
- Paper 3: "A Study of Civic Hacking for Improving the Performance of Government 3.0 in Korea" by **B. Shine Cho & Sam Youl Lee**
- Paper 4: "Multilevel prognosis of logistics chains in case of uncertainty: information and statistical technologies implementation" by Dmitry Garanin, Nikita Lukashevich, Anna Svirina & Aleksandr Klavdiev
- Paper 5: "Global Value Chains: Green Economy and Sustainable Development Challenges" by Adam Albekov, Taras Medvedkin, Yevgeniya Medvedkina, Oleg Bodiagin & Inga Mezinova

### Session-16-#303-5(GS1 &GS3 & GS5)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 18:20~19:50)

### "Technology, and Business Model in Second IT revolution(so to speak 4th industrial revolution) era"

- Chairs: HangSik Park(Eulji University, Korea) & David Parks(Newcastle Youth Offending Team, UK)
- Honor Discusser: Anil K Gupta
- Paper 1: "Technology convergence, open innovation and dynamic economy" by HangSik Park
- Paper 2: "IT-related business model innovation cases in Korea towards 4th industrial revolution" by Heyoung Yang & Su Youn Kim
- Paper 3: "Analysing the Major Issue on the 4th Industrial Revolotion by Data mining Approach" by Jeonghwan Jeon & Yongyoon Suh
- Paper 4: "An international perspective on the social value equilibrium: a case study" by Katri-Liis Reimann & David Parks
- Paper 5: "Grassroots to Global: A multi-actor evolution and transfer of the Bullet Santi from India to Kenya" by Chintan Shinde, Suleman Okech, Chetan Patel, Astad Pastakia, Ramesh Patel, Christopher Kanali, Peter Nyariki, Paul Apondi, Livingstone Mulamu, Mansukh Jagani, Upendra Rathod, Shailesh Dodiya & Anil K Gupta







### SOltmC & RTU 2017 June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## Session-16-#309-5(SS18 & SS20 & SS29)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 309, Time: 18:20~19:50)

# "The Ecosystem of Open Innovation and organizational innovation"

- Chairs: Chih-cheng Lo (National Changhua University of Education, Taiwan), Ying-Che Hsieh (National Tsing Hua University, Taiwan)
- Paper 1: "How innovation contributes to the sustainable business ecosystem: A lesson from the Taiwanese local comic industry" by Ying-che HSIEH & Li-Hsiang Yi
- Paper 2: "The design innovation of E-textile and wearable computer-a historical" by Wei Her Hsieh & Shih Yun Lu
- Paper 3: "Research on China's Technology Industrialization based on the Measure of Patent Propensity and Project Cooperation" by Xin Liu & Lei Ma
- Paper 4: "Startup Innovation in the Design Industry" by Boyoung Kim & Hyojin Kim
- Paper 5: "Finding Opportunities to Innovate 119 Emergency Medical Service by Design Thinking" by Taesun Kim

### Session-16-#321-5(GS2 & SS19)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 18:20~19:50)

#### Chairs: Valentina Della Corte & Giovanna Del Gaudio(University of Naples Federico II, Italy)

- •Paper 1: "Innovation and tradition-based firms: the case of "La Torrente" by Valentina Della Corte, Giovanna Del Gaudio & Fabiana Sepe
- Paper 2: "Innovating and Inventing for Sustainable Cities: a Tale of Three Incongruities" by Craig
   A. Stephens, Matthias O. Müller, Alan K. Graham & Andreas J. Harbig
- Paper 3: "A Study on Establishing Economic Activation Strategy Based upon Inter-Industry Network Analysis: The Case of Korea" by Hyoung Sun Yoo, Ji-Hui Kim, Dong Kyu Won & You Eil Kim
- Paper 4: "Analysis of Research Trends of the Cathode Materials for Lithium-Ion Batteries" by
  Young-Il Kwon
- Paper 5: "A Study on New Approach for the S&T Intelligence Service" by Yong-il Jeong

Session-16-#301-5(SS24 & SS25)

# Why uncertainty is unequal without government's precaution action? : the case of toxic humidifier disinfectant

### Young Jun CHOI

(Associate Professor, Yonsei University, <u>sspyjc@gmail.com</u>)

#### **Mi Sun JEON**

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#### Abstract

Since 2001, the humidifier sterilizer had been regarded as an innovative and health-promoting product for babies and pregnant women and extensively sold until 2011 in South Korea. However, mysterious deaths due to serious lung diseases have been reported and the prosecutor finally started the investigation in April 2016. According to a civic group, 266 people are thought to be dead due to the disinfectant and about 1,600 people are still suffering from lung diseases. While the media and citizens are condemning companies which sold the product, it seems that the role of the government has been less scrutinized. In this context, this article aims at critically discussing the role of the government in dealing with the possible risk of the humidifier disinfectant. We pay attention to the unequal nature of uncertainty and risk, which significantly constraints individuals' rationality. Some could be in the state of nescience whereas others could be aware of the risk, i.e. either 'probabilities known' or probabilities unknown'.

We will review the incident of the poisonous disinfectant from 1996 when the core chemical, PHMG, inside the disinfectant was first developed by a local company, and question why the government has failed to stop such a high number of deaths. In so doing, we will conduct and analyze in-depth interviews with key informants and examine relevant documents from the government, civic groups, and newspapers. In the end, we will argue that the uncertainty is highly unequal without the precaution action by the government, and it is essential for the government to introduce the precaution principle for public health related policies.





Session-16-#301-5(SS24 & SS25)

# Effect of Art Enjoyment on the Perception of Inequality

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Sam Youl Lee (Associate Professor, Yonsei University, <u>samyoul@yonsei.ac.kr</u>)

# Abstract

Recently in Korean society, worsening phenomena of polarization and subjective perception of class have been the subjects of concern as a serious social problem. When phenomenon of polarization is deepening and subjective perception of class is negatively formed in society, discomfort among social classes is created and ultimately will hinder social integration. The government views these deepening polarization and worsening phenomenon of subjective perception of class as serious policy agendas, and is pursuing a variety of social integration policies to solve and overcome them. In addition, in academia, there are a variety of disciplines which are dealing with polarization as a major research topic. Many studies have illuminated polarization from an objective point of view, considering it as a structurally formed phenomenon in society. However, it is difficult to find studies trying to see either perception of polarization of people or subjective perception of the class against objective class level. In this study, an attempt to complement the existing researches by considering the subjective perceptions of polarization and class is made with more expanded view.

On the other hand, previous studies have tried to reveal the main influencing factors of worsening phenomena of polarization and class, and have found that generally economic factors such as income and assets and social factors such as social capital would be important ones on the phenomena of polarization and class. However, studies that examine the relationship between cultural factors and them are relatively difficult to find and discussions on the role of cultural factors have been insufficient. With recognition of these problems, this study focuses on the issues of deepening phenomenon of perception of the polarization and the worsening phenomenon of subjective perception of class against objective class level in Korean society, and tries to empirically elucidate the effects of cultural factors as an alternative to mitigate them.

Analysis data used in this study are '2013 Consciousness and Values Survey of Koreans', conducted by 'the Ministry of Culture, Sports and Tourism', and are used for descriptive statistics and multiple regression analysis. In addition, detailed analyses are carried out by separating samples into the sub-groups to discuss the findings.

It is found that cultural factors such as 'satisfaction with cultural leisure activities', 'satisfaction with cultural living conditions', and 'cultural and artistic infrastructure' have different effects on each

dependent variable, and they generally not only mitigate the perceptions of social and economic polarization but also play an active role in relaxing subjective perception of class against objective class level. Specifically, 'satisfaction with cultural leisure activities' is found to lower the perception of social polarization and make people positively perceive their own classes. On the other hand, 'satisfaction with cultural leisure activities' activation but aggravate the perception of economic polarization. In addition to the subjective 'satisfaction with cultural leisure activities' and 'satisfaction with cultural living conditions', 'cultural and artistic infrastructure', which is an objective cultural situation, is found to mitigate the perception of economic polarization and have a positive impact on the perception of the class gap. According to the results of the relevant previous studies, cultural experiences and activities contribute positively to the individual's subjective thinking and feelings and social attitudes (Galloway, 2006; Jeannotte, 2003; Matarasso, 1997). The results of this study also support the positive role of culture which has been highlighted in previous studies.

Key words: Perception of the Social Polarization, Perception of the Economic Polarization, Perception of the Class Gap, Role of Culture, Cultural Policy, Social Integration Policy





Session-16-#301-5(SS24 & SS25)

# A Study of Civic Hacking for Improving the Performance of Government 3.0 in Korea

### **B.** Shine Cho

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### Sam Youl Lee

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#### Abstract

This study investigates civic hacking as a tool to improve the performance of Korean Government 3.0. Government 3.0 is a new paradigm for government operation to deliver customized public services and generate new jobs in a creative manner by opening and sharing government-owned data to the public and encouraging communication and collaboration between government departments. It has implemented since 2013, and the national government has been highlighting its achievement focusing on the public sector cases. However, its performance in terms of the increased citizen participation in utilizing the benefits of Korean Government 3.0 services has been rarely considered. Civic hacking is a form of civic engagement that aims to create web applications to solve civic problems and improve government services by using open government data. Therefore, it is expected to improve the performance of Government 3.0 in Korea by increasing the utilization of government 3.0 in the civic sector.

The first part of this article aims to enlarge our understanding about civic hacking, which is a relatively new type of citizen participation and rarely introduced in the field of public administration. It categorizes about 270 civic hacking projects in the US and Korea by using the typology model of citizen participation which consists of two axes: two fields of participation(political and administrative) and three types of participation(consultation and partnership, standing, and consumer choice and control). The majority of civic hacking projects is categorized as the consumer choice and control type participation in the field of administrative participation. Both in the US and Korea, civic hackers develop web/app application to provide a new type of administrative services. It also clearly shows that civic hacking in Korea is happening around Seoul while it happens all around the US by many of local brigades. This strong network promotes the widespread of useful applications. In addition, the collaboration between civic hackers and local governments are widely found in the US while it is rare in Korea.

This study also conducts interviews of four civic hackers in the US and Korea as the first analysis shows the possible contribution of civic hacking to improve the performance of Korean Government 3.0 in terms of increasing its utilization in the civic sector and providing new government services created by citizens. Interviewees emphasized the collaboration with local governments and other public or non-profit organizations and more amount of usable open data as the critical factors to promote civic hacking. They then listed the lack of civic tech personnel and financial support as risk factors that threaten the

sustainability of civic hacking. The result shows that Korean has a strong foundation to promote civic hacking by the early implementation of open data policy and the establishment of Korean Government 3.0. Nevertheless, it needs more understanding of local government officials in order to invigorate civic hacking at the local level.

Findings support the idea that the vitalization of civic hacking in Korea is expected to improve the performance of Korean Government 3.0, especially at the local level. This study recommends Korean local governments to hold hackathons to build a community of local civic techs and help them get organized and keep working to solve local public problems by using their skills. In addition, it is also necessary to increase the understanding and awareness about civic hacking by educating the local government public officials and let them utilize civic hacking as a tool to improve the performance of Korean Government 3.0 at the local level.





Session-16-#301-5(SS24 & SS25)

# Multilevel prognosis of logistics chains in case of uncertainty: information and statistical technologies implementation

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# Abstract

**Purpose/ Research Question**: Effective, strategic, current and operational management of modern logistics systems requires continuous monitoring and forecasting of their condition in many parameters. Especially these questions are critical in justifying the need for modernization or technical re-equipment of the enterprise, when the issue for the evaluation of its technical and economic potential is relevant.

It can be concluded that there is the need to study the issues of formation of scientifically-based logistics solutions. Moreover, by analogy with the systems theory in engineering, it comes to research of the effectiveness of these decisions in conditions of limited, incomplete and often inaccurate information. In general, the management of the logistics process is based on the adopted corporate policies and involves the coordination of related solutions in various areas (scientific, technical, economic, marketing, sales, etc.). The difficulty of solving this problem is the complexity of combining all these elements to achieve the long-run objective that is to optimize the logistics process in view of the strategic objectives of the organization.

A decision on the need to modernize the logistics system must be taken in a timely manner and formed with prior, current and forecast information based on adaptability concept with predominant use of «efficiency-cost» criterion. Adaptability means the implement of the conversion process of all currently available useful information to make effective solutions and ensure the functioning of a competitive logistics system.

The review and analysis of the methodological problems of the choice and decision-making theory in the management of the logistics process have identified the need to take into consideration the level of uncertainty. The development of these issues should be carried out on the basis of information and statistical methods and models of decision-making, taking into account the uncertainty and risks, with the construction of the adaptive forecasting models. Current advances do not allow solving these problems quite effectively. Since the methods of scientific, technical and economic analysis have specific features of their application, for example, for a multi-dimensional prediction parameter logistic systems, therefore there is a need for the information-statistical approach.

### Key Literature Reviews:

1. Arefyev I, Klawdiev A. Prognozowanie informacyjne stanu systemu transportowego. Z.N. Politechniki zapiskij, N 75. Transport. Gliwice. 2012. s. 5-8

2. Arefyev I.B., Volovik A.A., Klavdiev A.A. Method of assessment of the river craft technical condition on the basis of the microstatistics. Scientific journals. Maritime University of Szczecin, 2014, № 37, pp. 5-10.

3. D. Garanin, D. Pervuhin, V. Shpenst. Bases of Stochastic Similarity of Difficult Systems. Applied methods of statistical analysis. Novosibirsk, 2015. pp. 343-350

#### Design/ Methodology/ Approach:

The proposed approach enables the integration of previously developed procedures for statistical analysis of data, and implemented in the form of program information processing technologies (Statgraphics, SPSS, Statistica, etc.) with methods of decision-making support on the basis of maximum uncertainty principle. In this case, a multi-dimensional prediction of the logistic system parameters can be represented in the form of branched algorithm, which is based on well-known methods of different types of analysis such as correlation, time series, factorial and mathematical analysis.

#### (Expected) Findings/Results:

At the same time increase of the objectivity and validity of the results is ensured not only by the implementation of the consistency principles, but also by the introduction of a comprehensive verification of the forecast results of the procedure. Automation of this kind of algorithms allows to improve decision support system and thereby contribute to the adequate and efficient management of logistics systems.

Keywords: logistics chains, uncertainty, supply chains.





Session-16-#301-5(SS24 & SS25)

# Global Value Chains: Green Economy and Sustainable Development Challenges

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#### Abstract

**Purpose/ Research Question**: This paper substantiates the necessity for studying the complexity and ambiguousness of "green" economy's principles', opportunities' and drivers' influence in a view of the need for maintaining the economic growth in general and sustainable development in particular. On the basis of foreign experience review and publications' analysis, the main dimensions of new international business philosophy (the transformation of classical global value chain theory, *R. Kaplinsky, M. Morris, 2000*) are proposed. These dimensions are related to preserving and expanding the role of human capital, forming the post-industrial business, developing horizontal links and the opportunities of sustainable development. The verification of hypothesis of the dense interconnection between "green" economy efficiency indicators, the process of international investment and achieving the economic growth in the framework of individual economic system as well as in human civilization in general, is conducted with economic-mathematical tools.

Present recession being the feature of macroeconomic advancement of either some developing and developed countries, makes relevant the necessity of adjusting current tools of financial-economic, industrial and social policy with simultaneous energizing of looking for new strategic directions and

drivers of growth. Among these, there is search for the new paradigm of socio-economic relations capable of meeting the pressing challenges faced by economy and society: economic crises and recession, social inequality, state deindustrialization, unemployment, limited natural resources, environment pollution etc.

Thus, in one hand, three unresolved issues of record growth rate period of 1990-s and 2000-s, according the biennial reports by Organization for Economic Cooperation and Development (OECD) are declared to be poverty, unemployment and inequality since 2012. The same issues are mentioned as the consequences of economic crises and financial shocks in the transactions by Noble Prize winning economists J. Stiglitz, P. Krugman and  $\mu$  M. Spence, who directly bring the matter of existential choice for human civilization into the context of evolutionary transformations. In other words, it is not about doubting the fairway of world economy, which is the necessity of resuming of economic dynamics and states' well-being, but about revealing and definition of new triggers being the new key issue shifting the traditional emphases of states' and global corporations' industrial policy.

On the other hand, in the United Nations Environment Programme defines green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". In simple terms, it is low carbon, resource efficient, and socially inclusive. In a green economy, growth in income and employment should be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.

Therefore the logic of this research contemplates the study of how the latest challenges by sustainable development of economic systems with various taxonomic attributes influence the achieving of positive dynamics and key development indicators increasing in the framework of assumptions and limitations provided by the principles for the green economy, which the authors propose to be considered not as the result of purposeful activity of economic entities but as the tools for long-term balanced business planning.

The authors of this paper exercise the scientific search for the possibility to transform the traditional pattern of global value chains of international business (*R. Kaplinsky, M. Morris (2000)*) being exposed to the system of assumptions and limitations provided by the principles for the green economy with the aim of achieving sustainable development of economic systems with various taxonomic attributes.

# Key Literature Reviews:

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Stiglitz J. The Great Divide: Unequal Societies and What We Can Do About Them, W.W. Norton Company, 2015

Krugman P. Return of Great depression. Global Crisis from the Nobel Prize Winner's point of view. 2009

Spence M. The Growth Report: Strategies for Sustained Growth and Inclusive Development. Washington, DC, 2008

UNEP. 2010. Green Economy Developing Countries Success Stories. UNEP, Geneva., p. 5.





### Design/ Methodology/ Approach:

With the aim of meeting the stated purpose of the research the authors implement the following fundamental theoretical and applied objectives:

to analyze the fundamental basis of economic growth as the result of economic systems' transformation;

to study the theories and methodology background of global value chains of international business;

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to contemplate the place and role of international business in the system of modern world economy;

to investigate the key concepts for transnational corporations' interactions with the public institutions within the advancement of synergetic economic growth;

to undertake the analysis of quantitative and qualitative characteristics of the system of assumptions and limitations provided by the principles for the green economy;

to reveal potential locations for the incorporation of green economy influence factors into the patterns of global value chains of international business;

to examine foreign experience of implementing the system of green economy's assumptions and limitations within cluster analysis of economic systems by the structural features of national economies;

to perform the economic-mathematical analysis of the influence by the investment process in the field of economic systems transformation financing aimed to achieve the sustainable growth;

to form the concept "Global value chain 2.0" (GVC 2.0) as the modern paradigm for sustainable growth of economic systems in a view of the opportunities of green economy.

For the working hypothesis of this research stands the following statement: there is a dense interconnection between the rate of economic growth, the investment process, the transnationalism level and such indicators of the green economy's assumptions and limitations system as the role of renewable energy sources, urbanization level, research-and-development spending.

#### (Expected) Findings/Results:

The nominated research's hypothesis of potential interconnection between the green economy's assumptions and limitations system, the imperatives of sustainable development and the process global value chains transformation, requires the verification within following aspects:

1. The maintenance and improving of theoretical and methodological background of subject and object basis of the research;

2. Expert assessment of applied indicators of expanded reproduction system transformation on regional and sub-regional levels within the implementation of green economy's assumptions and limitations system principals and sustainable development imperatives;

3. Economic-mathematical proof (or disproof) of existence of economic effect in the dynamics of macroeconomic development of regions at all economic levels in a process of quantitative and qualitative shift in content of traditional global value chains' elements

Keywords: supply chains, innovation, sustainable development, green economy.

Session-16-#303-5(GS1 &GS3 & GS5)

# Technology Convergence, Open Innovation, and Dynamic Economy

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### Abstract

World economy has confronted with low economic growth several years before. Many experts agreed that those words such as Openness, Convergence, Creation of new market demand through new emerging technologies (e.g. IoT, Big data, AI etc.) maybe open to solve current economic crisis over the world. When they link to network, law of increasing return will come true.

As main issue of the 4<sup>th</sup> industrial revolution touched in the 2016 WEF is closely related, enlargement of Open innovation and Convergence will lead to new dynamic economy and sustainable development.

**Keywords :** the Fourth industrial revolution, dynamic economy, open innovation, convergence, disruptive innovation





Session-16-#303-5(GS1 &GS3 & GS5)

# IT-related business model innovation cases in Korea towards Fourth industrial revolution

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# Abstract

# Purpose/ Research Question:

The Fourth Industrial Revolution is being promoted by the progress and convergence of various information and communication technologies which are going on at the same time like as smart devices and big data, artificial intelligence, robotics, Internet of Things, unmanned vehicle, 3D printing, nanotechnology etc. The Fourth Industrial Revolution is expected to bring about great changes throughout the future society. The World Economic Forum held in December 2016 adopted the agenda of "Mastering the Fourth Industrial Revolution" and held in-depth discussions on the Fourth Industrial Revolution. The contents of the discussion are whether the Fourth Industrial Revolution can be an alternative to overcome global economic crises, how to review the revolutionary changes of the social structure that will occur after the singularity of industrial revolution and how to respond to them to be.

The private companies are the ones most hard-pressed to prepare for the Fourth Industrial Revolution. In particular, companies in the technology sector that are the driving forces of the Fourth Industrial Revolution are trying to become game changers that change the rules of the past. Currently, smart devices and big data are penetrating into each segment then it is difficult to say that the Fourth Industrial Revolution has entered the stage in earnest. At this point, what is most needed to promote the Fourth Industrial Revolution? Perhaps it is a business model innovation.

New technologies need a new business model to create new value. However, the traditional business model still has market leadership. The importance of business model innovation has been mentioned in several previous studies. (Henry Chesbrough(2007), Amit and Zott(2012) and Porter et al.(2015)) Now, a business model that can create new kinds of value is just as important as technology. New technologies are desirable to be combined with new business models to create new value and promote the Fourth Industrial Revolution.

Business model innovation requires strong leadership to succeed. Sufficient understanding and full

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support of the top decision makers of the enterprise is essential. Leading companies in the market are more likely to succeed in business model innovation based on technological advantage and market share advantage. However, even after successful technology development, business model innovation is very difficult to succeed for latecomers.

At this moment, the role of government emerges in the era of the Fourth Industrial Revolution. In the wake of the WEF in 2016, Union Bank Switzerland released a white paper on the Fourth Industrial Revolution which title is "Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution". This white paper explains the influence of the Fourth Industrial Revolution and suggests implications of various perspectives. Especially the white paper presented the result of country assessment which is the adapted relative rankings from WEF Competitive Report, using Fourth Industrial Revolution categories. Switzerland, Singapore, the Netherlands, Finland, the United States, and the United Kingdom ranked first through fifth, while Korea ranked 25 out of 45 countries. The fact that UBS's white paper presented countries ranking means that the competition at the national level was accelerated in the Fourth Industrial Revolution era.

If the Fourth Industrial Revolution brings about radical changes in the industrial structure, the role of the government should change accordingly. However, there has not been much discussion about the role of the government in the era of the Fourth Industrial Revolution. In the meantime, the government has encouraged companies to R & D and helped them to succeed in technology development. But now, not only technology development but also business model innovation is important. Governments need to think about how they can help business model innovation succeed.

This study is an analysis of cases of Korea in which the government supported business model innovation. Ministry of Science, ICT and Future Planning of Korea implemented *Flagship Project Support Program* that will support building a new business ecosystem and creating new business ideas with regard to technologies in the fields of virtual reality (VR) and SmartCar-IoT. Both Flagship projects in the fields of VR and SmartCar-IoT consisted of a consortium construction for business ecosystem, business model implementation and user recruitment based on one year of government support. This study is a case study of two Flagship projects. The purpose of this study is to examine what roles the government can play in the era of the Fourth Industrial Revolution and how it can produce effective results.

**Key Literature Reviews (About 3~5 papers)**: Henry Chesbrough(2007) argues that today's innovations should no longer include technology and R & D but also business models. In the past, it was possible to hire talented people to develop high-quality products, but now the cost of technology and product development has reached enormous scale. The important thing is value creation and value capture, not technology and product itself. Once the focus is adjusted to the value, it naturally comes to the fact that the business model is important. Chesbrough described the importance of the business model as "a better business model often will beat a better idea or technology". However, he says 'nurturing a new business model is not easy', and the reason for this is the 'business model innovation leadership gap'. To accomplish the business model innovation, all relevant core players must participate, this is only possible when leaders at the top level understand business model innovation and have strong leadership.

Amit and Zott (2012) explained the importance of business model innovation to Apple's case. Apple was a company that developed and sold a family of products represented by personal computers until the





nineties. At that time, Apple was an enterprise that worked to develop innovative hardware and software. However, Apple surprised the market by creating iPods and iTunes. Apple has made a very radical innovation in its business model. Apple was the first company to combine iPod music distribution service. Apple has directly linked music label owners with consumers and has changed the way music is consumed. Apple has not just introduced innovative hardware to the market, but a new business model. Amit and Zott presented three ways to achieve business model innovation. First, adding new activities before and after existing business models. Second, it links a variety of activities in a new way. Third, change one or more parties into other activities that constitute existing business model.

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Porter et al. (2015) point out that smart, connected products have completely changed the value chain, as a result, companies are redefining their industries. Smart, connected products present new implications for organizational structure and collaboration, which means business model innovation. In other words, business model innovation is becoming more important because of the smart, connected products that are emerging at the heart of IT technology. Porter et al. mention that smart and connected products are different from past IT technologies. In the past, IT technology has improved the business processes of enterprises, resulting in value chain automation or value chain integration. Smart and connected products are embedded in IT products themselves, changing the value creation method itself. Therefore companies need to understand how smart, connected products create value. And they have to change their business model to fit the way smart, connected products create value.

The phenomenon described by Porter et al. can be called the Fourth Industrial Revolution. The Fourth Industrial Revolution is going on in all industrial sectors around the world. Businesses must make business model innovation to adopt new value creation methods. However, as Chesbrough mentioned, many companies fail the business model innovation by the leadership gap. Despite Amit and Zott 's suggestion of three methods for business model innovation, there are not many successful cases of successful business model innovation. In particular, it is more difficult for latecomers to become the main characters of success stories of business model innovation. If the difficulty of business model innovation is due to the high huddle of voluntary cooperation among companies, this would be a market failure. However, previous studies do not address the role of the public sector in business model innovation. We need to consider about what roles the public sector can play in overcoming market failures in business model innovation and effectively leading the fourth industrial revolution.

**Design/ Methodology/ Approach**: This study is the result of analysis of the *Flagship Project Support Program* which Korea Ministry of Science, ICT and Future Planning promoted. The *Flagship Project Support Program* is a governmental program aimed at helping the demonstration of promising future technologies that can create new market services and create a business ecosystem. The promising technologies selected for the Flagship project are VR and SmartCar-IoT (Internet of Things), two of the main items of the fourth industrial revolution. In the field of VR and SmartCar-IoT, in which leading companies in the field of smart technology have already taken the hegemony, relatively latecomers should seek a model that is different from the existing business model in order to secure competence. The *Flagship Project Support Program* provided the opportunity for related players to collaborate and promote to consumers for business model creation of VR and SmartCar-IOT. The value chains of Flagship Projects were analyzed through comparison with existing value chains. As a result, the consortium of each project has established an open platform for the VR and SmartCar-IOT and has created a new business ecosystem that is different from the existing business model.

In this study, we analyzed the business model of the existing market and the business model of the flagship project. First, we analyzed the value chain established in the two Flagship projects. We investigated the characteristics of the players participating in each project and grasped the collaborative relationship. We analyzed the relationship and interactions between smart products, contents, data and consumer, and constructed the value chain based on the results. And we have suggested implications that help us understand how new values are created in the era of the Fourth Industrial Revolution.

**(Expected) Findings/Results:** This is a case study of Korea Ministry of Science, ICT and Future Planning program to build business ecosystem in Korea and create new market new service for VR and SmartCar-IoT technology field which are two of the main items of 4th Industrial Revolution. As a result of the analysis, the two Flagship projects have tried to create a new type of value creation by building an open platform. In the existing market, a competitive camp has been established based on one-to-one or one-to-many partnerships among large corporations. Differently, players participating in the two Flagship projects sought to build an open platform by breaking down the walls of the camp through voluntary participation of users. We confirmed that cooperation between SMEs and large corporations, voluntary participation of users, and open platform creation also resulted in new business idea creation. The comparison of the existing value chain and the value chain of the Flagship project provides insights into the direction of the company in the Fourth Industrial Revolution and what role the government should play.

**Research limitations/ Implications**: In this study, we have learned how latecomers can construct business models and how to make value creation in the fields of VR and SmartCar-IoT technologies, which are two of the main items of the 4th Industrial Revolution. Open platforms for smart technologies are considered to be the most powerful option for latecomers. Because the open platform not only can break the walls of the camp, but it can also lead to voluntary participation of users. The open platform is a creative business ecosystem environment. We can see that several new business ideas have been derived from the cases of these two Flagship projects. However, since this study is two examples of VR and SmartCar-IoT, it is necessary to fully consider the characteristics of the field to apply to other fields. Also, it is desirable to be careful when interpreting the results of this study because the business condition in Korea differs from that of other countries.

# Keywords:

4<sup>th</sup> industrial revolution, virtual reality, Smart Car, Internet of Things, open platform

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Union Bank Switzerland, "Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution", UBS White Paper for the World Economic Forum Annual Meeting 2016.



Chesbrough, Henry. "Business model innovation: it's not just about technology anymore." *Strategy & leadership* 35.6 (2007): 12-17.

Amit, Raphael, and Christoph Zott. "Creating value through business model innovation." *MIT Sloan Management Review* 53.3 (2012): 41.

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Session-16-#303-5(GS1 &GS3 & GS5)

# Analysing the Major Issue on the 4<sup>th</sup> Industrial Revolotion by Data mining Approach

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### Abstract

Now is the age of the 4<sup>th</sup> industrial revolution. Many issues are coming out on the 4<sup>th</sup> industrial revolution such as artificial intelligence, robot technology, autonomous driving, internet on things. This study aims to analyse the major issue of 4<sup>th</sup> industrial revolution based on the data mining approach. For this purpose, data mining approach such as text mining and topic modeling were employed to perform a systemic analysis on the 4<sup>th</sup> industrial revolution. The data was collected from Korean newspaper between 2013 to 2017. The findings of this study is expected to provide fruitful implications for making promoting policy for the 4<sup>th</sup> industrial revolution and formulation of technology strategy of the firms related to 4<sup>th</sup> industrial revolution.

Keywords: 4<sup>th</sup> industrial revolution, Major issue, Topic modeling, Open innovation.





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# An international perspective on the social value equilibrium: a case study

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# Abstract

# Purpose/Research question:

For over 3 decades the notion of Corporate Social Responsibility (CSR) and the relationship between corporations, governments of countries and individual citizens has been the subject of extensive academic research and debate.

This paper will analyse the efforts to introduce a new concept of social enterprise which deals with the desistance of ex-offenders in Estonia. It will analyse the co-production challenges in establishing a service in collaboration with actors from the private and public sectors. It will also analyse the provision of the same service in the UK and USA comparatively.

Using a case study approach, we will present the key drivers for private sector partnerships with an organisation primarily concerned with delivering social and environmental outcomes. By taking an international perspective we will offer critical analysis of how this social value is constructed, understood and utilised in practice to satisfy the objectives of all parties. We will explore the barriers and drivers from the point of view of all of the stakeholders and give consideration to there being a point at which a critical mass is achieved. In particular, we will evaluate the significance of the cultural context in which these partnerships are being developed and what this tells us about the future potential growth of the economic model.

# Key Literature Reviews (About 3~5 papers):

This paper draws on existing academic literature, secondary sources and the professional knowledge of the authors including first-hand experience of building cross-sectoral networks which connect organisations to support social impact. We will explore the nature of the relationships in the context of conventionally oppositional ideologies, of socially vs. economically progressive ends which are presented as potentially mutually inclusive and beneficial outcomes to be achieved.

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Maruna, Shadd. (2001). *Making good: How ex-convicts reform and rebuild their lives*. Washington, DC (USA): American Psychological Association.

Rex, S. (1999) 'Desistance from offending: Experiences of probation', Howard Journal, 36(4): 366-83.

Zamagni, S and Zamagni, V. (2010). Cooperative Enterprise: Facing the Challenge of Globalization. Edward Elgar Publishing.

# Design/ Methodology/ Approach:

The analyses is based on extended field research. The empirical part consists of the interviews conducted with members of the advisory board of the social enterprises represented by the public and private sectors. The analyses is twofold: it covers the aspect of generation of corporate social responsibility and the logistical constraints in setting up the similar social enterprise structures in the three countries.

# (Expected) Findings/Results:

The paper examines the benefits and limitations, challenges and outcomes of the social enterprise working with the ex-offenders in the field of environmental maintenance in the pursuit of desistance from crime and the long term reduction of further offending.

# **Research limitations/ Implications:**

The paper evidences the need for country specific adjustments in the models of social enterprises and the harmonization of policies fostering the increase in corporate social responsibility.

# Keywords:

Social Enterprise, Social Value, Corporate Social Responsibility, Innovation, Desistance, Co-production





Session-16-#303-5(GS1 &GS3 & GS5)

# Grassroots to Global: A multi-actor evolution and transfer of the Bullet Santi from India to Kenya

Chintan Shinde, Suleman Okech, Chetan Patel, Astad Pastakia, Ramesh Patel, Christopher Kanali, Peter Nyariki, Paul Apondi, Livingstone Mulamu, Mansukh Jagani, UpendraRathod, ShaileshDodiya and Anil K Gupta

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### Abstract

Abstract: Bullet Santi is one of most studied innovations emerging from the New Social Movement of the Honey Bee Network. It is one of three technologies that Society for Research Initiatives for Sustainable Technologies and Institutions (SRISTI) transferred to Kenya under a USAID funded Technology Transfer project. The innovators, MansukhbhaiJagani (the Bullet Santi & Seed and Fertilizer Dibbler) and Dharambir Kamboj (Fruits and herbs processing machine), made the technologies opensource in Kenya to aid replication and spur cross-pollinated innovation. Jagani has, in fact, never enforced his patent even in India where several fabricators are currently making the machine. This framework of open innovationhas accelerated the evolution of the technology into a more complete product as years went by and as improvements from multiple fabricators chipped in. In Kenya, such ecosystem was needed to be developed for the technology transfer to be successful. All the designs, processes, as well as technical know-how were shared with the Kenya counterparts. The Kenya artisans spent several days with the Indian grassroots innovators gaining several technical insights as well as tacit "tricks of the trade" in India and Kenya. Several public sector or aid-driven initiatives have been unsuccessfully tried before to increase the mechanization numbers in Africa. However, the initiatives did not lay emphasis on developing a supporting network where an innovation can thrive and be localized. SRISTI with the help of partner Jomo Kenyatta University of Agriculture and Technology (JKUAT) has created a nurturing ecosystem of artisans, repairmen, private and public actors wherein the Bullet Santi is being introduced. With the help of several innovators from India and formal institutions like JKUAT and NMC as well as the Juakalis (informal artisans) in Kenya, the technology evolved from the three-wheel Bullet Santi to the four wheel mini tractor called Shuja to suit local requirements and conditions. Based on this co-created design, further tractors will be delivered to Kenya which have been tailor-made for Kenya. The paper shares in detail this evolution in the larger context of HBN's open innovation approach as well all the process flows for the project.

Session-16-#309-5(SS18 & SS20 & SS29)

# How innovation contributes to the sustainable business ecosystem: A lesson from the Taiwanese local comic industry

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#### Abstract

This study aims to investigate how innovation contributes to the sustainable business ecosystem in the context of cultural and creative industries. Since Moore (1993) first proposed the concept of the business ecosystem, abundant research has been carried out in various fields, producing different streams of research on ecosystems such as innovation (Adner, 2006; Adner & Kapoor, 2010, 2016), platform (Yun et al., 2017; Iansiti & Levien, 2004; Rong et al., 2013), and entrepreneurial (Nambisan & Baron,

2013). In the innovation ecosystem stream, researchers have focused recently on the network of actors involved in developing and commercializing innovations, and their joint value creation (De Vasconcelos Gomes et al., in press). Since innovation is recognized as the successful execution of new products, services or processes (Gordon & McCann, 2005), the cultural and creative industries have conventionally been linked with innovation, given that numerous participants in such industries are involved in creating new products (Wijngaarden et al., 2016). One example, Taiwan's local comic industry, has a long history dating back to 1895. It started to develop rapidly in the 1990s, reaching its peak in the 2000s (Yu, 2012), but shrinking dramatically since then. By focusing on the Taiwanese local comic industry, this study aims to explore the key factors needed to sustain the health of an innovation ecosystem in a cultural and creative industry, as well as seeking to identify the factors that led to the industry's decline.

#### **Research Background**

Since the Taiwanese local comic industry tends to be significantly affected by government policy as well as economic conditions, it has been through different stages since its incubation. When Taiwan was under Japanese rule (1845-1945),





Taiwanese comics were used to comment on government policy rather than to entertain readers. In the 1970s, the content and function of local comics started to change. Various themes of comics (such as sports, love, career, comedy) evolved and comics became a common type of reading matter for the Taiwanese (Yu, 2012). In the late 1990s, the local industry reached its peak. With the fad for well-known comics (such as Young Guns) and artists, Taiwanese local comics successfully spread through Southeast Asia, gaining fame (Chen, 2011). However, influenced by the Asian financial crisis in 1997, the industry plunged into recession. Several comics have now ceased to be published, and most of the artists have left the comic industry or turned to the creation of derivative products.

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### **Key Literature Reviews**

As a stream derived from ecosystem research, research on innovation ecosystems provides an ideal model of the interdependent relationships in specific industries, mainly focusing on value creation through the development of new technologies or creation of new products (Ritala et al., 2013). By arranging themselves within an innovation ecosystem, participants can obtain competitive advantages through the mechanism of value creation (Adner & Kapoor, 2010), and various labels, such as open innovation and platform leadership (Adner, 2006). So far, innovation ecosystem research has mainly been applied to high-tech industry (Adner & Kapoor, 2016; Gawer & Cusumano, 2014). Little research has focused on observing how innovation ecosystems contribute in the context of cultural and creative industries. Hence, this study seeks to identify the essential elements needed to keep a cultural and creative industry robust and healthy.

#### Methodology

To investigate how different actors interact within the ecosystem and how innovation influences Taiwan's local comic industry, this research adopts the grounded theory method (Eisenhardt, 1989; Yin, 2013). The data are collected mainly through semi-structured interviews aimed at illustrating how the Taiwanese local comic industry sits within the business ecosystem framework. Other data, such as industry-related reports, stakeholders' websites, and archival data are also collected, to analyze whether the Taiwanese local comic industry has formed a community as a business ecosystem, and how different organizations and agents interact.

# **Expected Findings and Implications**

Our findings would contribute to the theory of innovation ecosystems through its investigation under a different context. Furthermore, the outcomes could help thegovernment to formulate an appropriate policy aimed at rebuilding the Taiwanese local comic industry, impacting related parties involved in the comic industry (such as schools, publishers, artists and investors), and building up an efficient interactive system that would create additional profit-making and competitive advantages.

#### **KEYWORDS:**

Innovation ecosystem, innovation, cultural and creative industry, comic industry, Taiwan

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Session-16-#309-5(SS18 & SS20 & SS29)

# The design innovation of E-textile and wearable computer-a historical development perspective

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### Abstract

### Introduction

According to definition of wear and wearable from dictionary: Wear is often used as a verb –Have (something) on one's body as clothing, decoration, or protection. Refer to the term "wearable", in general, a wearable computer or other electronic device that is small or light enough to be worn or carried on any part of human body. Of course, the definition of wearable is ever growing and above definition does not comprehend the vast realm of digital era. It seems to exist everywhere and soon become part of our lives.

#### **Review of Wearable Computer**

In the early 1960s there were Mathematicians such as Edward O. Thorp and Claude Shannon, they created computerized timing devices to help them predict and gamble on roulette-wheel speeds in Las Vegas, which transmitted by radio waves to an earpiece, afterwards, Thorp is the self-proclaimed inventor of wearable computers.

In 1981, one of early pioneer of the wearable industry was Steve Mann who developed a backpack- mounted system to control his photographic invention. In 1994, he became especially know for developing the Wearable Wireless Webcam, which allowed him to upload images on the Internet for around two years.

In 1996 a workshop 'Wearables in 2005' which was conducted and sponsored by DARPA (U.S. Defense Advanced Research Projects Agency). The foundations for the wearable technology and the following definition of wearable computing was created: "data gathering and disseminating devices which enable the user to operate more efficiently. These devices are carried or worn by the user during normal execution of his/her tasks" (Urban et al. 1996).

In the early 21st century, the newest hybrid art forms of science, fashion and wearable technology are generating creations that would be beyond imagination, there were another driving force from haute couture as well. Take for example Designer Thierry Mugler revealed a jackets which printed like circuit boards in 1991 and Alexander McQueen showed a transparent acrylic bodice with flashing LED lights and circuit-board-like trousers in 1999, until recently and the most remarkable artworks of must come from Hussein Chalayan. His fashion shows are represented as multi-sensory installations where sound, light, and technology play a role as important as the body itself.

There is an evidence to show that many international company are looking for a new way to bridge technology with the human form (corporate examples include IBM, Philips and Nike) when technology and computing become more ubiquitous in their conception. In 2000, IBM tried to break up conventional mobile phone into their basic components and packaged as various pieces of digital jewelry instead of one single device, such as earrings, necklace, ring, bracelet, possibly along with Bluetooth wireless technology. Research and Development from Philips Design Probes, which aims to understand what a

2020 lifestyle might be like, they has produced a range of prototype for the integration of technology in the human body, apparel, culture and environment (Marzano et al. 2001).

The MIT Media Laboratory has played an important role in computational fashion design such as Maggie Orth, Elise Co, Prof. Joe Paradiso, and others have created many conceptually esthetic and innovative projects in this area. In1997, Paradiso developed expressive footwear for Computer- Augmented dance performance embedded with a sensor system, which could detect many expressive degrees of freedom and apply them to operate music synthesizers and computer graphics system in a real-time performance. Maggie Orth considered her work in variety way includes programmable color change textiles, interactive textile and light pieces, electronic fashions, and design products. Described by Seymour (2008), "Wearables are true extensions of the idea of incorporating ubiquitous computing in everyday objects." Above all, we observe the applications of wearable technology in computer technology, fashion and art from the historical review, and how the designers operate it as medium.

#### CHALLENGE OF Washability

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While many of the wearable device are not really wearable at all, most of them has been experiential developed as a prototype and exists in laboratories only. Why has this happened? The reason is that washability is a crucial characteristic of e-textiles in terms of the wearable system, unless it is made by disposable material, for example, a lifestyle jackets developed by Philips in collaboration with Levi Strauss has already been put on the market. These jackets consist of waterproof with voice-recognition mobile phones and





MP3 players, and it can be removed before the jacket is washed. However, the consumers did not want to buy another electronic devices was problematic and result in the jackets were failure of commercial market ultimately.

### USING QR CODES AS DESIGN ELEMENT

In general, people use bar codes to buy things from market, or the latest technology which is Dash Button from Amazon, simply use smartphone download the Amazon App, and sign into your account, and select the product you want from order. Recently, people are familiar with QR code, which was developed in 1994, and become one of the widest used application tools all over the world. The initials QR stand for Quick Response, and now many businesses might be able to use QR codes to promote goods and sell things on-line. There are some advantages of using QR code, including user convenience, environmentallyfriendly, cost-effective, versatile, device independent, measurable, competitive differentiation (Burillák, 2010). Normally, we often see it on printed matters such as fliers and name cards or stiffness form like plastic or metal, but not on any soft material at all. Having this in our mind, so we develop a new way to represent the QR code on the surface pattern design of socks (Figure 1).

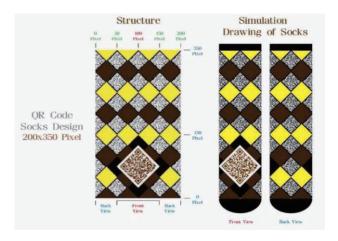


Figure 1. Simulation Drawing of Socks

It is first time this invention was introduced to the world, and it is also washable and contain the information provided to the customer. The major problem in this research is that resolution of the pattern, although the structure of knitting is similar to the pixel. The needles of 4-inch diameter of making socks is 200 in this research, a typical machine specification would be 4-inch diameter, 168 needles (Spencer, 2001).

In order to access the QR code successfully, the adaptation of a QR code into motif and pattern involves some very subtle degrees of arrangement. The designer has to consider the factors of material of yarn, loop, grid pattern and gauge of needle. In order to convert the source into a grid pattern as closely as possible and capture its essence in a few

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stitches, the designer needs to carefully choose the right machine for the final production (Hsieh, 2007).

#### IN CONCLUSION

It have been treated as platforms for embedding wearable and wireless technologies as a starting point to use clothes and accessories for many designers such as wearables, clothing and accessories. There are so many opportunities arise in the realm of wearables since they join together. However, challenges remained as well, a lot of consideration and negotiation between design, function and aesthetic form must be solved. Especially, as wearables are meant to be worn, a particular attention has to be paid to make them adorable, durable, potable, fashionable, washable, unobtrusive and sustainable device. With this new QR code pattern design on fabric, it will provide information content-creation systems and even integrated marketing platforms to any shops which wish to improve and communicates with customers by connecting the "virtual" and "real" worlds in the future.

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Session-16-#309-5(SS18 & SS20 & SS29)

# Research on China's Technology Industrialization based on the Measure of Patent Propensity and Project Cooperation

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#### Abstract

**Purpose/** Research Question: Patent industrialization should be the final goal of patent application. However, numerous innovation subjects haven't put effort into patent application during the process of technical management. There are three main factors contributing to this phenomenon. Firstly, the innovation software programs products such as common are excluded from the scope of the patent protection objects. Secondly, on account of inventors' concern about the innovation deficiency of his inventions and possibility of rejection, innovations are not worthy of a patent even though the innovation is in principle patentable. Thirdly, for sake of keeping confidential, technical know-how or any other methods are adopted by inventors to carry out legal protection of patent right to obtain economic benefits(Basberg, 1987). The research to innovation economics of strategy in patent application can date back to 1960s(Kuznets, 1962; Taylor, Silberston, 1973). Strategic choices in patent application are explained earlier in these researches. Later on, the survey studies by Mansfield(1980) and Levinet et al (1987) during the 1980s highlighted that, in most industries, patent protection was not the typical tool adopted by firms for the extraction of economic returns from innovations and technology industrialization (Cohen et al, 2000). The view that patent is incapable of surely indicating the trend of technical innovation is discussed in various innovation literatures (De Rasenfosse, 2010), nevertheless, technical innovation is still demonstrated in the form of patent which is selected as research object in empirical research. The connection between patent and industrialization has never been interrupted since the foundation of patent system. Promoting the transformation and implementation from patent to industrialization is not only the internal need of patent system, but also one of the key breakthroughs to solve the problem of low patent enforcement rate in contemporary China. This research analyzes the role of China's patents in technology industrialization and explores the attributes and features of technology industrialization results in various industries based on the theory of innovation ecosystem(Li, 2014), which aims to evaluate the patent propensity in technology industrialization results and propose theories and positive ideas which stimulates the patent





industrialization.

**Key Literature Reviews:** The concept of 'propensity to patent' (or 'patent motivation') usually defined in the literature as the ratio between patents and R&D expenditures(Scherer, 1983; Hall & Ziedonis, 2001). This definition mainly clarifies the general relationship between patents and innovation expenditures, whereas it doesn't put forward the subjective and objective factors influencing the patent application of an innovation (eg. the relevance to divers strategies of applicants for patent and features of various industries). The definition of patent propensity has been clarified in numerous following researches, namely the share of patented innovations in the total number of innovations occurring in a given time period(Moser, 2005, 2012). On closer inspection, there is an operability problem yet based on this definition, which is to calculate how many patentable innovations were actually patented during the specified time period. Moreover, different methods have been implemented in different researches to solve this problem(Meisenzahl&Mokyr, 2011; Nicholas, 2011).

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In order to conduct the empirical research, exploring an approach to quantize innovations is of the utmost importance. Primarily, the corresponding relation between innovations and patents should be set up. Scholars has combed and quantized some representative innovations from various industries as samples and found that patent propensity varies with industries and influenced by changeable factors(Fontana, 2013). The final goal of technological achievements is to transform technology into practical productivity, which is creating value profits for obligee through external output of intellectual property(Collan, Heikkilä, 2014) and providing service to the public through the realization of intellectual property value, especially the use value. As one of the legal existence forms of scientific and technological achievements, patent should be an important carrier of transformation in scientific and technological achievements. Patent industrialization is one of the specific forms of the transformation of scientific and technological achievements, as well as one of the forms of realization of technology industrialization. On account of the uncertainty in the process and results of technological industrialization, legal remedies such as legal right, law enforcement protection, administrative and legal rights protection are used to reduce this uncertainty. The core meaning of industrialization is the scale, that is, the patent industrialization is not limited to the application of the patent. More importance should be attached to the innovation products based on patent technology completing the cataclysm from quantity to quality and forming economies of scale, which will become a crucial part of the national economy according to a specific standard of division and stimulate the self-cycling of R & D investment and industrial development(Yu,2010). To be sure, path to patent industrialization has been divided into self-industrialization, technology paid transfer of technology, alliance with the third party(Wu,2012). Furthermore, since the difference of subjects conducting the industrialization, paid transfer of technology and alliance with the third party can be summarized as indirect industrialization while selfindustrialization can be summarized as direct industrialization. We should note that indirect industrialization is largely affected by external factors and operated by capital in many cases, which makes it difficult to directly realize the transformation from technology to practical productivity. For this reason, the main viewpoints and conclusions of this research are aimed at direct industrialization of technology.

Reviewing the existing literature, we find that scholars have drawn many meaningful conclusions in different periods varying with their patent propensity regarding the study in industrial diversity of patent propensity(e.g. Acs & Audretsch concluded that the United States in 1982 displayed the highest patent propensity in wood furniture industry while the oil field shared the lowest; Arundel&Kabla found that in 1993, Europe put most patent propensity in the pharmaceutical industry while the textile industry got the lowest; Brouwer&Kleinknecht discovered that the Netherlands in 1992 showed the highest patent propensity to rubber and plastics industry while the metal processing industry got the lowest; Thomson studied US industrial patent propensity in 1853 and found that the electronics industry was the highest and the watch industry the lowest).

Overall, the main result emerging from those literatures is that the industrial diversity of the technology industrialization results should be based on the same patent protection system in the same period. Additionally, the source of the industrial diversity depends on the technological development, competitive situation, technical characteristics, commercial characteristics, innovation model, organization mode and so on.

**Design/ Methodology/ Approach:** This paper select 'Chinese National Prize for Progress in Science and Technology Award' as research samples of technology industrialization and dig out effective patents contained in 8270 technology industrialization results. Our source of data is the State Intellectual Property Office of the P.R.C (SIPO). We analyze and summarize the patent propensity of technology industrialization results in different areas in China, and apply the k-means clustering according to the patent propensity of different kinds of industrialization results, taking k = 5, which means that the applicability level of the industry is classified into five (i.e. Industry of high applicability, higher applicability, medium applicability, lower applicability and low applicability ). Apart from that, the patent density and distribution of China's technology industrialization have been revealed as follows. It is not surprising then that the main cooperative relationship of the technology industrialization has been measured as well based on the innovation ecosystem and the improved triple helix theory.

(Expected) Findings/Results: This paper has found that the cooperation between scientific research institutions and enterprises is of the highest compactness. Furthermore, the high applicability of patent in China is mainly concentrated in the fields of more mature traditional technologies such as mechanical and electrical technology. Overall, due to the fact that there is a certain process cycle in technology industrialization, the tendency to technology industrialization depends on the maturity of technology market in different areas, influenced by several factors(e.g. market demand and value subjects). On closer inspection and research, it is found that there are potential risks in the implementation of patent transformation concerning emerging technology areas. Another finding should be put forward is that the policy incentives(e.g. 'National Science and Technology Progress Award')should aim at promoting the transformation and implementation of patent technology.

**Research limitations/ Implications:** Although much progress has been achieved in this research, there is no doubt that it still has some shortcomings. We can not deny the fact that this research is restricted by selection rule of awards and there may be some policy orientation in the industrial technology field of the sample, which enables it difficult to fully reflect the real situation of China's technology market. As a





consequence of the long periodicity of technology industrialization, it is difficult to reflect the current technological development hotspots. In the following research, we will continue to make up for deficiencies, exploring other factors affecting the patent industrialization and its mechanism of action and accelerating the rational application and effective implementation of China's patent in the industry. We would like to note that the the definition and measurement of patent propensity in technology industrialization are beneficial to clarify the basic trend and distribution of patents in China's technology industrialization. At the same time, we are ought to guide related subjects to construct consciousness of patent application and overall arrangement, aiming at transformation and implementation and gradually form a sound, scientific motivation for patent application.

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**Keywords** : patent propensity, technology industrialization, triple helix theory, innovation ecosystem, emerging technology

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Session-16-#309-5(SS18 & SS20 & SS29)

# Startup Innovation in the Design Industry

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# Abstract

### **Purpose/ Research Question:**

The growth of online and mobile business and the development of not only the cultural and creative industry but also the contents and knowledge industry has expanded and diversified the existing business models and created new ones, triggering new interpretations and discussions on business models. These changing business trends have paved the way for the expansion of the design industry and opened new windows of opportunity for the traditionally small and non-specialized design business. Until now, the design business had not been distinguished from design industry or design service, and had not been viewed as an independent field. Rather, the design business had merely been part of a process.

As such, the lack of clear definition and structured system had been a bottleneck for many design companies trying to achieve capital and social success and establish the foundation for growth strategy in line with the changing environment. Against this backdrop design startup business, which is typically a newly emerged entrepreneurial venture, and business model, is fast-growing to meet a market place need by developing an innovative product, process or service in design industry and creative economy. This research attempts to clearly define the design startup business model and innovation process with following the research questions;

- 1. How can we define the startup business and startup firms in design industry?
- 2. How is the startup innovation developed by the design firms or designers?
- 3. What kinds of type of the design startup business models are classified?
- 4. What are the success or influence factors of design startup business and innovation?
- 5. What is entrepreneurship to design startup firms?

#### Key Literature Reviews:

The world economy is being rapidly converted into a global, digital, and networked system along with changes in society in the 21st century. Business organizations are seeking ways to reinforce innovation strategies, new technologies, and customer understanding for business success. It is through careful insight into customers' minds that a business can improves its product and gain more buyers and

subsequently more revenue. This is why most assets are poured into research and development (R&D) in all industries (Ulwick & Anthon, 2002). 'Design R&D' is the process by which products and ideas are refined into better ones. Innumerable details are dug up to gain an insight into who the core customers are, and what they want or need. This is where a brand creation, market trend consideration, and new product testing comes into play. Furthermore, design R&D catalyzes new design thinking, design applications and production processes to create killer applications, and can provide an important niche market for a non-mainstream platform. It does so through rigorous multi-disciplinary research into new strategies, tools, and tactics of design conceptualization and realization (Kim & Back, 2011).

In this environment, today design firms and designers should be able to suggest highly successful design activities not by performing subjective aesthetic process but objective and scientific design development process through market-oriented information seeking, scientific design development and effective design management etc. In addition, designers should cultivate design business mind and model by various sources such as new creative idea, new design trend to market change or design thinking for new customer service (Kim & Yi, 2007).

And the end of these activities new design startup companies had launched in the global market and design-driven startup market is growing by design groups and designers who want to build their own business. The exact definition of startup is widely debated. However at their core, most definitions are similar to what the U.S. Small Business Administration describes as a "business that is typically technology oriented and has high growth potential" (Blank and Dorf, 2012). A startup is usually a company such as a small business, a partnership or an organization designed to rapidly develop scalable business model (*Robehmed, 2013*).

Design service expansion in creative economy is an alternative strategy for startup firms to seek growth. Design service expansion shares common features with other types of growth strategy: service and product diversification, acquisition, and franchising. These strategies provide startup firms with new market niches as well as opportunities to exploit firm resources across different areas. Also design business usually involves launching a new operation in an unfamiliar business (Barringer and Greening, 1998; Berger and DeYoung, 2001; Qian and Li, 2002; Emmons et al., 2004).

# Design/ Methodology/ Approach:

This paper is designed by three research parts; literature review, conceptual model building, and case study. And the methodology is as in the following: First, literature review about new business environment, startup innovation and strategy, design industry, and design business change is examined by related papers and second documents. Second, the design startup business model is conceptually designed by the discussions for the business model development and classification of advanced researches based on an empirical research. Third, the several cases about design startup business model are analyzed by design startup firms in Korean design industry. Also the case study uses interview and experience research methods, and finally draws the success and influence factors to build a design startup business.

#### (Expected) Findings/Results:

This paper aims to clearly define the design startup innovation and new design business model. Most of all to overcoming the limitation is that not enough the existed researches about design startup innovation,





the paper suggests the definition of design startup and shows new research trends of startup innovation in design industry. To this end, the paper proposes a design startup business framework and related cases which classifies the business model into four types based on business approaches between the capital or social, and business activities into product or service. At the result the findings as critical factors to design startup innovation and development is discussed to improve the design firms and designers in new startup business environment.

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# **Research limitations/ Implications:**

The suggested framework and findings on this research will expand the definition of design startup and contribute to the expansion of design business activities and the development of diverse business models. Also the study result will help the design companies recognize the importance of new business model and entrepreneurship for their future business. Nonetheless this study has the following limitations; First, even if model building was designed through literature review the business type model is on intuitive standards by business approaches and activities and conceptual level. The model can be identified by an empirical research method to business type classification in future research. Second, the cases to analyze design startup business was collected in Korean design industry. It means that the cases have the unusual status and situation on Korean business environment and culture. To gain an assertion validation this study need to be developed on global design startup firms.

Keywords: Startup, Design Business, Innovation, Business Model, Design Industry

Session-16-#309-5(SS18 & SS20 & SS29)

## Finding Opportunities to Innovate 119 Emergency Medical Service by Design Thinking

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#### Abstract

**Purpose/ Research Question**: Entering into experience economy, industrial design begins to emphasize on product experience which is umbrella concept including various design issues of usability, visual attractiveness, functions and other characteristics. With the change of design point, public service, as intangible product, became one of the design area. This study aims to find chances to improve 119 Emergency Medical Service (EMS), one of the basic public services, through analyzing service experience of stake holders by a qualitative approach based on design thinking.

- 1. What is the whole flow and sequence of 119 EMS?
- 2. Who are stakeholders relating to 119 EMS?
- 3. Who can be the most critical player in terms of stake holder map?
- 4. What is a possible direction to improve quality of 119 EMS?

### Key Literature Reviews:

In many cases, 119 EMS were thought as having 2 stages, pre-hospital and hospital stage, or 3 stages, arriving on site, transporting and handing over patients. Concerning EMS, despite decreasing numbers of trauma mortality rate and pre-hospital mortality rate, in preventable trauma mortality rate, there were no differences for the past 10 years from 1991 to 2011 (Kang et al., 2013). It indicates that there are possibly other factors independent of medical treatment qualities provided by hospitals and one of the factors is a way to offer emergency medical service. When considering 119 EMS mainly involved with the pre-hospital stage of EMS, according to the 2010 service satisfaction survey, positive response rate of 74.8% ('very satisfied' 31% and 'satisfied' 43.8%) tells that there was only a small increment of 1.2% from the 73.6% of 2009. Respondents with 'being unsatisfied and very unsatisfied' pointed out 'late arrival of the first service' 29.4%, 'old and faulty facilities' 23.5%, 'poor attitude of rescuers' 23.4%, and 'inappropriate treatment of rescuers' 17.6% as their reasons (National Emergency Medical Center, 2011). This result shows that arrival time of the first service is considered as even more critical to service receivers including victims. More related with 'late arrival of the first service', the success rates of less-than-5-minutes arrival time of the first service are as follows; Seoul, 83.4%; major cities average, 59.8%; rural area average, 44.1%; national average, 52% (National Emergency Medical Center, 2013). It shows the tendency of polarization in service quality between urban and rural areas.





### **Design/ Methodology/ Approach:**

To achieve the research purpose, this study adopted interview with 119 rescuers, and mainly observation of rescuers activities in 119 EMS. More specifically, research and analysis methods were as follows; first, to get insight concerning service experience of service users and providers, 8 users and 11 rescuers of 119 EMS were interviewed. Second, for 2 days, the whole rescue activities from receiving calls to handing over patients to hospitals were observed accompanying contextual inquiry on site. All interviews and observation were executed with prior, or instant consents of interviewees and service providers, or service users respectively. Third, based on service experience of the users and providers, stakeholders were identified and their interaction between service processes were defined.

### (Expected) Findings/Results:

Integrating experience remembered by 119 EMS rescuers, and patients (guardians), the 119 EMS briefly consists of 3 stages, pre-hospital stage, hospital stage, and post-hospital stage and it is possibly segmentalized into arrival on site, transports, in-hospital, and homing. In the whole process of 119 EMS, stakeholders seems to be classified with four groups, service users (patient/victims, and guardians), executers (EMS field agents), and supporters (headquarters personnel, advisory medical doctors, hospitals, and policemen) and partners (neighbors). It is possibly said that among the stakeholders and performing and having responsibilities of the first treatment. However, the problem is that their abilities vary individually. Although EMS field agents are senior or junior emergency medical technicians (EMTs), because junior EMTs are able to handle only limited tasks in state of emergency where various immediate health-related-risks occur, supportive measures compensating the defect should be considered.

### **Research limitations/ Implications:**

Although this study tries to have deep understanding 119 EMS through a qualitative approach, provided a large scaled survey is adopted, further research would take more strong reliabilities and validities. In addition, because this study was more focused on analyzing stake holders' experience, it could not provide various solutions to problems found. Therefore, in following studies, creating solutions with solid evidence is needed in order to improve quality of 119EMS.

Keywords: Emergency Medical Service, Stakeholders, Service Experience

Session-16-#321-5(GS2 & SS19)

## Innovation and tradition-based firms: the case of "La Torrente"

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### Abstract

**Purpose/ Research Question**: Until recently, innovation studies have focused on radical, technologybased innovations in large firms, above all multinationals, whilst innovation patterns in family businesses have not been deeply studied. However, over the past years, some scholars have concentrated on innovation strategies with specific reference to family businesses (Terziovski, 2010; Rosenbusch et al., 2011). In contrast with conventional thinking based on the assumption that knowledge from the past can cause path dependence, inflexibility and conservatism (Leonard-Barton, 1992), several scholars have started to recognize the potential advantages of searching in the past to develop innovative products (Messeni Petruzzelli and Savino, 2014; Nerkar, 2003).

Consistent with this research stream, the aim this paper tries to achieve is to understand how family businesses characterized by long-lasting traditions can implement innovative products, remaining anchored to past.

This issue is notably evident in food industry, where family businesses are facing several changes that affect the way in which business is done: risk perception is growing international competition is always more dominated by cutthroat rules the boundaries among sectors are becoming blurred, leading to a kind of "industry convergence".

Key Literature Reviews (About 3~5 papers): In light of these global and structural changes, the adoption of an effective innovation system seems to be crucial for food family businesses. These ones should implement innovative strategies combined with "secret" recipes related to the firm's tradition and to that of their territory.

Basically, knowledge pertaining to the past is increasingly recognized as a powerful and unique source of innovation (Messeni Petruzzelli & Albino, 2012). Consequently, firms need to develop capabilities to





interiorize and reinterpret past knowledge to innovate. Specifically, we argue that long-lasting family businesses benefit from their past knowledge and the success of these firms depends on their ability to leverage tradition to create innovative products.

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**Design/ Methodology/ Approach**: Adopting a qualitative research methodology, mainly focused on a case study, this paper tries to cover some unexplored points concerned to the possibility of combining tradition and innovation to gain success in the high-competitive international arena food family businesses are forced to face with. We analyse the case of "La Torrente", that is an international recognized Italian firm operating in the food industry. "La Torrente" on one hand is characterized by a highly innovative business approach; on the other has long-lasting tradition and a strong connection to the territory of reference.

(Expected) Findings/Results: "La Torrente" has a winning formula, based on an integration of tradition and innovation in products and processes. Its efforts to innovate are related to both the large variety of products and the growing attention to the quality aspect.

**Research limitations**/ **Implications**: this study has some limitations due to the applied methodology. In particular, we choose to adopt a qualitative method of a single case study.

The implications are both theoretical and managerial. From a theoretical perspective, there emerges the need to deeply study the formalization of an effective blend of tradition and innovation, above all in family businesses. As for the practical implications, the case study "La Torrente" constitutes a best practice, especially for family businesses with a long-standing history and a strong connection to the territory.

Further developments of this research will concentrate on other representative case studies in the food sector.

Keywords: tradition, innovation, food industry

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Session-16-#321-5(GS2 & SS19)

### Innovating and Inventing for Sustainable Cities: a Tale of Three Incongruities

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#### Abstract

Global population growth and urbanization continue apace, making cities ever more important to humanity. But most cities are not environmentally, economically, socially, or fiscally sustainable and are unable to secure the investment financing needed for multi-dimensional sustainability. At their root these problems proceed from the misapplication of Cartesian reductionist approaches to complex dynamic city-systems. A new framework is needed for integrated, collaborative, systemically effective investment essential to city sustainability; this paper introduces an initiative to provide that framework, now under way in partnership with the cities of London and Boston. This is a unique opportunity for the System Dynamics field, one that requires large-scale socio-economic innovation as well as a host of new technological inventions that will reshape and automate the practice.

Keywords: Sustainability, Cities, Urban Dynamics, Innovation, Invention, System Dynamics

### **Disclaimer:**

This paper has been previously presented at the 2016 Conference of the System Dynamics Society in Delft (see: <u>http://www.systemdynamics.org/conferences/2016/proceed/papers/P1369.pdf</u>).





Session-16-#321-5(GS2 & SS19)

# A Study on Establishing Economic Activation Strategy Based upon Inter-Industry Network Analysis: The Case of Korea

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### Abstract

**Purpose/ Research Question**: The governments strategically foster specific industries for the revitalization of the national economy as a whole. Then, which industry should be fostered first? To find the answer, it is important to analyze the ripple effects across industries. In general, the inter-industry ripple effect can be identified through the input-output table. However, the input-output tables do not provide information on networks among sub-industries. In addition, there is a possibility that it cannot represent the whole by sample survey of some companies. In this study, we analyzed the effect of inter-industry ripple effect by analyzing the transaction network between firms. In addition, through the analysis of the inter-industry network, we suggested a method to find the industry sector that should be fostered first for economy activation.

Key Literature Reviews (About 3~5 papers): Previous studies on inter-industry networks have been conducted on the basis of input-output tables. These studies consist of research on the structure of the inter-industry network itself and the effects of the network structure on the economy as a whole. James McNerney et al. analyzed the topology, flow size distribution, and community structures of each country's inter-industry networks using 1997 input-output tables of 20 OECD countries. Florian Blochl et al. reported that the impact of economic shocks on each industry can be understood, through centrality analysis in an inter-industry network. Random walk centrality represents the industry that receives the

most immediate impact. Also, in the industries with high counting betweenness, shocks last the longest. Maria Semitieal-Garcia and colleagues analyzed the Spanish input-output table and reported that interindustry networks are characteristic of scale-free networks. Therefore, it is reported that more efficient diffusion can be achieved when innovation is spread from hub industries in the networks.

**Design/ Methodology/ Approach**: In this study, transaction data of over 40,000 major Korean companies are used as basic data. This data was grouped into the industry level to which the company belongs and converted into an inter-industry trading network. The inter-industry network was compared with the input-output table published by the Bank of Korea. We conducted basic network analysis on the inter-industry trade network and analyzed the key industries. This is compared with the results of the agent-based simulation and we suggested the method of choosing the industrial field to be fostered first for the economic activation.

(Expected) Findings/Results: In the inter-industry network, the out-degree transaction value of each industry was compared with the total sales by industry in the business management analysis of the Bank of Korea. As a result, the out-degree values averagely covered about 50% of the total sales by each industry. There was also a high correlation coefficient of 0.967 (p < 0.001) between the two. In addition, the inter-industry transactions data in the network were compared with the input-output table of Korea. As a result, there was a correlation coefficient of 0.57 (p < 0.001) between the two. The industrial network also shows a more detailed industry-level trade relationship than the input-output table or the business management analysis data. Therefore, we considered that the use of the inter-industry network data was very appropriate.

The inter-industry network consisted of 35,388 links between 586 nodes (industries). In addition, the average path length is 2.019 and the cluster coefficient is 0.654, indicating that industries are closely connected. It has an almost completely connected network characteristic clustered around multiple hub industries.

As a result of analyzing the inter-industry network, it was found that the hub industries, which affect a strong and direct effect on the surrounding industries, were machinery manufacturing, synthetic resin manufacturing, and construction business, besides transportation service, wholesale and retail business. In addition to public and private demand, automobile manufacturing, mobile phone manufacturing, and construction are playing an important role as demand industries. As an intermediary between industries, it has been found that there are industries such as construction industry, publishing industry, transportation industry, service industry, electricity supply industry, and real estate industry besides wholesale and retail industry. In the manufacturing industry, machinery, chemicals, and parts and materials industries showed greater control over the flow of goods.

On the other hand, transportation, wholesale and retail, and construction industries with high closeness centrality are expected to have the fastest ripple effect in all industries. Among the manufacturing industries, the impact of the manufacturing of machinery, chemicals, and metal products is expected to be largest. Therefore, in order to activate the whole industry with limited resources, it is expected that priority should be given to the machinery, chemical and metal manufacturing industries in terms of diffusion efficiency. This is similar to the result of the actual agent based simulation.

Research limitations/ Implications: The inter-company transaction data, which is the basic source of





this study, is advantageous in that it uses data from a large number of companies. However, it is difficult to secure accurate information on the sale of private consumers and overseas sales to all companies. In addition, in this study, the industry level studied was divided in detail in the manufacturing sector in which many companies participated, but other industries were tied at the middle level. A careful approach is needed because the results may vary somewhat depending on the level of industry involved. **Keywords**: Inter-industry network, Input-output table, Network analysis

Session-16-#321-5(GS2 & SS19)

## Analysis of Research Trends of the Cathode Materials for Lithium-Ion Batteries

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#### Abstract

In this study, the research trends of anode materials for lithium-ion secondary batteries were investigated. To measure the citation impact of papers, the papers with the highest impact were selected by calculating their pageranks. Then, a citation tree related to the most impact paper was created and the papers included in this citation tree were reviewed. As a result, it was found that studies on anode materials were conducted using Sn at first, and then Si and graphene were used as major anode materials. This was a result of active research to enhance the energy capacity of mid- to large-sized secondary batteries which are used in environment-friendly vehicles and other applications. Graphenes of heterogeneous elements, metals or metal compound nano particles synthesized on the surface of graphenes, and wrapping of nano particles with graphenes were researched actively in studies of anode materials for secondary batteries. This study has significance in that scientometric analysis methods such as network analysis were used to examine specific research trends in core research areas including as anode materials for secondary batteries.

### Purpose/ Research Question:

The purpose of this study is to analyze the trends of the lithium-ion batteries by analyzing the technology activity based on the papers

### Key Literature Reviews (About 3~5 papers):

- [1] Jae Yun Lee (2011a). A Study on Document Citation Indicators Based on Citation Network Analysis, Journal of Korean Society for Library and Information Science, 45(2), 119-143.
- [2] Jae Yun Lee (2011b). Improved methods for assessing single paper's citation impact, Collected Papers from the 18th Conference of the Society for Library and Information Science, 29-34.
- [3] Page, L., Brin, S., Motwani, R., & Winograd, T. (1999). The PageRank citation ranking: Bringing order to the Web. Technical Report. Stanford InfoLab. Retrieved from http://ilpubs.stanford.edu:8090/422/
- [4] Langville, A. N., & Meyer, C. D. (2006). Google's PageRank and Beyond: The Science of Search Engine Rankings. Princeton University Press.





[5] Chang, Kun; Chen, Weixiang (2011) Single-layer MoS2/graphene dispersed in amorphous carbon: towards high electrochemical performances in rechargeable lithium ion batteries, Journal of Materials Chemistry, 21(43):17175-17184

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[6] Xiong, Qin-qin; Tu, Jiang-ping; Lu, Yi (2012) Three-dimensional porous nano-Ni/Fe3O4 composite film: enhanced electrochemical performance for lithium-ion batteries, Journal of Materials Chemistry, 22(35):18639-18645

### Design/ Methodology/ Approach:

In this study, 11,191 papers on secondary batteries published in academic journals between 2000 and 2012 were searched and analyzed using keywords related to lithium-ion secondary batteries.

To measure the citation impact of papers in the citation network of the papers, pageranks were calculated, which is a global network analysis method. The pagerank calculation formula was developed to measure the importance of web sites and the calculation formula for PageRank(W(di)) is as follows: W(di)=  $(1-d)/n \times d \times \sum i(W(dj))/(CO(dj))$  (1)

where d denotes damping factor, which is the probability for clicking another link to search the Web because the user is not satisfied with the given information. Furthermore, to calculate the PageRank value W(di) of each paper, the weight of each paper in the previous step must be sent to the citing paper in the present step through repeated calculations, and the initial weight for repeated calculation was set to 1/n for every paper. The weight of a paper with no citation was distributed evenly to all the n papers. Calculation was stopped if the variation of weights converges to below a certain value through the repeated calculations. The mutual links between papers were removed in advance so that the PageRank values would converge to an appropriate value through repeated calculations.

### (Expected) Findings/Results:

Papers with the highest citation impact in secondary batteries area were found using pagerank analysis, and the research trends of anode materials for secondary batteries were analyzed through the citation tree of these papers. As a result, the paper that had the greatest impact on follow-up studies in the entire papers related to secondary batteries was 'Small particle size multiphase Lithium-alloy anodes for lithium-ion-batteries' published by the Technical University of Graz in Austria, which had 136-fold greater influence compared to the average paper. This paper evaluated the electrochemical characteristics of the anode material for secondary batteries that they produced by electroplating Sn. These research trends suggest that the development of anode materials is focused on increasing the energy capacity of mid- to large-sized secondary batteries that are being applied to environment-friendly vehicles.

This study has significance in that to investigate the research trends of anode materials for secondary batteries, the paper with the highest impact was found by using a quantitative information analysis method, and the papers citing this paper were generally reviewed to analyze the research trends on core subjects.

### **Research limitations/ Implications:**

This study has limitations in that it reviewed papers citing one paper with the highest impact and investigated only one research trend among many studies. Furthermore, as review papers were included as well as research papers in the citation relations, there is a limitation in understanding the accurate research trend. Therefore, in future studies, the research trends need to be investigated with multiple papers with high influence and review papers should be excluded from the paper data analysis.

Keywords: secondary battery, anode materials, pagerank, citation tree





Session-16-#321-5(GS2 & SS19)

### A Study on New Approach for the S&T Intelligence Service

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### Abstract

National R&D policies are needed for domination on S&T Intelligence related value-added industries and to catch up AI global technology competition for the 4th Industrial Revolution. World economy have a face with the rapid expansion of global competition. Technology Intelligence, Market Intelligence, and Competitor Intelligence are very important of the large-scale investment on R&D System of US, EU, Japan and China. Korea is absence of systematic national support systems, low investment results in lack of competitiveness and commercial innovation. The 4th Industrial Revolution is looking for breakthrough to overcome current computing limit, but Korea lacks of preparation, may fail for firstmover technology acquisition and the technology development strategy. I want to be studying Technology Intelligence, Market Intelligence, and Competitor Intelligence for the 4th Industrial Revolution.







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## June 17(Saturday)

# Session-17-#301-1(SS11 & SS13)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 08:00~09:30)

### "Creativity, Public Service Motivation, and Innovation Diffusion at Comparative Perspective"

- Chairs: KwangHo Jung (Seoul National University, Korea), Seung-Hee Lee(Southern Illinois University, USA)
- Honor Discusser: Deborah Dougherty
- Paper 1: "Public Service Motivation and Creativity" by Jane Workman, Kwangho Jung & Seung-Hee Lee
- Paper 2: "Behavioral Model of Innovation Adoption: Comparing Chinese and U.S. College Students" by Seung-Hee Lee, Jane Workman & Kwangho Jung
- Paper 3: "The Civil Servant Pension Reform in South Korea as Social Innovation: Using Advocacy Coalition Framework (ACF)" by Keunyoung Lee & Kwangho Jung
- Paper 4: "Sustainable predictive-analytics driven knowledge management in university teaching to improve students' learning experience and performance" by John Yi

### Session-17-#303-1(SS10 & SS27)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 08:00~09:30)

### "Open innovation for industrial ecosystems"

- Chairs: Jinxi Wu, Lei Shi(Tsinghua University, China)
- Honor Discusser: Uwe Cantner
- Paper 1: "Innovation ecosystem of CNG vehicle: a case from Sichuan Province in China" by
   DING Ling, WU Jin-xi & DUAN Ming-ying
- Paper 2: "Impacts of Potential Climate Change and Human Deforestation on Temperate Forest Carbon Pool in the Capital Area of South Korea" by **Sun-Soon Kwon & Sang-Don Lee**
- Paper 3: "A study of wintering habitat use pattern of red-crowned cranes in Demilitarized Zone in Korea" by Sangdon Lee & Hiroyoshi Higuchi
- Paper 4: "Technology commercialization of new knowledge from university-industry collaborations: focus on patent propensity" by Junghee Han
- •Paper 5: "The Construction of technology innovation ecosystem of Chinese manufacturing enterprises: A case study of the Nanjing panda LCD Technology Co., Ltd" by Lei MA & Jingxian GAN







### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 17(Saturday)

# Session-17-#321-1(SS21 & SS30)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 08:00~09:30)

"Technology and Innovation Driven Industrial Development and Business Economics"

- Chair: Min-Ren Yan(Chinese Culture University, Taiwan)
- Honor Discusser: Giovanni Schiuma
- Paper 1: "Simulation-based System Dynamics Decision Support System for Innovation-driven Business Development and Economical Evaluations" by Min-Ren Yan
- Paper 2: "Strategic Modelling for Improving Open Systems Innovations and International Supply Chain Collaborations in Multinational Enterprises" by Min-Ren Yan & Ling-Wei Jen
- Paper 3: "Nation-wide Eco-System of Academia-Industry Collaborations for Technological Innovations and Industrial Economics: A Case Study of Science Parks" by Min-Ren Yan, Kuo-Ming Chien & Wen-Lin Cho
- Paper 4: "A study on the factors influencing academics' knowledge-transfer activities: The case
   of South Korea" by Ki-Seok Kwon

### **Public Service Motivation and Creativity**

Jane Workman (Southern Illinois University)

**Kwangho Jung** (Seoul National University)

Seung-Hee Lee (Southern Illinois University)

#### Abstract

Research Question: Little Empirical research has explored various relationships between creativity and public service motivation(PSM). Most previous research has discussed how economic incentives promote creativity. Recent research in organizational behavior has addressed significant relationships between creativity and innovation(Amabile, 1988; 1997; Rank et al, 2004) without clarifying what motivations can facilitate creative and innovative attitudes. In addition, previous studies have mainly focused on a relationship between ethics and entrepreneurship associated with creativity without identifying what kind of ethics involves in increasing(or decreasing) innovative and creative attitudes(Bacu, 1998; Berman & West, 1998; Bernier & Hafsi, 2007; DeLeon, 1996). There are, however, significant relationships between creativity and non-economic incentives. This study focuses on how public mind influences creativity. More specifically, this study explores how PSM can be related to creativity function. This study argues that creativity can be affected by various types of public motivations including attraction to public policy making, sympathy, public interest, social justice, and sacrifice. These sub-factors in public service motivation involve the propensity of risk-taking to serve common problems and public issues. Those with a higher level of PSM are likely to search diverse intricate issues, social dilemmas, and economic crises. Such efforts to explore appropriate solutions to these problems can induce creativity. In addition, those with a higher level of PSM are likely to promote creative attitude and ideas through cooperation and self-sacrifice (Alves et al., 2007; Bardach, 2001; Perry-Smith & Shalley, 2003).

**Research Background:** Global economy and environment have increasingly requested creative mind and policy strategy for public organizations (Mazzucato, 2011; Nijkamp, 2003; Weerawardena, 2006). However, little empirical research has explored how public institutions can promote creative mind and environment for public employees. This study suggests that PSM can positively facilitate creative process and products for public employees surrounded huge bureaucratic constraint and burden. Since the last decade, the conceptual instrument of PSM originally developed by James Perry(1996) have been applied to various research areas including public performance, ethical activity, and job satisfaction. There are, however, many neglected areas strongly associated with public service motivation. For





instance, PSM may influence innovation process and creativity function through various mediate mechanisms including intrinsic incentives and creative attitudes. In addition, PSM is expected to demolish various bureaucratic barriers to constraining creativity in public organizations(Borins, 2000; Chen & Huang, 2010; Kim, 2010). Little empirical research has discussed a relationship between innovation and PSM and a relationship between PSM and creativity.

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**Research Method:** Based on survey data from employees in public sector of South Korea, this study empirically tests whether or not the sub-elements of PSN are associated with creativity after controlling for various socioeconomic factors including job position and experience, education, income, age and gender. Creativity is measured by several dimensions including creative attitude and personality and the concept of PSM consist of 15 items from public participation, to altruism, to self-sacrifice, and to public interest.

**Expected Research Findings:** It is expected that public interest, empathy, altruism and attraction to policy making are likely to be positively associated with the level of creativity. These sub-elements of PSM are expected to positively related to attitudes such as intrinsic incentives(Dewett, 2007), risk-taking, imagination, flexibility, and non-conformity. All these findings come from multiple regression analyses, after controlling for socio-economic variables including age, gender, education, and income.

**Keywords:** Public Service Motivation, Bureaucratic Pathology, Creativity, Intrinsic incentives, Risktaking, Imagination, Flexibility, and Non-conformity

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# Behavioral Model of Innovation Adoption: Comparing Chinese and U.S. College Students

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### Abstract

The diffusion of innovation is a function of various factors including individual characteristics, organizational and institutional factors, and culture. Various research has explored how these factors are associated with the diffusion of innovation. However, little empirical research has discussed how creativity is associated with the diffusion of innovation. Further, little research has tested whether or not individuals with a higher level of creativity can be more or less related to the early adopters or later adopters. There are two possible arguments regarding this hypothesis. One is that individuals with a highly creative mind are more likely to be early adopters; the other is that individuals with a highly creative mind are less likely to be early adopters. Different culture has a different mechanism regarding a relationship between creativity and adoption behavior of innovation. These two competing hypotheses may vary from country to country. We, relying on a comparative college survey, compare how the hypotheses differ from Chinese and U.S. college students.

Keywords: Creativity, Diffusion of Innovation, Early Adopters, Later Adopters, Cultural Context

## The Civil Servant Pension Reform in South Korea as Social Innovation: Using Advocacy Coalition Framework (ACF)

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Kwangho Jung (Seoul National University)

#### Abstract

This study aims to analyze the policy-making process of the 2015 South Korea's civil servant pension reform act by using the Advocacy Coalition Framework model designed by Sabatier and Jenkins-Smith. The study will focus on South Korea's civil servant pension reform act that occurred in the end of May, 2015. The temporal scope covers from 2009 latest reform, and the 2014's President administrative policy speech that had strongly been showed her will to reform the pension issue to the end of May, 2015 when the reform bill enacted. The study investigates each advocacy coalition in order to elucidate the actors that constitute the two coalition groups, and to scrutinize whether a policy broker had been existed in the process. The paper also tries to find the relatively stable parameters and external events that affected the reform and also the belief system that shared by two advocacy coalition group. The result clearly shows that the two coalition group shared their normative beliefs ultimately for example, the need to change the current civil servant's pension system, but, the gap in the numerical change in the policy core belief and secondary belief between the two actors had seemed to be excessively large and uncompromising. It led the policy formation to follow the advocacy coalition of opposition (The Civil Servants'). However, due to the adjustment by the policy brokers, the reform bill dramatically has been realized in the end of May, 2015. The paper concludes that in order to conduct and adjust the conflict between the advocacy coalition groups, the existence of policy broker can play major role to produce the successful policy outcome.

Key words: Civil Servant's Pension Reform Bill & Act, Advocacy Coalition Framework, Policy Innovation





# Sustainable predictive-analytics driven knowledge management in university teaching to improve students' learning experience and performance

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### **EXTENDED ABSTRACT**

### Purpose & Research Question:

The bulk of the responsibility of students' performance falls on to the students themselves, for they ultimately have to effectively manage their time and motivate themselves to develop their competency in the subject. However, knowing that students' personality factors can play important role in achieving their goals, if the instructing professor can predict students' performance early on in the semester based on the students' personality related to the class learning environment and sustain such knowledge over time, there is a significant opportunity for the professors to control the environment to obtain optimal effort and performance out of the students, resulting in students earning higher class grade than they would normally earn.

With the emergence of predictive analytics in the last decade, there exists a strong demand of its applications in wide areas to provide stakeholders at various organizational levels with valuable information to enhance their decision-making. One of the areas of tremendous opportunities for predictive analytics lies in higher education and how universities can leverage student and educational data to extract insights to benefit students, faculty, and administrators alike. These techniques also provide ability to predict the future outcomes based on set of assumptions as long as robust training data set is available to develop a predictive model. Furthermore, these techniques can map input (independent) variables to target (dependent) variable to understand which input variables are significant to the target variable, compare the several predictive models to determine the best model for the given data, and find value-adding associations between the inputs and target to manage the knowledge to sustain optimal student performance over the entire college curriculum.

In this research, we aim to answer if it is possible to use the predictive analytics to predict students' semester grade in the first week of the semester using their non-cognitive factors. Once determine the feasibility, the result is to utilize to enhance students' class experience and performance throughout the semester, and measure how much of an improvement this predictive application can make.

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### **Key Literature Review:**

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### Methodology:

Experiment versus control group are selected to conduct this research based on non-cognitive factors collected via survey from the students in the experiment group. These students' data are collected and analyzed, to provide insights in enhancing learning environment and improve students' class performance.

SAS Enterprise Miner will be used for the data mining and predictive analytics analysis. After identifying variables significant non-cognitive factors for students, and test for skewness of greater than +1 or less than -1. Upon identification of skewness, the log transformation will be applied to offset the skewness in the transform variable step. Then, the 70% of the data set will be partitioned to be used to train the predictive models with other 30% held out for the purpose of validating the model; this step takes place in the data partition step.

Predictive analytics techniques in decision tree, neutral network and various regressions will be developed for the data. This step will followed by comparing the models based on the average squared error (ASE) of the validation data's known target values to the predicted values, which is a measure of the model's predictive accuracy and performance. Finally, the model with the lowest ASE will be selected and its results analyzed. Once the reliable model is found, then the model will be used to predict the final semester grade for new students' taking the class and the associations between the inputs and target are analyzed. The insights from these models will be managed to provide sustainable insights to optimize the learning environment and resources for the students.

### **Expected Result:**

Based on preliminary research result, the performance of our methodology is very impressive with about 10% improvement in students' performance from experiment versus the control group. There are more specific factors more significant than others in enhancing students' performance, but will need further time to analyze the work and validate the finding for this research paper. Overall, the result is powerful approach to utilize predictive-analytics to managing student-performance knowledge in university teaching to improve students' learning experience and their performance.





### **Limitations & Implications:**

One of the limitations of this study is that the total sample of students' performances are all from a business quantitative class offered from a single university and taught by a single faculty. Therefore, results may not be generalized to other courses and other universities with different student makeup; however, this study provides framework for other researchers interested in developing similar predictive models for their courses in their universities.

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For the future direction of the research, the increasing use of predictive model and improve accuracy can lead to increase in knowledge management activities. Over time, the research framework can transform the way universities teach and develop our students.

### Keywords:

Knowledge Management, Sustainability in Education, Analytical Modeling

**Paper type:** Academic Research Paper

Session-17-#303-1(SS10 & SS27)

### Innovation ecosystem of CNG vehicle: a case from Sichuan Province in China

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#### Abstract

**Purpose/Research Question**: The dynamic innovation ecosystem provides the enterprise with the most competitive advantage of innovation environment. Sichuan Province in China, as one region of the earliest technology development of Compressed Natural Gas (CNG) station and CNG vehicle, had sustainably developed the innovation ecosystem of CNG vehicle over the past more than and 20 years. It relied on the advantages of the local conditions richly endowed by its resources. From the perspectives of energy security and emission reduction, the development of CNG vehicle has received extensive attention in academic circles. Many countries in the world are in the development of natural gas vehicle. In recent years, Chinese also began to accelerate the development of natural gas vehicle. This study takes the CNG vehicle innovation ecosystem in Sichuan Province, China as the research object. It studies the cultivation path and the characteristics of CNG vehicle innovation ecosystem in Sichuan CNG vehicle. The scenarios are the baseline, energy-saving, emission reduction and comprehensive ones. This study used elastic coefficient method to predict the market demand, and modified the elastic coefficients according to the different scenarios.

Key Literature Reviews (About 3~5 papers): The scholars understood the concept of innovation ecosystem (IE) step by step. Adner (2006) regarded IE as a multiple enterprises' cooperation on various products, with the purpose to better cope with customer's requests. In 2010, Adner and Kapoor further reveals that IE not only includes the innovation activities of the core firm, but also the innovation activities of its upstream suppliers, its downstream customers and complementors. Therefore, IE is an intra-complementary network of all the aforementioned players, with a shared objective to provide valuable products and services for their customers. Zahra and Nambisan (2011) framed IE as a loose





network, in which every enterprise coordinates on innovation and/or innovation platform, yet being dependable on each other for the ultimate benefits and survivals.

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From academic research perspective, scholars have carried out series of research on innovation ecosystem. For example, according to Rohrbeck et al. (2009), IE is composed of three subsystems, namely research subsystem, development subsystem, and application subsystem. The enterprises span the boundary of traditional research and development between organizations, to obtain the external knowledge resources to improve the innovation competence (Rohrbeck et al., 2009). Scholars also examined what are the influential factors in building and maintaining the health of IE. Arimoto and Levien (2004) argued that along with the investment on manpower and finance, the knowledge creation and the long-term basic research were acting as the investment on innovation in a healthy IE. The regional cluster will create new product or service, and increase enterprise profit and social welfare, through collaboration between university and industry. In an industry with frequent and rapid changes, enterprises need to be highly cooperative to cope with the continuously changing market expectations.

**Design/ Methodology/ Approach**: First of all, through literature research and expert interview, this paper reviewed the historical context of the development of Sichuan CNG innovation ecosystem, in order to reveal the cultivation path of innovation ecosystem. Secondly, according to the cultivation path, this research summarized the characteristics of Sichuan CNG vehicle innovation ecosystem. As to innovation ecosystem from the ecology metaphor, the characteristics includes the ability to integrate environment, ability to add value, health, life cycle (Wu 2015). Thirdly, it focused on the market demand of Sichuan CNG vehicle for scenario prediction. The market demand potential of CNG vehicle is the driving force of its innovative ecosystem.

Consumers have a wide selection of alternative technology trajectories of vehicle products. This research comparatively analyzed the development potentials of the alternative technology trajectories of vehicle products based on the expert interviews and data calculations for Sichuan province. The analysis showed that to continue to develop the innovation ecosystem of CNG vehicles has a great potential in the future of Sichuan province, China.

In order to predict the future market demand of Sichuan CNG vehicle, this research defined four scenarios of the future development based on the foregoing innovation ecosystem characteristics of Sichuan CNG vehicle. They were the baseline, energy-saving, emission reduction and comprehensive scenarios. Based on the elastic coefficient method of Guan and Kang (1996), this study revised the market demand prediction method, and gave the prediction formulas of Sichuan CNG vehicle.

**(Expected)** Findings/Results: This paper has important reference to the innovation ecosystem development of CNG vehicle for the regions with the resource advantages. It makes the regions maintain energy security and emission reduction. The theoretical contributions are as follows:

Firstly, through the review of the historical context of the development of Sichuan CNG innovation ecosystem, this paper revealed the cultivation path of innovation ecosystem. The path may be divided into three stages, i.e. innovation of product and complementary product, industrial innovation, ecosystem. In the three stage, the enterprise and the government performed their respective duties, to achieve innovation and consistent pace. There are big gaps of technology, talent, institution and culture between Chinese company and the government. Companies and the government need to achieve collaborative

innovation mechanism according to the stage of development of innovation ecosystem.

Secondly, the study found that the characteristics of innovation ecosystem in essence is to create the "ecological environment" to connect enterprise technology improvement, complementary goods resources supply, market demand, and government strategy and policy in the process of industrialization and technological achievements. This ecological environment will help to promote the continuous improvement of product innovation system and the network system of complementary products. If there is the lack of this dynamic environment, the innovation of the train will fall to the "death valley".

Thirdly, the study predicted the scenario developments of innovation ecosystem of Sichuan CNG vehicle. The development potentials of Sichuan different technical trajectories of the vehicle were compared based on the current characteristics and technology of innovation ecosystem of Sichuan CNG vehicle. It modified the elastic coefficients according to the trend of slowing down of the regional economic growth rate. On these grounds, it predicted the vehicle ownership, and production and sales of Sichuan CNG vehicle according to the formulas and the baseline, energy-saving, emission reduction and comprehensive scenarios.

**Research limitations/ Implications**: Any innovation policy needs to suit local conditions. In the resource and environmental constraints, China is imminent to build a new industrial system with the ecological characteristics (Feng, 2008). With the rich natural gas, low price, transportation layout of gas pipeline, Sichuan is dense in the natural resources advantage for the development of CNG vehicle. It is hopeful for Sichuan CNG vehicle to realize corner overtaking in the development of innovation ecosystem is rooted in the local situation, there is no innovation ecosystem vacuum. Policy recommendations are mainly included in two aspects:

(1) It requires strict implementation of fuel consumption policy, so as to force the fuel vehicle companies to develop CNG vehicle in the local market. As the previous analysis on different technical trajectories, the development potential of fuel vehicles is minimal. In the future under the extrusion of saving oil policies, the enterprises of traditional fuel vehicles has no way to go. According to Chinese government' requirements, all of passenger cars averagely consumes fuel from the 6.9L/100km of 2015 to 5.0L/100km by 2020. Therefore, the development of CNG vehicle is a feasible path for the enterprises to rely on the resource advantage of Sichuan.

(2) It needs large scale promotion of CNG vehicle engine, and reduction of the content of sulfur in CNG. As previously defined the scenarios, there are a large potential in energy saving and emission reduction for Sichuan CNG vehicle. At present, Sichuan is promoting the technology of CNG tank for CNG vehicle. There is no large-scale promotion of special engine of CNG vehicle. The special engine will enhance the full combustion and dynamic performance for CNG vehicle. Moreover, the sulfides from CNG have a corrosive effect on CNG vehicle engine at present. They will improve the maintenance cost and reduce the service life of the vehicle.

Keywords: innovation ecosystem; CNG vehicle; cultivation path; scenario prediction





Session-17-#303-1(SS10 & SS27)

# Impacts of Potential Climate Change and Human Deforestation on Temperate Forest Carbon Pool in the Capital Area of South Korea

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### Abstract

This study estimates the impact of potential climate change and human interference (anthropogenic deforestation) on the temperate forest carbon pool change in the capital area of South Korea, using a dynamic global vegetation model (DGVM). Also, the characteristic of forest carbon pool change was simulated based on a biogeochemical module. The change of atmospheric carbon dioxide (CO<sub>2</sub>) concentration is deeply related with the change of forest carbon pool which is estimated with those of net primary productivity (NPP) and soil carbon storage (SCS). The NPP and SCS were estimated at 2.02-7.43 tC ha<sup>-1</sup> yr<sup>-1</sup> and 34.55-84.81 tC ha<sup>-1</sup>, respectively, during 1971-2000. The SCS showed a significant decreasing tendency under the condition of increasing air temperature and precipitation in near future (2021-2050) and far future (2071-2100) which were simulated by a future-climate scenario data without any human interference. Besides, it is estimated that the temporal change of NPP indicates only a little decrease, which is a little influenced by potential climate change.

In the effect of potential climate change plus human interference, the decrease rate of NPP and SCS were simulated at 17-33% and 21-46%, respectively, during 2000-2100. Furthermore, the effect of potential human interference contributes to 83-93% and 61-54% of the decrease rate of NPP and SCS, respectively. The decline of forest carbon pool simulated in this study can play a positive role in the increasing atmospheric carbon dioxide. Consequently, the effect of potential human interference can further accelerate the decline of temperate forest carbon pool. For the effective reduction of carbon dioxide emission in urbanizing areas, it would be more effective to control human interference. Consequently, this study suggests that the reforestation corresponding to deforestation rate should be at least maintained with long term monitoring- and modeling-related studies against climate change problems.

**Keywords**: climate change, dynamic global vegetation model, human interference, net primary productivity, soil carbon storage

SOltmC & RTU 2017

#### **INTRODUCTION**

The emission rate of greenhouse gases (GHG) by human interference is increasing since the industrial revolution (Marland et al. 1999; IPCC 2001). In addition, it is clear that the global warming is a main environmental concern because there is a strong possibility that the increasing global surface air temperature is attributed to the increase of greenhouse gases in the latter half of the twentieth century (Marland et al. 1999). Even though the global surface air temperature increased with 0.74°C during the past 100 years, the global warming is accelerated up to 1.3°C per 100 years for the recent 50 years (IPCC 2007).

In the potential adverse effect of global warming on ecosystems, there is a possibility that approximately 10-40% of animals and plants face the extinction when the global surface air temperature increases up to about 1.5-2.5°C and human interference occurs (Thomas et al. 2004; IPCC 2007; Carpenter et al. 2008). Carbon dioxide ( $CO_2$ ) is a main greenhouse gases contributing approximately 50% to climate change (Rodhe 1990). Generally there are two kinds of strategies in the reduction of  $CO_2$ ; one is the carbon source control and another is the enhancement of carbon sequestration in forest areas. Most of reduction methods focused on the carbon source control, which occurs from energy uses and industrial processes. However, there is a growing concern in the enhancement of carbon sequestration in forest areas since forest areas were counted to the carbon sequestration in Kyoto protocol. The carbon assimilation in forest areas plays an important role in not only carbon sequestration but also landscape, recreation space and terrestrial ecosystem conservation (Korea Forest Service 2009).

In this research, the variation of temperate forest carbon pool in the capital areas of South Korea is estimated with long-term simulation of Soil Carbon Storage (SCS) and Net Primary Productivity (NPP) under the condition of potential climate change and anthropogenic deforestation using a dynamic global vegetation model which includes a biogeochemical concept. Also, this research suggests a strategy as an effective enhancement of carbon sequestration in forest areas where human interference is expected.

#### MATERIALS AND METHODS

#### Study site

The study was carried out in temperate forest areas in the capital area of South Korea located in the middle of Korea peninsula and consists of Seoul Metropolitan City, Incheon City and Gyeonggi Province Fig. (1). The study area is covered with 565,024 ha forest (about 50% of the total area) which ranges within latitudinal range of 36°89'~38°29' and longitudinal range of 124°59'~127°85'. This area is the most urbanized area with approximately 23 million populations (about half of national population) in South Korea, in which human interference is strongly expected. Annual air temperature varies from 11°C to 13°C and annual mean precipitation is approximately 1,100 mm in this study area.

In this study, 4 study points (A, B, C and D) were selected to analyze locational distinction and to compare our simulation data to other study data; A point (37°45'25.37"N, 127°9'11.62"E) is KoFlux DK-site where a permanent flux tower where was installed in the Kwangneung Natural Forest (Kim et al. 2007; Lim et al. 2003), B point (37°47'1"N, 127°10'37"E) adjacent to A is located in the Korea Practice Research Center, C point (37°23'45"N, 127°5'1"E) is in the Kumto Mountain inside of Pangyo housing development area recently constructed, and D point (37°25'2"N, 127°3'22"E) is adjacent to C located in the Chunggye Mountain Fig. (1).



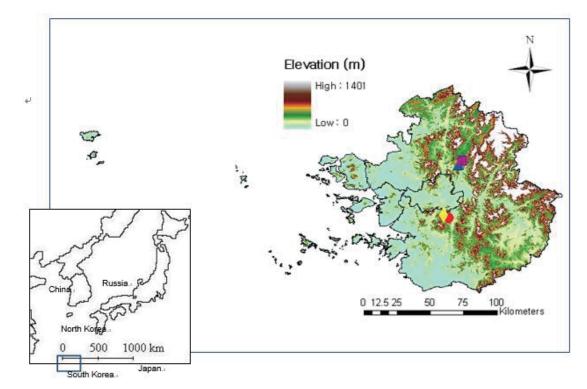


Fig. (1). Study Area : The Capital Area of South Korea. (▲ A, ■ B, ● C, ◆ D : selected points)

Dynamic global vegetation model (DGVM)

MAPSS-CENTURY (MC1) model as a new dynamic global vegetation model was used in this study, which was made to estimate the impacts of global climate change on forest ecosystem structure and function at a wide spatial range from landscape (50m) to global scales (Bachelet et al. 2001). In addition, the MC1 model can simulate the cycling of carbon, nitrogen, water, and the change of vegetation under the condition of climate change using the combination of biogeological MAPSS model and biogeochemical CENTURY model (Parton et al. 1994; Neilson 1995; Bachelet et al. 2001).

The main functions of MC1 are to (1) predict life-forms (*e.g.*, coniferous and deciduous-evergreen tree and grass species) and their biomass in different vegetation classes using a climatologic rule base, (2) simulate the dynamic of carbon, nutrient and water in aboveground and belowground ecosystems through plant production, soil organic matter decomposition and nutrient cycling (Bachelet et al. 2001; Lenihan et al. 2008). In California in the United States, there was a case study that the change of vegetation distribution, carbon dynamic and fire disturbance was simulated with local and continental scales under the condition of climate change using MC1 model (Lenihan et al. 2008).

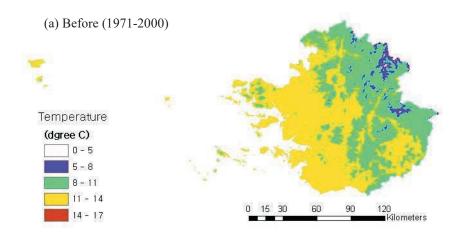
Data handling

The spatial resolution of simulation used in this study was on 0.005° (approximately 500 m) and all input data were raster dataset with 49,046 pixels, which were divided by the historical period of 30 years (1971-2000), near future (2021-2050) and far future (2071-2100). The past climate data were observed by Korea Meteorological Administration (KMA) and future predicted climate data were originated from Korea National Institute of Meteorological Research, with A1B scenario presented by IPCC.

Three categories of input data were used in the MC1 model; 1) geographic data such as elevation, 2) soil data such as soil bulk density, soil texture and rock fraction, and 3) climatic data such as monthly mean, maximum and minimum air temperature, monthly mean cumulative precipitation, humidity, wind speed and solar radiation.

The data of air temperature and precipitation were calibrated at the sea level which considered the effect of elevation of measuring point and the height of measuring equipment. The IDSW (Inverse distance squared weighting) method was applied to the calibrated climatic data except air temperature (Lee et al. 2007). The calibrated air temperature data were interpolated into the spherical semi-variogram kriging as a spatial statistic method (Park et al. 2008). The other data were rescaled to fit on 0.005° spatial resolution. All input data were prepared by Arc/Info 9.3 (Geographic Information System by ESRI).

Fig. (2) and (3) showed the regional distribution of monthly mean air temperature and monthly mean cumulative precipitation in historical period (1971-2000), near future (2021-2050), and far future (2071-2100), respectively. It was simulated that the mean air temperature and precipitation in the study area would increase by 1.4°C and 10 mm in near future and 4°C and 24 mm in far future, which was based on A1B scenario presented by IPCC Fig. (4). In addition, Figure 4 showed the change of climatic conditions in the selected four sites and capital area in this study.





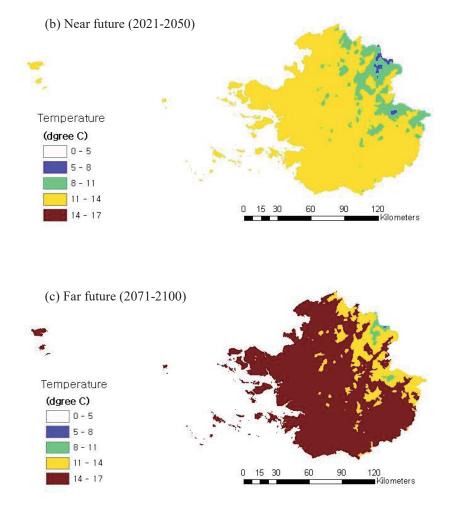
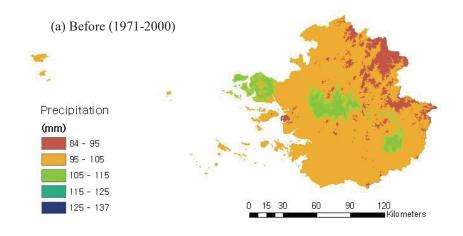


Fig. (2). Distribution of Mean Air Temperature in Capital Area.



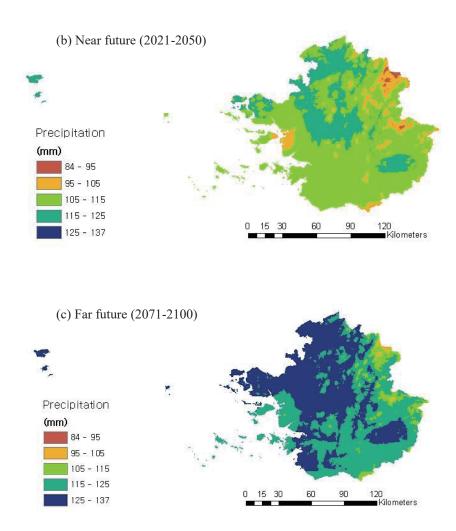
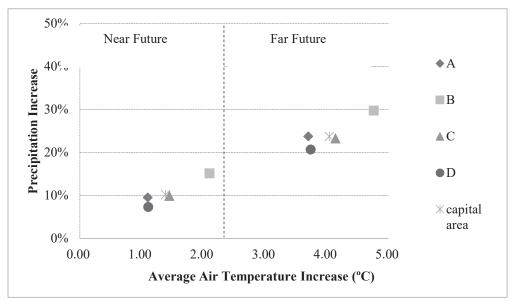


Fig. (3). Distribution of Monthly Mean Accumulative Precipitation in Capital Area.





**Fig. (4).** Change of Future Air Temperature and Precipitation Relative to Historical Period (1971-2000) Predicted by Korea National Institute of Meteorological Research with A1B Scenario Presented by IPCC. (Near future: 2021-2050, Far future: 2071-2100).

The NPP and SCS results in this study were extracted by current forest area after simulated with potential vegetation distribution and carbon dynamics which were based on the climatic change and soil conditions. Human interference (anthropogenic deforestation) data cannot be applied to the MC1 model simulation because the input data is required much more in detail. However, the forest areas in the capital area of South Korea have been reducing by 1,940 ha (average during 2003-2009) per year because of forest land use changes to fields, ranches, housing, factories, roads and golf courses (Forestry Statistical Yearbook 2004-2010). Moreover, the damaged area because of forest fire was about 16.4 ha (average during 2003-2009) per year (Forestry Statistical Yearbook 2004-2010). In this study, the change of NPP and SCS by the human interference was estimated with the decrease rate of forest areas (Forestry Statistical Yearbook 2004-2010) and the simulated NPP and SCS results by MC1 model under the condition of climate change.

### **RESULTS AND DISCUSSION**

Net primary productivity change by potential climate change

The simulated NPP are ranged from 2.02 to 7.43 tC ha<sup>-1</sup> yr<sup>-1</sup> under the historical period of 1971-2000; the average is 6.02 tC ha<sup>-1</sup> yr<sup>-1</sup> Fig. (5). In the near future simulation, NPP varies from 2.32 to 7.63 tC ha<sup>-1</sup> yr<sup>-1</sup> under the condition of potential climate change during 2021-2050; the average is 5.85 tC ha<sup>-1</sup> yr<sup>-1</sup>, which decreases by 3% compared with that of 1971-2000. In the far future simulation, NPP shows from 2.89 to 7.67 tC ha<sup>-1</sup> yr<sup>-1</sup> under the condition of potential climate change during 2071-2100; the average is 5.88 tC ha<sup>-1</sup> yr<sup>-1</sup>, which decreases by 2% compared with that of 1971-2000.

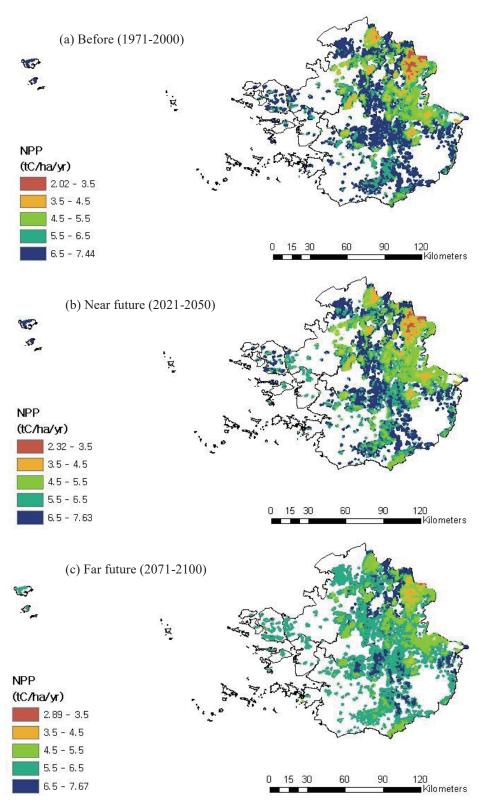
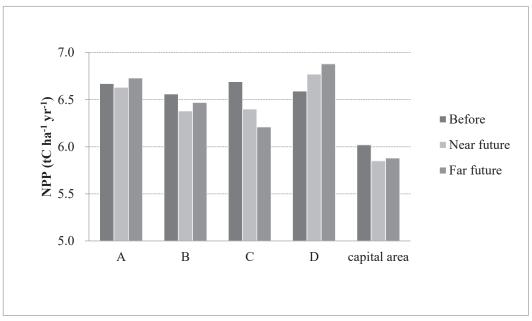


Fig. (5). The Simulation Results of Net Primary Productivity (NPP) in Capital Area.

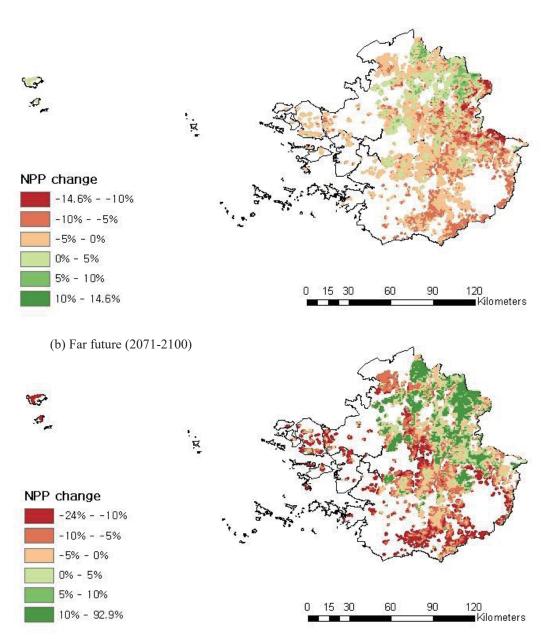


In the selected 4 simulation points, the NPP of A, B and C points indicates a decreasing tendency but not D point in near future (2021-2050) relative to past (1971-2000) Fig. (6). In the far future simulation, the NPP of A and D points increase but those of B and C points decrease. Although the NPP of C point decreases by 48%, that of D point near to the C point increases by 29%, which are located in near urbanizing area or not, respectively. In the comparison of other simulated data, the simulated NPP of temperate forest in A point during 1971-2000 was 6.67 tC ha<sup>-1</sup> yr<sup>-1</sup>, which is approximately 10% higher than 6.04 tC ha<sup>-1</sup> yr<sup>-1</sup> of NPP simulated at the same point by a Lund-Potsdam-Jena Module of Community Land Model 3.5-DGVM from Lim et al. (2010). In addition, our simulation data is similar to 6.69 tC ha<sup>-1</sup> yr<sup>-1</sup> of NPP simulated by a TEM model of Melillo et al. (1993) in temperate mixed forest.



**Fig. (6).** The Results of Net Primary Productivity (NPP) in Selected Points and Capital Area. (Before: 1971-2000, Near future: 2021-2050, Far future: 2071-2100)

In this study, the change rate of future NPP simulated is described with GIS Fig. (7). In the near future simulation, forest areas where NPP decreases are more than NPP-increased forest areas, which range from 0 to 14%. In the far future simulation, the NPP is regionally fluctuated with the increase by 93% (especially northern areas) and decrease by 24%. The forest areas where NPP decreases are mainly coastal areas or relatively low elevation forest areas. On the other hand, the relatively high elevation forest areas above 150 m indicate 4.62% increasing rate of NPP comparing far future (2071-2100) and past (1971-2000). With regard to the result, in high elevation forest areas above 200 m, the NPP increases by respective 1-3% and 6-14% during 1999-2030 and 1999-2090 which Peng et al. (2009) simulated with a climate scenario of temperature and precipitation increases and a TRIPLEX model in the northeastern China.



**Fig. (7).** Distribution of Net Primary Productivity (NPP) Change in Capital Area Relative to the Historical Period (1971-2000).

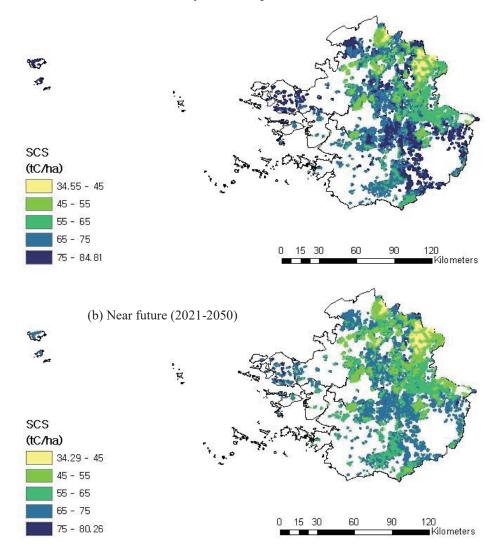
Even though the long-term simulation result of NPP is only small decrease tendency of 2-3% under the condition of potential climate change during 2000-2100, quantitatively it would be not negligible because NPP can be accumulated annually.

Soil carbon storage change by potential climate change

The simulated SCS varied from 34.55 to 84.81 tC ha<sup>-1</sup> under historical period of 1971-2000; the average is 66.84 tC ha<sup>-1</sup> Fig. (8). In the future simulation, the SCS decreases in most of forest areas, which is described with GIS Fig. (9). In the near future simulation, SCS ranges from 34.29 to 80.26 tC



ha<sup>-1</sup> under the condition of potential climate change during 2021-2050; the average is 61.37 tC ha<sup>-1</sup>, which decreases by 8% compared with that of 1971-2000. In the far future simulation, SCS indicates from 35.39 to 76.34 tC ha<sup>-1</sup> under the condition of potential climate change during 2071-2100; the average is 52.81 tC ha<sup>-1</sup>, which decreases by 21% compared with that of 1971-2000.



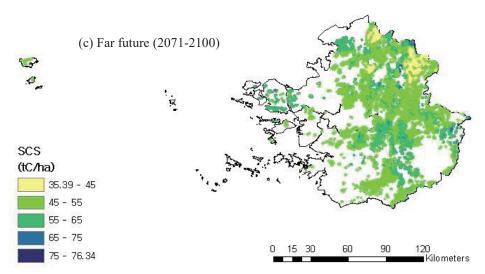
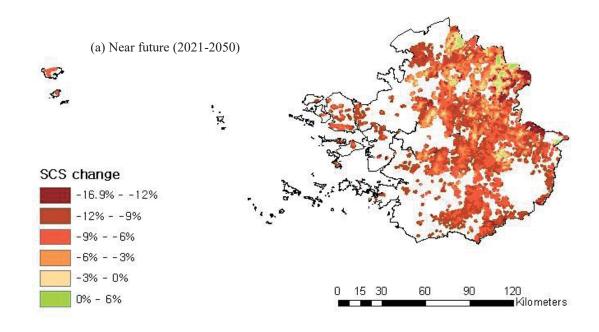
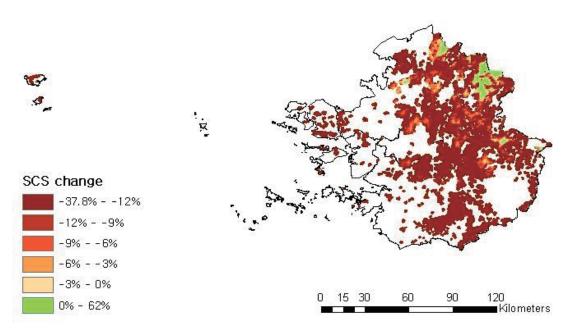


Fig. (8). The Simulation Results of Soil Carbon Storage (SCS) in Capital Area.



(b) Far future (2071-2100)



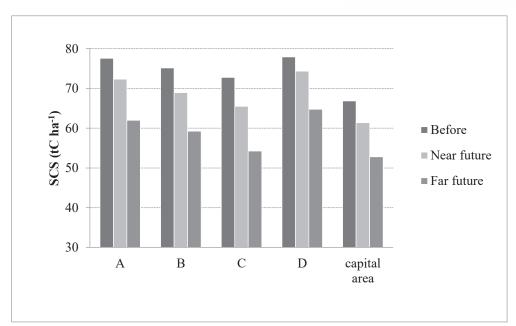


**Fig. (9)**. Distribution of Soil Carbon Storage (SCS) Change in Capital Area Relative to the Historical Period (1971-2000).

In the selected 4 simulation points, the SCS of A, B, C and D points shows a decreasing tendency during 2000-2100, which decreases by 3.58-7.29% and 13.17-18.52% in near future and far future, respectively Fig. (10). The variation is presumably derived from the distinction of soil and climate. In the comparison of other simulated data, the simulated SCS of temperate forest A point during 1971-2000 is 77.57 tC ha<sup>-1</sup>, which is approximately 5% higher than 73.8 tC ha<sup>-1</sup> of SCS simulated at the same point by a Lund-Potsdam-Jena Module of Community Land Model 3.5-DGVM from Lim et al. (2010).

Even though Davidson and Janssens (2006) reviewed that a consensus has not yet emerged on the temperature sensitivity of soil carbon decomposition, in the decrease of SCS by the climate change, many researchers have reported that the SCS decreases with the climate change (Bonan and Van Cleve 1992; Trumbore et al. 1996; Melillo et al. 2002; Neff and Hooper 2002; Peng et al. 2009; Pan et al. 2010).

Therefore, according to the long-term simulation result, SCS would be a main factor in the decline of temperate forest carbon pool, which decrease continuously and largely by 21% during 2000-2100 (quantitatively 14.03 tC ha<sup>-1</sup>).



**Fig. (10).** The Results of Soil Carbon Storage (SCS) in Selected Points and Capital Area. (Before: 1971-2000, Near future: 2021-2050, Far future: 2071-2100).

Impact of human interference on temperate forest carbon pool

This study tried to estimate how potential climate change and human interference have an influence on the change of forest carbon pool because there is not only the effect by potential climate change but also that by human interference on the change of forest carbon pool.

In the simulation results, the NPP and SCS showed small and large decreasing tendencies, respectively. However, the NPP and SCS are simulated with a significant decrease under the condition of potential climate change and human interference in the future simulation. Assuming that the forest areas decrease with current decrease rate in the future, it is simulated that the NPP and SCS decrease by 2,836 TgC yr<sup>-1</sup> (17% $\downarrow$ ) - 2,276 TgC yr<sup>-1</sup> (33% $\downarrow$ ) and 29,753 TgC (21% $\downarrow$ ) - 20,437 TgC (46% $\downarrow$ ), respectively, in temperate forest areas in the capital area of South Korea (Table 1). In addition, the effect of human interference contributes 83-93% and 61-54% to the NPP and SCS, respectively, during 2000-2100 (Table 2).

 Table 1. Calculations of forest carbon pool considering human interference.

		Before(2000)	Near future(2050)	Far future(2100)
Without Human	NPP (TgC yr <sup>-</sup> <sup>1</sup> )	3,401	3,305	3,322
interference*	SCS (TgC)	37,766	34,676	29,839
Considering Human	NPP (TgC yr <sup>-</sup> <sup>1</sup> )	3,401	2,836	2,276
Interference**	SCS (TgC)	37,766	29,753	20,437

\* Original simulation data were multiplied by 565,024 ha of forest region in capital area from



2009 Land Cover Map by Korea Ministry of Environment

\*\*Forest land use change (1,940 ha/yr) and fire damage area (16.4 ha/yr) from Forestry Statistical Yearbook (2004-2010) by Korea Forest Service were considered of human interference

Decline of NPP	Contribution of climate change (%)	Contribution of human activity (%)
Near future(2050)	17	83
Far future(2100)	7	93
Decline of SCS	Contribution of climate change (%)	Contribution of human activity (%)
Near future(2050)	39	61
Far future(2100)	46	54

 Table 2. Contribution of potential anthropogenic deforestation and climate change to forest carbon pool.

The decrease of forest carbon pool will result in a positive feedback to climate change, which is caused by the decrease of NPP and SCS. Consequently, if the forest areas decrease with the current level by human interference, it would further accelerate the climate change. It is desirable for a continuous forest management to be performed with some interest and support by international and domestic levels, because a decline of carbon sequestration capacity in forest can be improved by forest area managements, fire managements and fertilizer uses and soil amendments (Lal 2005). In addition, it is necessary to consider such NPP and SCS simulation data when the national and local land planning are established, because forest is an important and effective carbon sink.

For the effective reduction of carbon dioxide emission in temperate forest areas, above all it would be effective to control anthropogenic deforestation. Consequently, this study suggests that it is necessary to reforest extra areas corresponding to deforestation rate if there are some unavoidable plans. It is concluded that potential human interference (anthropogenic deforestation) has more influence on the decline of temperate forest carbon pool than potential climate change in the capital area where human interference is expected with national and local land planning.

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# A study of wintering habitat use pattern of red-crowned cranes in Demilitarized Zone in Korea

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### Abstract

The study was the first attempt to identify the habitat use pattern of red-crowned cranes (*Grus japonensis*) around the DMZ by overlapping coordinates with the land cover classification (LCC). Daily habitat use pattern was highly different (P = .000) between daytime (06:00-18:00) and nighttime (18:00-06:00). Cranes in Cheolwon used agricultural paddies more frequently in the daytime (P = .002), and forest areas at night and this indicated that cranes presumably use rice paddies for feeding and forests for resting, respectively. Cranes night time in Paju used wetlands more often than random expectation based on the available wetland surface area (P = 0.017). This indicated different habitat use pattern between coastal (Paju) and inland (Cheolwon) areas. Securing agricultural paddies is important for providing them areas for feeding and forests should be important for resting during night time in Cheolwon supporting crane populations during their wintering migration in Korea.

### Introduction

Cranes of the genus *Grus* are listed as some of the most endangered bird species in the world. Many are recognized as 'Critically endangered' under the IUCN Red List category (Archibald and Meine 1996). Among the 15 crane species in the world, four occur in Korea: red-crowned crane (*Grus japonensis*), white-naped crane (*G. vipio*), hooded crane (*G. monacha*), and common crane (*G. grus*) (Lee et al. 1998). Of them, red-crowned cranes and white-naped cranes are regular visitors to the Korean peninsula, especially in the Demilitarized zone (DMZ). Most of species migrate long distances and stop over several rest-sites during their migration.

In the south of DMZ there is CCZ (Civilian Control Zone) only in South Korea side, and cranes spend 60–80% of their time in fields, searching for food and feeding (Lee et al, 2007a), indicating the importance of foraging in winter. Their primary food in winter is rice grains that fall during the harvest. The birds are mostly observed on unplowed rice paddies rather than on plowed land (Lee et al 2007b). Pae and Won (1994) suggested that cranes visit the rice fields for feeding and they observed a frequent





movement between rice fields and nearby forests and wetland areas. Thus, it is expected the birds would be more often seen foraging on the rice fields than in other areas. However, crane species also use other habitats except for rice paddies for their resting. In DMZ there are forested areas that entrance is strongly prohibited due to military purpose and there are streams and wetlands that crane species also depend on their time for feeding and resting. Most crane studies were focused on the use of rice paddies, but in the large landscape level the habitat use pattern has never been tested. In this study, we compared habitat use pattern of red-crowned cranes around DMZ to test hypothesis that crane habitat use is different between time of day due to their daily behavior patterns and we would like to test it in the DMZ.

DGIST

Agriculture is recognized as a major driver of global biodiversity loss (Norris, 2008): agricultural intensification caused by the green revolution has been paralleled throughout the world (Krebs et al., 1999; Fujioka et al., 2010), and agricultural land use is predicted to continue expanding in the next 50 years, particularly in Asian and African countries (Scharlemann et al., 2004 and Balmford et al., 2005b). There is clearly an urgent need to understand what is happening to the relationship between agriculture and biodiversity in regions other than Europe and North America. More importantly, earlier reviews of biodiversity conservation in rice paddy areas have mostly focused on the value of rice fields as providers of wetland habitats, which support the biodiversity. Few collected information on the impact of rice-farming practices on biodiversity (but see Donald, 2004). Thus, reviewing conservation management problems in Japanese farmland should provide useful information that has much in common with, and is comparable with, that in other rice-growing countries. Insights derived from such studies can then be applied in an international context.

The study of these birds' migration routes and habitats has recently advanced due to the use of transmitters that can be tracked by satellite (Jouventin and Weimerskirch 1990, Higuchi et al. 1996, 1998). Previous studies showed that cranes use of wetlands are quite common and wetlands considered to be among the most productive ecosystems on Earth (Matthews, 1984 and Zhao, 2002, ). However, wetland areas in many places around the world are being pressured by rapid conversion of residential and commercial complexes so that animals use in this areas are strongly affected. Based on crane migration studies securing wetland reserves has been proved an important method, and it is especially true in areas surrounded agricultural paddies. Also cranes often stayed in rice paddies for food and however often observed they frequently moved wetlands and forests nearby. However habitat use pattern was not strongly shown in quantitative ways, especially in Korean DMZ because it is strictly prohibited to enter inside DMZ for military control.

Recently, remote tracking of cranes via satellite has proven to be an efficient method for identifying the migration routes of birds that travel long distances (Shimazaki et al. 2004). This method is especially useful for endangered and rare species that need systematic analysis of habitat use during migration. However, most studies using satellite-tracking only focused on migration routes, but the exact habitat use pattern on the ground remained unknown. Therefore, the purpose of this study was to identify the key habitats utilized in the DMZ by identifying habitat use during wintering migration and securing key habitat for crane species. The results will help to enhance crane conservation in DMZ.

### **Study Areas and Methods**

Study Areas

The study area is located in the DMZ and the surrounding areas of the Civilian Control Zone (CCZ). The DMZ is a 248 km long, 2 km wide border separating North and South Korea from East to West. The DMZ comprises 19,294 km<sup>2</sup>, approximately 2% of the total Korean peninsula. The CCZ is located outside of the DMZ only in South Korea (including coastal areas in east and west) and ranges from 5-20 km in width (Lee and Chung 2002). This area is relatively flat with wetlands bordering the Han River in the eastern areas of Paju as a result of overflow during the summer monsoon season.

Outside DMZ there is the Civilian Control Zone (CCZ) between North and South Korea which contains some of the most important wintering sites for wintering crane species (Kim and Wilson, 2002). The DMZ is a 4 km wide zone running across the Korean peninsula, with an area of 907 km<sup>2</sup>. There are no farms or human residences within the DMZ. South of the DMZ, in South Korea, is the CCZ, a 5–20 km wide zone under military control, with some rice cultivation and a limited human population. Despite their critical importance to the conservation of these two species of cranes detailed analyses of crane ecology and behavior at these sites have rarely been conducted due to military restrictions on access.

Further, a Civilian Control Line (CCL) was set up that varies from 5 km to 20 km from the DMZ southern boundary. This line creates the boundary of the CCZ. The borderline area passing CCL partially includes two provinces and 14 cities or counties (Chuncheon City, 2005). In spite of these residential areas, the CCZ is made up of primarily farm and forest lands.

CCZ is composed of villages and agricultural areas, and forests in the DMZ are well developed without disturbance by humans. This situation results in a vast expanse of agricultural paddies, and recently, thanks to the introduction of machinery, increased amounts of left-over rice after the harvest, providing fodder for cranes during their winter migration (Pae et al. 1996, Lee et al. 2006). Other species common in the areas were: bean geese (*Anser fabalis*), white-fronted geese (*A. albifrons*), mallards (*Anas platyrhynchos*), and teal (*A. crecca*).

### Habitat estimation

A total of 7 red-crowned cranes (5 cranes in 1993, 2 in 1994) were used in this study. Each individual was equipped with a satellite transmitter, known as platform transmitter terminals (PTTs), and then released on site. The transmitters measured 80x60x35 mm with a 180mm antenna and had a weight of 80 g. The transmitter was attached to a harness made with Teflon ribbons which were used to attach the unit to the cranes breastbone, but not surgically implanted. The total weight of the PTT and harness was 130 g which is about 2% of the body weight of an adult crane (Higuchi et al. 2004). Signals from the transmitter were sent to the ARGOS system on board the NOAA weather satellites. The system uses Doppler shift as the satellite passes overhead to calculate the position for each bird. The ground receiving station sends the data to the World Computing Services Center, which then converts the data to usable coordinates such as latitude and longitude which are then transmitted to the researchers through the internet.

The PTT transmitters were set to a 6 hours active and 12 hours inactive cycle with 60 seconds between pulses while active during the period of this study. Coordinates were transmitted 1-7 times per day between the middle of November and the end of December in 1993 and in 1994. The data was used to analyze Transverse Mercator (TM) and the coordinate system of Geodetic Datum, Tokyo.





*Determination of available habitats.* The land cover classification (LCC) is the basic information that needed for a remote-sensing and use the land surface pattern from the surface. It is composed of nine categories: deciduous forests, mixed forests, coniferous forests, stream channels, rice fields and agricultural areas, wetlands, open areas, grasslands, road and housing areas so that we can understand the condition of lands from the satellite (Appendix I).

DGÁST

Determination of used habitats - Intuitively, the kernel method consists of placing a kernel (probability density) over each observation point in the sample. A regular rectangular grid is superimposed on the data, and an estimate of the density is obtained at each grid intersection, using information from the entire sample. The estimated density at each intersection is essentially the average of the densities of all the kernels that overlap that point. Observations that are close to a point of evaluation will contribute more to the estimate than will ones that are further from it. Thus, the density estimate will be high in areas with many observations, and low in areas with few.

#### Statistical analysis

A habitat use pattern was analyzed based on a land cover map. The daily movement pattern can be divided into two time periods: daytime (06:00-18:00) and the nighttime (18:00-06:00). The habitat use pattern was compared between day and night. A land use percentage by cranes was calculated for each coordinate point from the transmitter using data points.

We estimated total area of each habitat based on the calculation for each coordinate both in Cheolwon and Paju areas separately. Habitat use pattern was compared between daytime and nighttime using Wilcoxon signed-rank test in the Cheolwon area only. The total area of each habitat type was estimated to compare the percentage of crane habitat use in Paju and Cheolwon separately. The chi-square test was used to test whether use of various habitat types by birds is non-random. For this test all data from seven individuals were pooled together. Although such pooling may result in strictly speaking non-independent data because they were measured many times on the same individuals, the locations reading were made at intervals of 2-3 days which might have contributed to relative independence between consecutive locations of an individual. Identification of the preferred habitat types used by cranes was tested (Zar 1999) and to see the changes in habitat use between day and night.

### Results

Cranes used the DMZ in the Paju (n=115) and Cheolwon areas (n=254) during 1993-1994 (Table 1). A total of **six** individuals were used to acquire data. Coordinates for each area were overlapped in the LCC map.

In the Cheolwon area, it was possible to obtain the activity pattern during the day (n=169) and night (n=85) (Table 2), but for the Paju area, only nighttime data were used in the analysis (n=115) (Table 3). In the Paju areas the agricultural areas were used more often than other habitat types (45.22%), but wetlands (mudflats) were also often used (19.97%).

The percentage of use of agricultural areas by cranes in Chelwon was higher during the day than at night (Wilcoxon test; Z-value=7.623, n=6\_; P = 0.000) (Fig 1).

In Cheolwon estimating size of total area of each habitat by kernel method and the habitat use pattern in daytime was compared and it was significantly different (chi-square value=22.47, df=7, P

=.002). Use of various habitats at night (data pooled from all five individuals: chi-square value=59.053, df=7, P =0.000; Table 2) and during the day (chi-square value=22.47, df=7, P =0.002) was different from the randomly expected use based on the proportions of surface area covered by each habitat type in the Chelwon area. Use of various habitats at night by one crane in the Paju area was also significantly different from the randomly expected use (pooled from ??individuals : chi-square value=18.62, df=8, P =.017) (Table 3).

The kernel estimation and nighttime habitat use pattern was also significantly different (chi-square value=59.053, df=7, P =.000).

In the Paju area, habitat use pattern was compared with total area of each habitat in this area. The chi-square results showed a significant difference in habitat use pattern (chi-square value=18.62, df=8, P =.017) (Table 3).

#### Discussion

This study attempted to identify the movement patterns of red-crowned cranes around the DMZ using data from satellite tracking. Crane migration routes in Korea can be either to the east coastal areas of the Paju area or to the Cheolwon area. These results are consistent with previous studies of migration routes in the Korean peninsula (Higuchi et al. 1996).

This was the first study to attempt to identify the ground use pattern of cranes using satellite tracking data. Previous studies showed the migration routes in Korea, but did not show information regarding habitat types used by the cranes. Our study found the movement pattern of cranes in DMZ with the help of land cover classification (LCC) which had been established recently by the Ministry of Environment in Korea, the data for which was obtained in 1998.

How can it be justified to compare crane activity from 1993-4 with habitat data from 1998? There may have been a change in LCC from then and now, however, the difference should be small for this time period. Considering the unique nature of the DMZ, entry into this area is not permitted without special government authorization, thus posing a barrier for studies.

The cranes were found to use agricultural paddies for foraging; this could be the reason why cranes used DMZ for their wintering grounds as this area had high amounts of grain leftover from the harvest (Lee et al 2006). Having little human disturbance may be another reason that the area is a popular stopover for wintering cranes.

Crane habitat was significantly different from day and night (Fig 1). During the day, cranes used agricultural paddies but at night they moved to the forests, presumably for resting and to avoid predation. The DMZ is also popular site for black vultures (*Aegypius monachus*), Peregrine falcons (*Falco peregrinus*), and kestrels (*F. tinnunculus*) due to the high abundance of waterfowl (Lee and Chung 2002). This observation is similar to that of Higuchi and Minton (2000) who observed cranes movement to the CCZ during the day and to the DMZ at night. However, they only observed the movement pattern but did not show the percentages of habitat use.

This study also had a limitation of crane activity because the crane location data did not distinguish if the birds were on the ground or in flight. The actual activities of cranes need further clarification in future studies. However, this study has shown that importance of different habitats for behaviors of cranes. The importance of rice fields as winter foraging grounds should be secured for providing feeding





to two threatened crane species. However the predation threat to cranes is also being present because there are large number of black vultures and hawks as bird species and lynx and raccoons. The increased threat of predation makes them use rice fields during daytime and forests for night time. Forests are potentially more secured from predation pressure.

DEVIST

Also, most rice paddies are located in the CCZ and there are roads for military use and tourists. Agricultural activities also are common in the CCZ whereas most forests are located in the DMZ and civilian control is very tight so that very little pressure for cranes is happening and cranes prefer this area for nighttime resting and sleep.

The pressure for land development both in the CCZ and elsewhere in Korea is increasing so that it is now necessary for wildlife managers to consider the foods available to migratory cranes during wintertime. Management actions for crane conservation in the CCZ involve encouraging farmers to leave large areas of unplowed fields following their fall harvests. This can be achieved by payments or other incentives from South Korean governmental agencies or conservation organizations to farmers who leave fields unplowed. Such programs have been widely implemented in Europe and are being considered in other countries. Also, because farmers in this region receive a higher price for their rice as it is marketed as 'Cheolwon Crane Rice', perhaps local farmers' associations could be approached to voluntarily leave some fields unplowed in order to maintain these two culturally important species.

Ohishi et al. (2004) also reported that red-crowned cranes have expanded their breeding sites from the original marshland to farmland by adaptively increasing home range sizes and including a wider range of food resources (e.g., seeds and seedlings of dent corn and livestock food) in their diets. These studies indicate the possibility that the population of red-crowned cranes in Japan may also continue to increase, and consequently cause serious conflicts with agriculture. An excessive concentration to a limited number of areas and consequent conflicts with agriculture are also seen as serious problems for the increasing populations of hooded cranes and white-naped cranes in Izumi (Uchida et al., 1986). Over 60% of hooded and white-naped cranes in Izumi (Uchida et al., 1986), over 50% of hooded cranes in Yashiro (Eguchi et al., 1993), and over 90% of red-crowned cranes in eastern Hokkaido (Tomioka and Itou, 1990) seem to rely on artificial feeding for their diets in the wintering seasons. Artificial feeding has contributed to the successful recovery of these cranes populations from the brink of extinction by supporting the high survival rates in winter. This, however, seems to have become one of the causes of excessive concentration on a limited number of sites by preventing natal and/or breeding dispersal (Ohsako, 1987). There is a clear need to investigate the impact of artificial feeding on the survival rates in winter, dispersal rates, and consequent population dynamics of crane species.

This study also indicated the need to limit the development or modification of agricultural paddies into villages or other uses for the conservation of cranes. Currently, there is great pressure for modification of the CCZ into residential areas to ease population density on the Korean peninsula. The tidal zone of the west coast seems to be an important site for cranes, this region is also subject to development (e.g. industrial complexes) especially near the mouth of Han River.

The length of edges between rice fields and forests, that is, the simultaneous presence of rice fields and surrounding forests, is often positively related to the presence of this species not only in breeding sites but also in wintering sites (Wu et al., 2006). This is because grey-faced buzzards require both rice fields and forests for foraging and breeding; the abandonment of rice cultivation seems to directly cause the

loss of habitats for this species through a reduction in the length of edges between rice fields and forests (Ueta et al., 2006). Amano et al. (2008) also reported the positive association between habitat spatial heterogeneity (the simultaneous existence of rice fields, fallow fields, open water, and forests) and the richness and abundance of grassland species in rice paddy dominated landscapes. Grassland species observed in Amano et al. (2008) include endangered/declining species such as marsh grassbird (*Locustella pryeri*) and chestnut-eared bunting. Thus, these results also indicate the importance of habitat heterogeneity for declining bird species in rice paddy areas in Japan.

The DMZ and CCZ's status as bio-reserves is in jeopardy because of increasing pressure for agricultural, industrial, and urban development from both the south and north (Westing, 1998). Recently, the South Korean government passed the law of "Support for the Borderline," which was strongly supported by communities in the CCZ. This law may allow for development to occur in the CCZ to compensate communities for restrictions made by the military. On the other hand, the Ministry of Environment designated the DMZ an ecosystem preserve, a move strongly supported by environmentalists. Communities and environmentalists have come into conflict. Policy-makers promoting ecotourism as a strategy for sustainable development for the DMZ and CCZ need to justify the zones economic value as bio-reserves. Valuation of natural resources is also necessary to promote conservation management, to provide a compelling case for inter-governmental efforts to protect the area (Wilson and Tisdell, 2001), and to justify continuing support from the public, government, and non-government organizations (Lee and Han, 2002).

This study only analyzed the data of 1993 and 1994, and may only be a small window to the movement of cranes in the DMZ because of the limited number of transmitters and due to changes in climate. A long term study should be conducted to determine a clear relationship between crane activities and habitat use pattern.

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crane number	Year	location	# data points
20848K	1993	Paju	115
20267K	1993	Cheolwon	47
20266K	1993	Cheolwon	52
20265K	1993	Cheolwon	70
20263K	1993	Cheolwon	67
3623K	1994	Cheolwon	18
Total		6	369

Table 1. Number of signals, year, area of red-crowned crane species

Table 2. The habitat use pattern of red-crowned cranes in Cheolwon areas during daytime (06:00-18:00) and nighttime (18:00-06:00)

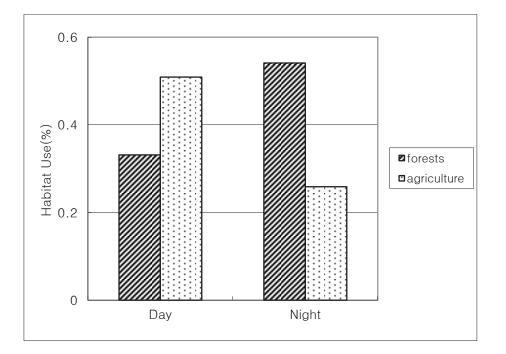
Habitat category	daytime data points	size of each habitat	nighttime data points	size of each habitat
Deciduous forests	13	7.69	1	1.18
Mixed forests	42	24.85	44	51.76
Coniferous forests	1	0.59	1	1.18
Streams	6	3.55	2	2.35
Rice fields, agricultural areas	86	50.89	22	25.88
Wetlands	-	0.00	-	0.00
Open areas	1	0.59	-	0.00
Grasslands	16	9.47	15	17.65
Roads and housing areas	4	2.37	-	0.00
Total	169	100.00	85	100.00



Table 3. The habitat use pattern of red-crowned cranes in Paju areas during daytime (06:00-18:00) and nighttime (18:00-06:00). The habitat use only obtained during nighttime, and total area of each habitat was estimated using kernel method.

Habitat category	Nighttime	% Crane used	Size of each habitat (%)
Deciduous forests	2	1.74	5.90
Mixed forests	5	4.35	12.41
Coniferous forests	7	6.09	4.76
Streams	5	4.35	9.61
Rice fields, Agricultural areas	52	45.22	31.12
wetlands	35	30.43	19.97
Open areas	4	3.48	3.10
Grasslands	1	0.87	0.71
Roads and Housing areas	4	3.48	12.42
Total	115	100	100.00

Fig 1. Habitat use pattern of red-crowned crane during daytime (06:00-18:00) and nighttime (18:00-06:00) in Chelwon areas. The agriculture areas were used more often during daytime than nighttime where the use of forests (coniferous, deciduous, mixed) was less used during nighttime



Appendix I. The category of habitat pattern based on the Land Cover Classification

Habitat category	Explanation
deciduous forests	natural (or artificial) deciduous forests >75% of total areas
Mixed forests	mixed forests of deciduous and coniferous
Coniferous forests	natural (or artificial) coniferous forests >75% of total areas
Streams	inland streams
Rice fields,	rice fields, acricultural areas
agricultural areas	rice fields, agricultural areas
wetlands	areas with permanent water, tidal flats
Open areas	denuded areas with mines, roads
Grasslands	grasslands
roads, housing areas	residential areas or industrial areas





Session-17-#303-1(SS10 & SS27)

### Technology commercialization of new knowledge from university-industry collaborations: focus on patent propensity

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### Abstract

Technology commercialization process composites of from patenting of new knowledge to the market. Patenting is a clear unveiling of the research activities that are created through university-industry collaborations. This paper analyzes the patent process as one of commercializing innovative activities that result from collaborations between universities and regional small and medium enterprises (SMEs). To achieve our aims, we apply robust regression analysis to estimate the models to test five research hypotheses using firm-level data on 263 firms located in the Gwangju region of Korea. Our empirical results show that industry characteristics are negatively related with propensity to patent. In addition, and contrary to expectations, the InnoBiz firms that the government designated as innovative SMEs are not performing differently from general firms. Only the CEO's academic credentials are positively related to CEOs' managerial strategies rather than technology characteristics. We also suggest new technology commercialization related with universities policies and supports to promote regional SMEs including conglomerated firms as well as universities.

JEL Classification Codes: C51; D22; O31; O32;

Keywords: Technology transfer and commercialization; Patent propensity; University-industry collaboration; Regional SMEs.

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Session-17-#303-1(SS10 & SS27)

### The Construction of technology innovation ecosystem of Chinese manufacturing enterprises: A case study of the Nanjing panda LCD Technology Co., Ltd.

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### Abstract

#### **Purpose / Research Question:**

The development of national economy cannot be separated from manufacturing industry. Manufacturing is an important hub for connecting raw materials and products, and is the key point of product production and value appreciation, and is also the leading force of product innovation and process innovation. With the development of economic globalization, profit-driven of capital exacerbate the international division of labor, and the make full use of national resources factors also increase the dependence between enterprises (Zhang, 2011). Chinese traditional manufacturing enterprises are always facing the situation of backward technology, weak R & D strength, over reliance on resources and cheap labor capital. At the present stage of China's manufacturing enterprises can produce its own brand products, but in product quality, stability and scalability is a big gap between the international advanced level, and the majority of employees are poorly educated, enterprises lack of staff who obtain core technology. In addition, the development of manufacturing enterprises in China's special national conditions has gradually become a part of the production line of the developed countries, resulting in the China's manufacturing industry enterprises either in technique or core competence are too dependent on developed countries. With the process of technological innovation is shortened, production tends to be flexible and streamlined, greatly improving the production efficiency, resulting in comparative advantage in the development of Chinese manufacturing enterprises gradually weaken, so enterprises should take the initiative to find a new breakthrough.

Innovation is considered to enhance the competitive advantage in the constantly changing environment in the key words (Tushman, Anderson, 1986). In the background of economic globalization and environmental turbulence, it is difficult to have all the resources needed for innovation, so the cooperation and symbiosis between enterprises and enterprises, enterprises and other types of organizations is becoming a new trend to research and practice. The innovative of business cannot be





evolved in a vacuum, it must to attracts all kinds of resources, funds, partners, suppliers, and customers, in order to create a cooperative network (Morre, 1993). In recent years, some large-scale international enterprises have successfully constructed their technology innovation ecosystem, and on this basis, those large-scale international enterprises developed growth rapidly in the fierce competition, their advantage is difficult to go beyond (Sun, Zhou, 2011). These enterprises are in the strategic center of technology innovation ecosystem, with the ability to choose partners and control the supply chain. The large-scale international enterprises regulate the flow of energy and material circulation among the members of the system, which affects the whole operation and evolution of the system, they are the most critical part of the whole system whose role is irreplaceable. At present, some Chinese enterprises have been aware of the importance and necessity of constructing their own technology innovation ecological system, but, because of the lack of practical experience and theoretical basis for success, the process is going slowly. At the same time, foreign multinational enterprises with successful development experience, they build up their technology innovation ecosystem which is adapted to Chinese environment quickly, it has formed a huge impact on Chinese local enterprises. Therefore, to research the technology ecological system and build the model of enterprise technological innovation ecosystem from the perspective of the core enterprise is helpful to enhance the survival and development of Chinese enterprises, which is conducive to improving the ability of core enterprises to participate in the international competition, and promote the sustainable development of the national economy. Thus, building a technology innovation ecosystem has become an important foundation for innovation, entrepreneurship, government management and industry development in the era of globalization. In this paper, we through the study of Chinese manufacturing industry enterprises' internal and external environment to explore the way of knowledge flow and technology form of manufacturing enterprise, and try to construct a framework of technological innovation ecosystem which is based on a core enterprise and include the institutions, government and other enterprises.

### Key literature Reviews:

Lorenzoni and Baden (1995) Fuller proposed that the leading enterprises are strategic centers which have higher coordination abilities and the strain abilities, and select, attract and leading other enterprise for innovation, with providing new opportunities for their best partners, to ensure the survival and development of entire innovation network. This definition is recognized widely. Accordingly, scholars believe that the leading enterprises are located in the center of enterprise innovation network (Morrison, 2004), leading enterprises can construct and control the innovation network, by contribution evaluating of their partners to the innovation network, and then decide the fate of other enterprises in the network (Leach, Matsoris, 1997). Gay and Dousset (2005) put forward different views from the perspective of technical ability. They believe that in the innovation network, only the enterprises with core technology which other companies do not have or difficult to imitate, are the leading enterprises truly, and the enterprises which take advantage of those emerging technology can be easy to master, are not able to establish the core position in the competition. The enterprises' technological innovation is a life system, so, the scholars have carried on research on the related problems of enterprise technological innovation from the ecological system, and put forward the theory of innovation ecological system of enterprises. The foreign researches explain the meaning of innovation ecosystem through the role of technological innovation ecosystem based on cases: enterprises get their survive environmental conditions, and

establish the market relationship through technology innovation ecosystem, and through the innovation ecological system, the enterprise can find methods to increasing value and reducing cost in the production process and the supply chain, effectively improve their core competitiveness (Esty, Porte, 1997). Through ecological technology innovation system, the enterprises can realize the intensive interaction among the R& D which bases, which not only can create opportunities to make enterprises quickly enter into each other's intellectual scene, but also greatly increase the value of enterprise pool of knowledge and resources (Persaud, 2005). In the technological innovation ecosystem, the interdependence and co-evolution of the enterprises can make the weak enterprises survive (Lansiti, Levien, 2004). Ander (2006) illustrated that innovation is no longer the task which a single enterprise can independently accomplish, but needs cooperation and complementarity with other enterprises which truly can create valuable products and services by a case of high-definition television, this complementary organization is the technology innovation ecological system. Chen and Gu (2008) think that the enterprise innovation ecosystem refers to the enterprise technological compound organization and compound environment for innovation within a certain period of time and space, the whole system is formed by the interaction and interdependence of material, energy and information flow for enterprise innovation. in the research of high tech enterprises' innovation ecosystem, Zhang (2009) clearly pointed out that the innovation ecosystem is consist of the core components of customer demands, collaborative R & D, intellectual property licensing, technology standard cooperation, strategic alliance, based on module knowledge alienation, coexistence of symbiosis, and co-evolution, the basic characteristics of innovation system are similar to the natural ecological system.

As can be seen, the existing literatures on technological innovation eco-system construction took the leading enterprises as the main body of research, however, the leading enterprises have natural advantages in the technology and social networks, the construction of innovation eco-system is more advantages than other enterprises. while some of the literature took the weak enterprises as the attachment of strong innovation network, which emphasized how the backward enterprises absorb innovative resources in a strong innovation network. But Chinese enterprises, especially manufacturing enterprises which rely on technology introduction, do not have these natural advantages on technologies, so this paper takes enterprises which rely on technology introduction as the main body to construct technological innovation ecosystem, and research how these enterprises build their unique technological innovation ecosystem to catch up and surpass on technologies.

### **Design/Methodology/Approach:**

Because the case study can describe and analyze a specific phenomenon based on the abundant qualitative data, and single case study can reveal how the case changes with time (Yin, 2003), which is more suitable for the study of longitudinal case. This paper is based on this method.

Eisenhard (1989) pointed out that, in the initial stage of the study, when we know little about the study or trying to study from a new perspective, the case study will be very effective. Therefore, as an exploratory study, this paper chose a single case for in-depth analysis, and choose the Nanjing panda LCD Technology Co. Ltd. as a sample to study its technological innovation process in 2009-2015. We choose the company as a case study of the object has two considerations: 1) The typical characteristics of a case.





Nanjing panda LCD Technology Co., Ltd. is a typical technology oriented enterprises, it introduced the Sharp Co's full set of LCD production line in 2009, which is the first introduction production line of liquid crystal panel in Chinese Mainland. Nanjing panda LCD Technology Co., Ltd. only spent two years on the establishment of its own R & D system, to achieve the scale of production. Through a series of innovative activities, this company also applied for a certain number of patents. 2) The acquisition of longitudinal data. This paper studies the company's patent data, the cooperation of patent application and so on through the China National Intellectual Property Office's patent data. These open patent data include the patent owner, patent name, technical information, patent applications, patent licensing, and other necessary analysis data. 3, The convenience of research. Nanjing panda LCD Technology Co., Ltd. and our research group is located in the same city, is conducive to our group to enter the enterprise to conduct a survey of.

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In the course of this case study, our research team mainly uses in-depth interviews, literature and image data, field observation method to collect data.

### (Expected) Findings/Results:

This paper applied the theory related to innovation ecological system and technological innovation to research the construction of technology innovation ecosystem about Chinese manufacturing enterprises. We put forward a new technology ecosystem framework, which is suitable for Chinese manufacturing enterprises, which provides a new strategy for the development of manufacturing enterprises in the post development countries.

### **Research limitations/ Implications:**

This paper reveals the construction process of the innovation ability of the Chinese manufacturing enterprises in the process of technological catching up, and obtain some useful conclusions. But there are still some problems existed: 1) Because of the limitation of single case study, the universality of the research conclusion has certain limitation. 2) The research conclusions need further large sample tests. This research considers the knowledge flow, technology formation and innovation of manufacturing enterprises in the construction of their own technological innovation system, construct the framework of enterprises internal and external cooperation. But the research conclusion is still lack of large sample data to test. In the future research, we will further enrich and improve the research framework through the research of more enterprises.

Keywords: Chinese Manufacturing enterprises; Technological innovation ecosystem; technology catchup

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Session-17-#321-1(SS21 & SS30)

### Simulation-based Strategy Dynamics Decision Support System for Innovation-driven Green Business Development and Economical Evaluations

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### Abstract

In the globally competitive environment, continuous product and business model innovations have become a critical strategy for enterprises to develop competitiveness and market potential. However, in the product innovation process, in addition to technological and functional product innovations, business model innovations comprising the values of the social, environmental, and sustainable development have been highlighted as a new generation business model in in recent years. To this vision, the strategic thinking of "Creating Shared Value" (CSV) has been proposed that encourages enterprises to re-define the concept of products, markets, production value chain and local clustering development.

To demonstrate the innovation-driven green business development and economical evaluations with innovative green supply chains, this research project takes a 70 billion NTD annually paper printing and publishing industry as the research object for investigation. Empirical data and in-depth interviews with industry experts will be adopted to explore the product innovation and market development strategy for international strategic alliances of green supply chain. Even though the green consumption and UPM green paper product innovation have been an global trend in the international community (UPM annual output already reached 10 billion euros), Taiwanese market is still in the early stages of development and thus worthwhile for research. In the past years, many manufacturers could merely rely on their experience to determine product pricing and promotion strategies due to the lack of a systematic decision support model to assist the dynamic planning for enterprise's product innovation and market expansion strategies, and to assess the effectiveness of the strategic plans.

In order to enhance company's strategic planning capability and business performance, this research project aims to combine the theory of bargaining power in the field of economics, management sciences and System Dynamics methodology to develop a Strategy Dynamics Planning Model for Product Innovation and Market Development (SDPM). SDPM could be a Management flight simulators (MFS) as well as a decision support system that help managers overcome the aforementioned obstacles. The concept of MFS is defined as the simulations of complex operational and strategic issues in businesses and other organizations. A management flight simulator is a learning tool that allows managers to compress time and space, experiment with various strategies, and learn from making rounds of simulated decisions in a designed learning environment that allow failure and reflection. Previous studies proposed

that management flight simulators are required to improve people's mental models in discover how complex systems behave. When experimentation is too slow, too costly, unethical or just plain impossible, simulation likes MFS become the main-perhaps the only- way we can discover for ourselves how complex systems work and where high-leverage points may lie.

Through computer simulation technique, the proposed model helps enterprises to increase the dynamic planning capabilities, business strategy performance and create added value. This study helps to analyze the competitiveness factors for the paper product innovation in green supply chain and market development. In addition, the potential customers and existing customers could be handled by five customer market stages in response to strategic planning under different resources and market conditions. The analysis of the customer base, product innovation strategy, market development strategies, operating cost, business performance assessment strategies could be performed by computer simulation. The quality of decision-making for industrial operations could be enhanced and the model could be further applied to China and international market.

The proposed simulation-based strategy dynamics decision support system demonstrates a powerful logic that offers substantial improvements in dealing with strategic planning for innovation-driven green business development and economical evaluations. Successful strategic business model development requires attention on the performance over time. Since performance reflects the state of business resources utilized, this study supports a systematic evaluation for time-phase performance with anticipated resources. In addition, the strategic architecture of the business developments is enabled to cover the feedback structure of interrelated critical variables among innovations, business model development, technology adoption, consumer awareness, and business economics. The field of strategic management and innovation are eager for dynamic theories that explain the evolution of performance differences among difference business models and are increasingly looking to managerial decision making as the source of dynamics. Therefore, this study contributes to address dynamics and systematic decision making with business model innovations. The proposed model helps to explain how business performance has developed up to the current date, and how to develop and implement strategies to improve future performance. For further development, cloud computing technique is able to be incorporated with the scientific approach.

Keywords: product innovation, decision support, strategy, system dynamics, simulation.





Session-17-#321-1(SS21 & SS30)

### Strategic Modelling for Improving Open Systems Innovations and International Supply Chain Collaborations in Multinational Enterprises

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### Abstract

In today's global market and international business environment, multinational enterprises are growing and their capability in innovations become one of the critical competitive advantages. Product design and manufacturing companies are not striving for individual capacities but for the effective working with international supply chains. However, in addition to environmental and social objectives, cost and economic feasibility has become one of the most critical success factors for improving supply chain management and collaborations, especially for the electronics OEM (original equipment manufacturing) companies whose operations costs often make up a very high proportion of final product prices. This paper presents a case study from the systems perspective by using System Dynamics simulation analysis and statistical validations with empirical data. Empirical data were collected from Japan and Taiwan manufacturing chains-among a diverse market to Australia, Hong Kong, and South Asia-and their global green suppliers to examine the benefits of strategic supply chain collaborations in terms of shared costs and improved shipping time performance. Since its establishment of 1920, as a comprehensive heat-energy appliance manufacturer, the benchmarked case of multinational enterprise has been providing various products under the leading brand images of "safety and assurance", "comfort" and "environment-friendly" and contributing to "heat and comfortable lifestyles". The product lineup consists of conventional thermal energy appliances such as kitchen appliances, hot-water units and heating units, as well as non-conventional products such as dish washers/dryers and clothes dryers.

A framework for the evaluation of horizontal and vertical supply chain collaborations was developed to examine the shared risk for cost effectiveness and reduced variations in supply line for shipping time efficiency by different strategies of collaborations. Since the international supply chain collaboration is an improvement of the supply chain system, this paper conducted a System Dynamics (SD) modeling and a simulation analysis to demonstrate the rationale and strategic decision making of international supply chain collaboration and how the collaborative system could reduce the risk in the supply line and eventually improve the supply chain performance. The SD modeling is to support the analysis of the research subject from a holistic viewpoint and functions as a virtual laboratory and management flight

simulator for policy experiments. A management flight simulator is a learning tool that allows managers to compress time and space, experiment with various strategies, and learn from making rounds of simulated decisions in a designed learning environment that allow failure and reflection (Bakken et al., 1992). Sterman et al. (2013) argued that management flight simulators are required to improve people's mental models in discover the behavioral patterns of complex systems which comprise IT projects. The scholar also posited that when experimentation is too slow, too costly, unethical or just plain impossible, simulation likes MFS become the main -perhaps the only- way we can discover for ourselves how complex systems work and where high-leverage points may lie (Sterman, 2014b).

Supply chains consist of cascades of firms, each receiving orders and adjusting production and production capacity to meet changes in demand. Each link in a supply chain maintains and controls inventories of materials and finished product. Previous studies have identified the instability and oscillation in manufacturing supply chains as a systems problem. Accordingly, it is necessary to understand the causal structure of the supply chain system. By using the SD modeling technique, the identified causal structure helps to demonstrate how an individual supplier could manage its inventories and resources as it attempts to balance production with orders from the collaborative OEM Company. With the strategic collaborations, OEM managers are able to place dependable orders with their suppliers to replace their own outward shipments of stock to customers and control inventories at shared risk and waste cost.

Based on the generic supply chain model and simulation functions proposed by MIT SD Group, the concepts of supply line, inventory, and collaborative procurement strategies have been considered for the development of a simulation model in this paper. For the procurement decisions, the benefits of supply chain collaboration could be reflected in the accuracy of forecast of procurement quantities and the actual amount of procurements. By using a computer simulation technique, the SD model demonstrates the instability in and fluctuations of components in the supply line and the inventory in a supply chain system. Except for the external factors affecting the supply chain system, the fluctuations are affected by two major internal factors:

(1) the dependent demand from the OEM company's innovations and collaboration strategies, including the forecast of procurement and the real procurement by the OEM company;

(2) the supplier's capacity planning for meeting the procurement forecast and the delivery time in production and component shipment.

The proposed model is able to demonstrate the shared risk of supply chain system under different collaborations. The simulation analysis suggests that the supplier's operations cost will be higher if the number of accumulated components in the supply line and the inventory are higher. In addition, the risk of shipping time efficiency and punishment cost are higher if there are any shortages during the inventory management stage. Therefore, since strategic collaborations could increase the total amount procured and reduce the accuracy of forecast orders to the green suppliers, theoretically it will reduce the supplier's risk and operations cost. The risk of inefficient production in supply line and inventory management could be reduced with the component procurement collaboration so that the reduced purchasing cost and better shipping time efficiency to the OEM Company become reasonable expectations with collaboration. In addition, once the cost of raw materials could be reduced, the total operations cost could be reduced and the shared cost benefit could be reasonably shared with the OEM company.

**Keywords**: system dynamics, strategy, supply chain collaboration, decision making, multinational enterprise, systems thinking.





Session-17-#321-1(SS21 & SS30)

### Nation-wide Eco-System of Academia-Industry Collaborations for Technological Innovations and Industrial Economics: A Case Study of Science Parks

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### Abstract

National policies for science parks and innovation have been identified as one of the major driving forces for high technology industries, especially for public funded science parks. In addition, technological innovations and R&D have been identified as one of the critical driving factors for high-technology firms to compete and thrive under intensive global competitions. The influence of R&D for business has gained increasing interests in both academia and practice, especially for the high-tech industry. Since the science park and innovation policy are getting acceptance by governmental agencies, a nation-wide macro viewpoint is needed for policy evaluations and high-technology industries should be considered as parts of the national/regional economies. This paper evaluates a nation-wide eco-system of academiaindustry collaborations for technological innovations and industrial economics based on the real data from one of the globally recognized high-technology industrial clusters, the national science parks in Taiwan. By taking advantage of robust small and medium-sized enterprise networking, of high quality of human resources, of government support and government-industry-university-institute collaboration, the Taiwan science parks have become globally well-known examples of science parks set up for national prosperity. The policy of facilitating science parks and innovations have been making a tremendously contribution to the development of the high-technology industry clusters, the creation of innovation clusters, and the national economy in Taiwan. This paper utilizes the globally recognized high technology industrial clusters and the case study of science parks in Taiwan to investigate the impacts of nation-wide eco-system of academia-industry collaborations with a holistic viewpoint and nation-wide statistics. First, the economic added values, international trades, and employment in the benchmarked science parks are evaluated. Second, the concepts of academia-industry collaboration and policies to eco-innovation system are introduced, while the measures and performance of innovation and applied R&D in the science parks are addressed. Based on the research results, lessons learned and policy implications for science park developments and academia-industry cooperation innovations are discussed. The innovation of high technology industries in Taiwan has been continuously facilitated by the government policy for strengthening academia-industry links and innovation. Industry-academia cooperative research matches the advanced and practical technologies and knowledge applications of universities with the needs of private-sector businesses. These projects develop the R&D capabilities of educational and research institutions while encouraging companies to participate in university-based applied research projects. To promote collaboration on highly innovative research projects, MOST defined the scope of research results and established optional models for technology transfer authorization, thus increasing the effectiveness of industry-academia cooperation. In 2014, a total of 813 such projects received government funding, 852 companies participated, NT\$328 million was raised in corporate matching funds, and 2095 graduate students received training. To develop the R&D capacity and eco-innovation system of the high technology industries in Taiwan, more innovation policies were promoted as follows:

- 1. PIONEER Grants for AIC: MOST has been jointly funding the PIONEER Grants for Frontier Technologies Development by Academia-Industry Cooperation with the Ministry of Economic Affairs since 2013 to encourage internationally and regionally leading firms to form alliances and engage in cooperative research with universities.
- Minor Alliance Projects: Academia-Industry Technological Alliance Projects make use of university researchers' technological capabilities and encourage professors to establish core technology laboratories as a bridge to industry users. Funded by MOST since 2013, these projects encourage academic organizations to build laboratories centered on their research as a new platform for industry-academia collaboration.
- 3. From IP to IPO: The purposes of this program are to encourage the establishment of startups by young researchers, promote an innovative, entrepreneurial culture at universities and research organizations, and foster an environment for industrializing R&D results or innovations.
- 4. Germination Program: The program accelerates technological diffusion by helping scientific research organizations establish mechanisms for the promotion and use of R&D results.
- 5. Industrial Fundamental Technology Projects: The program brings together academic and industrial resources to reinforce the technical foundations of Taiwan's manufacturing industry.
- 6. Applied Research Incubation Projects: The program promotes a biotechnology integration and incubation mechanism to evaluate, construct, and connect R&D capabilities along Taiwan's biotech value chain.

To promote science and technology polices and high-technology industrial developments, public policy makers need to continuously evaluate the economic impacts and innovation indicators of science park development. Most importantly, policies for facilitating economic added values and innovations could be the critical driving force from the government side. In this paper, the concept of economic added values, international trades, employment, R&D intensity, patent development are applied to a case study of the economic impacts and innovations of science parks in Taiwan, which is an addition to the theoretical and practical contributions on the development of high-technology industries. Especially for the governmental supported science parks, the proposed integrated analysis and performance evaluation





provides a more comprehensive perspective in supporting the performance evaluation of industrial incubation policies. From a macro standpoint, the integrated economic perspective is worth to be incorporated into the list of those factors used for the construction of nation-wide policies on the industry choices, segmentations, and structural developments. Our research results suggest that the national science parks policy can facilitate successful development of high-technology industries, which bring about both significant economic benefits and R&D performance. While the operations of the science parks in Taiwan have long enjoyed governmental support, the proposed case study provides several policy implications. First, a nation-wide macro viewpoint is needed for the planning of high-technology industrial developments. Second, when high-technology industries are considered as one of the national/regional economies by governmental agencies, appropriate economy index can better represent the contributions of the high-technology industries. Third, a proper industrial clustering mechanism and eco-innovation system can further help high-technology industries to reach the status of an upgraded economy. The proposed policy implications should lead to improved future research for better developments of science parks and high-technology industries. Technically, for other future research, more innovative and practical indices that accommodate the integrated concept between the economic and innovations for specific industrial requirements could be continuously discovered and applied in the future.

Keywords: innovation, science park, eco-system, academia-industry collaboration, policy.

Session-17-#321-1(SS21 & SS30)

### A study on the factors influencing academics' knowledgetransfer activities: The case of South Korea

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### Abstract

### 1. Introduction

This paper is aimed to investigate the relationship between the characteristics of academics engaged in science and engineering and their productivity of knowledge-transfer activities (e.g. academic patenting). However, it is hard to find previous literature examine this issue considering the context of academia in catch-up countries. In order to do this, not only a brief overview of Korean academic system but also descriptive statistics, correlation statistics and regression analysis are adopted, based on papers and policy reports on higher education as well as data from the official census on Korean academics respectively.

#### 2. Data

The data set has been mainly compiled from the KRF (Korea Research Foundation) annual survey on the academic research and knowledge-transfer activities of Korean universities in 2008. The data set contains input and output variables of the individual academics' activities, such as the amount of research funds from different sources, the number of internal research institutes and their research expenditure, and the number of papers, books, patents, technology transfers and research projects.

#### 3. Results and discussion

### 3.1 Descriptive Statistics

The descriptive statistics shown in Table 1 provide us with **individual and contextual properties** of 35,046 Korean academics engaged in science and engineering. In terms of individual characteristics, the average age of the Korean academics engaged in science and engineering is 48.2, while the average career period is 10.9 years, and 86% of them are male. Regarding the disciplines of the academics, 38% of them are in the field of engineering, and 36% of them are in the field of medical and pharmaceutical science. In terms of contextual properties, about 68% of those belong to private universities, as shown in Table 1. In terms of region, 30% of the universities affiliated are located in the capital area (Seoul, Kyunggi and Incheon).

Table 1 also provides us the details of the academics' research resource and research output. Firstly, on





the average, 75% of total research funding for Korean academics is supported by central government. The amount of funding from industry consists of more than 13% of the R&D expenditure of Korean academics. Secondly, the characteristics of the academics' research and knowledge-transfer activities can also be explored based on the descriptive statistics. In terms of research, on the average, they produce 0.42 papers in domestic journals and 0.42 papers in SCI journals per year. In terms of knowledge-transfer activities, 0.1 domestic patents and 0.02 overseas patents were applied for in 2008, and 0.5 million Korean won (US\$ 454 in 2008) was earned by three technology transfers on the average by Korean academics engaged in science and engineering.

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		00		U
	Mean	S.D.	Min	Max
Gender	.86	.35	0	1
Age	48.2	7.93	19	84
Career	10.9	8.86		43
Discipline				
- Natural Science	.20	.40	0	1
- Engineering	.38	.49	0	1
- Medical & Pharmaceutical	.36	.48	0	1
- Agriculture and Maritime	.05	.22	0	1
Location (in C area =1/No=0)	.30	.49	0	1
Legal status of the university affiliated	.32	.47	0	1
Number of papers published				
- Domestic journal	.42	.74	0	12.08
- SCI journal	.42	.92	0	19.25
R&D funding by sources* (Total)				
- Cent gov't	6.60e+07	3.04e+08	0	1.88e+10
- Loc gov't	4.64e+06	5.57e+07	0	3.08e+09
- Industry	1.16e+07	1.00e+08	0	1.31e+10
- Overseas	3.32e+05	1.07e+07	0	9.32e+08
- Self	4.88e+06	4.03e+07	0	4.23e+10
TTO size (no. of staff)	-	-	-	-
Regional BERD*	-	-	-	-
Patent applications				
- Domestic	.10	.53	0	20.58
- Overseas	.02	.22	0	16.27
Technology Transfer <sup>+</sup>	.32	.37	0	28
Revenue from TT*	5.0e+05	1.32e+07	0	1.93e+09

\*unit: 0.1 billion won (US\$0.1 million in 2006).

<sup>+</sup>Transfer of ownership regarding intellectual property rights (IPR) created by universities.

### 4.2. Characteristics of the academics engaged in knowledge-transfer activities

In this section, we investigate the characteristics of the academics in at least one of four knowledgetransfer activities (i.e. domestic patents application, overseas patents application, technology transfer and revenue creation from technology transfer) in several aspects, such as career stage, gender, affiliation, discipline, and the country in which the final degree was given.

### Career Stage

A career stage is defined as the term after the individual was hired as a tenure-track professor. As shown in the table below, except the oldest group, the junior professors tend to show a lower participation rate, in spite of their bigger proportion in the population, whereas the senior professors show a higher participation rate.

Career Per	riod*	0~5	6~10	11~15	16~20	20~	Sum
Academics in	Freq.	969	738	837	665	558	3767
KT	%	25.7	19.6	22.2	17.7	14.8	100
Population	Freq.	11067	6015	6558	4953	6451	35044
Fopulation	%	31.6	17.2	18.7	14.1	18.4	100
Particip. Ra	te (%)	8.8	12.3	12.8	13.4	8.6	10.7

\*Unit of career stage: year.

### Gender

In terms of the gender of the professors, the participation rate shows a slight difference between male and female professors.

Gender		Male	Female	Sum
Academics in KT	Frequency	3549	218	3767
Academics III K I	%	94.2	5.8	100
Dopulation	Frequency	29996	5050	35046
Population	%	85.6	14.4	100
Particip. Ra	te (%)	13.0	12.5	12.9

### Characteristics of affiliated universities

Legal status

Professors affiliated to public (national and prefectural) universities tend to show a higher participation rate.

Legal Status		Public	Private	Sum
Academics in	Frequency	1581	2186	3767
KT	%	42.0	58.0	100
Dogulation	Frequency	11228	23818	35046
Population	%	32.0	68.0	100
Partici	p. Rate (%)	14.1	9.2	10.7

### Location

The professors in universities near the capital area (Seoul, Incheon and Kyunggi) show a higher participation rate that those in regional universities.





Location		Capital area	Non Capital area	Sum
Academics in	Frequency	1869	1898	3767
KT	%	49.6	50.4	100
Population	Frequency	13656	21390	35046
Topulation	%	39.0	61.0	100
Partici	p. Rate (%)	13.7	8.9	10.7

### Discipline

The professors in engineering science departments show the highest participation rate, while those in medical science departments show the lowest rate.

Discipline		Eng	Agr	Med	Nat	Sum
Academics in	Frequency	2322	234	526	685	3767
KT	%	61.6	6.2	14.0	18.2	100
Population	Frequency	13549	1772	12806	6919	35046
	%	38.7	5.1	36.5	19.7	100
Particip. Rate (%)		17.1	13.2	4.1	9.9	10.7

\*Eng: Engineering, Agr: Agricultural and Maritime Science, Med: Medical Science and Pharmacy, Nat: Natural Science

### The country where the final degree was awarded

The professors trained in US institutions show a higher participation rate than those trained in Japanese institutions, while those trained domestically show a lower rate than average.

Country trained		Korea	US	Japan	Others	Sum
Academics in	Frequency	1678	1617	269	203	3767
KT	%	44.5	42.9	7.1	5.4	100
Population	Frequency	24127	7739	1759	1421	35046
	%	68.8	22.1	5.0	4.1	100
Particip. Rate (%)		6.95	20.9	15.3	14.3	10.7

### Research activities

The professors who published more papers show a higher participation rate than those who published less SCI papers, while those who produced a lowest number of papers also show a lowest participation rate.

No of SCI Papers*		0-0.5	0.5-1	1-1.5	1.5-2.0	2.0-	Sum
Academics in	Frequency	1633	709	499	290	636	3767
KT	%	43.4	18.8	13.2	7.7	16.9	100
Population	Frequency	26311	3869	2101	1009	1756	35046
	%	75.1	11.0	6.0	2.9	5.0	100
Particip. Rate (%)		6.2	18.3	23.8	28.7	36.2	10.7

\*The number of papers is calculated by formulae 1 (in case of single author), 2/(n+2) (in case of main

author), and 1/(n+2) (in case of co-author), where n=number of authors and n>1

### 4.3 Factors influencing the academics' knowledge-transfer activities

An economic model using a patent production function as a dependent variable is also adopted here. The **dependent variables** are related to the academics' knowledge-transfer activities in 2008 (i.e. the number of domestic and overseas patents applied for, the number of technology transfers and the revenue from the technology transfers). In terms of the **independent variables and the control variables**, the following factors influencing entrepreneurial activities are employed: scientific capacity, funding sources of academics, institutional characteristics (e.g. location and legal status). Alternatively, instead of institutional characteristics, dummy variables representing the universities' characteristics are adopted in order to understand what specific types of university differentiate the extent of entrepreneurial activities of universities

The dependent variables, such as numbers of patents and technology transfer in this study, are count variables (i.e. zero or positive integers). Therefore, a Poisson distribution and negative binomial distribution can be regarded as alternatives for the regression analysis here. According to the descriptive statistics in Table 1, over-dispersion (i.e. the variance is much larger than the mean) is clearly identifiable. This also proved to be statistically significant from the magnitude of the alpha value.<sup>1</sup> Consequently, a negative binomial (NB) model is more appropriate than the Poisson model in this analysis. Furthermore, in the case of domestic patents, the Vuong test result indicates that a standard negative binomial (NB) model has a better fit than a zero-inflated negative binomial (ZINB) model, while in the case of overseas patents and technology transfer, the latter has a better fit.<sup>2</sup>

Based on the above argument, a negative binomial (NB) regression model is employed for predicting the number of domestic patents. A zero-inflated negative binomial (ZINB) model is chosen for the estimation of the numbers of overseas patents and of the number of technology transfers. However, the Tobit model is adopted for explaining the revenue from technology transfer, because the dependent variable (i.e. the value of revenues) can be regarded to be censored in the area of a negative real variable. In order to prevent excessive multi-collinearity between the explanatory variables, the variables with a high VIF are excluded.<sup>3</sup>

According to the model provided above, we have identified the factors influencing academics' knowledge-transfer activities, as shown in table below.

<sup>&</sup>lt;sup>1</sup> All the alpha values in NB and ZINB models we introduced here are significantly different from zero at the level of 95% confidence.

<sup>&</sup>lt;sup>2</sup> In case of the estimation of domestic patents in model 1, Vuong test results of zero-inflated vs. standard negative binomial consistently supports the latter (i.e. z-value resulted from the tests are smaller than 1.96). However, Vuong test results in models 2 and 3 support ZINB models, which means that the dependent variables in these models has excessive zeros.

<sup>&</sup>lt;sup>3</sup> In each model, we exclude several independent variables with larger than 10 VIF (Variance Inflation Factor) value, because those variables are possibly linearly related to other independent variables. In this case, exclusion of significant independent variables could result in the overestimation of the significance of remained independent variables.



## Table 2 Negative Binomial (NB), Zero-Inflated Negative Binomial (ZINB) and Tobit estimation of knowledge-transfer activities

knowledge transit	ci activities				
Models	Model 1 (NB)	Model 2 (ZINB)	Model 3 (ZINB)	Model 4 (Tobit)	
widdels	Domestic Patent	Overseas Patent	Tech. Transfer (TT)	Revenues from TT	
Gender	.555***(.111)	.614**(.205)	.319(.222)	1.67e+07*(8.70e+06)	
Career	052****(.012)	.154***(.218)	.121***(.026)	4.63e+06***(8.87e+05)	
Career^2	002***(.0004)	005****(.001)	004***(.001)	$-1.41e+5^{***}(2.92e+04)$	
Discipline					
- Engineering	.796***(.068)	.410***(.152)	1.066***(.159)	5.12e+07***(6.35e+06)	
- Med. & Pharm.	903****(.095)	-1.319****(.193)	542*(.238)	-1.71e+07*(7.46e+06)	
- Agri. and Mari.	280*(.113)	-1.118*(.474)	.594**(.230)	3.82e+07***(9.97e+06)	
Location in C-area	.402***(.057)	188(.151)	.270*(.128)	1.88e+07***(4.61e+06)	
Legal status	.313***(.057)	.195(.152)	.190(.132)	$1.54e+07^{***}(4.65e+06)$	
Papers published					
- domestic journal	.175***(.027)	038(.087)	.205***(.052)	6.50e+06 <sup>**</sup> (2.32e+06)	
- SCI journal	.440****(.026)	.200***(.047)	.060(.050)	1.77e+07***(1.42e+06)	
R&D funding					
- Cent. Gov't	$1.05e-09^{***}(1.23e-10)$	$1.04e-09^{***}(1.86e-10)$	$1.82e-09^{***}(3.70e-10)$	.029***(.003)	
- Loc. Gov't	1.43e-09 <sup>**</sup> (4.72e-10)	5.16e-10(3.77e-10)	2.49e-09 <sup>***</sup> (7.06e-10)	.095***(.015)	
- Industry	$1.47e-09^{***}(4.08e-10)$	1.05e-09(8.86e-10)	2.39e-09 <sup>***</sup> (5.03e-10)	.046***(.007)	
- Overseas	4.42e-09(1.99e-09)	9.77e-09 <sup>***</sup> (2.58e-09)	8.20e-10(1.32e-09)	.205*(.081)	
- Self funding	2.85e-09 <sup>***</sup> (8.75e-10)	2.60e-09*(1.06e-09)	1.95e-09(1.02e-09)	.033(.031)	
TTO size	-	-	-	-	
Regional BERD	-	-	-	-	
Constant	-4.140****(.131)	-5.313****(.309)	-5.217***(.333)	-3.55e+08***(1.54+07)	
Ln-alpha/Sigma	.869(.057)**	1.417(.064)***	2.220(.075)***	1.20e+08(3.66e+06)***	
Log-likelihood	-9504.671	-2237.899	-3528.872	-15174.95	
Wald/LR $\chi^2$ (d. of f.)	3594.73(14)***	617.94(15)***	792.48(15)***	822.91(15)***	
No of observations	35044	35044	35044	35044	

a. Robust standard errors in brackets

b. \*p<0.05, \*\*p<0.01, \*\*\*p<0.001, +p<0.1

### 5. Conclusion: summary of findings

According to the results of the regression analysis, firstly, the individual characteristics of academics such as gender, career, and disciplines are significantly related to their knowledge-transfer activities. In particular, the inverse-U relationship between career and knowledge-transfer activities is strongly supported across the different models. Moreover, compared to the discipline of natural science, that of medical and pharmaceutical science is negatively and significantly related to knowledge-transfer activities. Secondly, the contextual characteristics of academics such as legal status and location of the affiliated universities are significantly related to domestic patents application and revenue creation from technology transfer. Thirdly, in terms of the sources of research funding, overseas patent application show a different pattern compare to the other regression results. In other words, research funding from local governments and that from industry are not significantly related to overseas patents application,

whereas research funding from overseas institutions is significantly related to overseas patents application. Finally, in terms of the relationship between research activities and knowledge-transfer activities, overseas patent application is only related to publication in SCI journals. In contrast, technology-transfer activity is only related to the publication in domestic journals.







### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

# June 17(Saturday)

# Session-17-#301-2(SS11 & SS13)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 11:20~13:00)

### "Knowledge, Value, Ethics, and Business Ecosystem"

Chairs: John C. Yi(Saint Joseph's University, USA), Jeong SukJae(KwangWoon University, Korea)

- Paper 1: "Ecosystems are co-created: Fostering value-driven relationships between business, government, and people with technology" by Brent Smith
- Paper 2: "Organization, platform, & Business Ecosystem" by Dohoon Kim
- Paper 3: "Creative Attitude, Cultural Literacy, and Cultural Receptivity in an Era of Sustainable
   Development" by Kwangho Jung, Seung-Hee Lee & Jane. E. Workman
- Paper 4: "The rise and fall of RFID-using food waste meter rate system: A case of Gangnam district in South Korea" by **Kwangho Jung & Sabinne Lee**
- Paper 5: "Higher Education Promotion for knowledge-based Innovation: focusing on Brain Korea 21 Program in Korea" by Kwangho Jung, Dongguk Kim & Chanwoo Kim

### Session-17-#303-2(SS10 & SS27)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 11:20~13:00)

### "Climate change and environmental resilience"

- Chair: Sang-Don Lee(Ewha Womans University, Korea)
- Honor Discusser: Ulrich Witt
- Paper 1: "Trends of phenological responses to climate change and urbanization in South Korea" by Se Young Park & Sang Don Lee
- Paper 2: "Open innovation of industrial ecosystems some Chinese cases" by Lei Shi
- Paper 3: "Business Model for Innovation within Circular Economy" by Junghee Han & Almas Heshmati
- Paper 4: "Analysis on determinant affecting open innovation of Korean Network Service Industry" by **Euo Do Kim & Junghee Han**







### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

### June 17(Saturday)

# Session-17-#321-2(SS21 & SS30 & GS4)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 11:20~13:00)

### "Social Network and Technology Commercialization"

- Chair: Kiseok Kwon(Hanbat National University, Korea)
- Paper 1: "Agro-economic situation in the world and domestic markets of agricultural and food products in the CIS countries: Russia, Ukraine, Kazakhstan and Belarus" by Lee Sangduk &Lee Soon-joo
- Paper 2: "Multiform Context Dynamic Cooperation Strategies of Enterprise Organization Knowledge Share" by LI Kun
- Paper 4: "Integrating Business Model Development and Open Service Innovations in Textiles and Clothing Industries: A Case-based Approach" by Min-Ren Yan, Po-Hong Lin & Chia-Chi Hsu
- Paper 5: "A comparative study between the heritage of the three states in Korea and the divine comedy in Italy-Hidden Rules in Happiness Equations-" by Sang C. Lee, Kwon Dong Kim & Jong Han Chae

Session-17-#301-2(SS11 & SS13)

# ECOSYSTEMS ARE CO-CREATED: FOSTERING VALUE-DRIVEN RELATIONSHIPS BETWEEN BUSINESS, GOVERNMENT, AND PEOPLE WITH TECHNOLOGY

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#### Abstract

Innovation is a topic of conversation, characteristic of distinction, and unifying objective for business professionals in the world's leading economies. Technology's creative geniuses (e.g., Steve Jobs, Bill Gates, Jeff Bezos) and geographic centers (e.g., Silicon Valley) are often cited as the model examples for what fuels, drives, and directs innovation. Yet, communities elsewhere have the potential to develop their own innovation ecosystems by carefully coordinating their resource base, exploiting (non)location-bound advantages, and charging government leaders to support co-creation exchanges among local/regional organizations.

Ecosystems can be sustained on a local level, and integrated into broader global ecosystems. Thus, innovation can be fostered locally to generate location-specific solutions. These solutions can originate from within the locale or be sourced beyond it, and applied within it. For example, cloud solutions developed by Amazon (Seattle, WA), visual analytics tools developed by Tableau (Seattle, state), and periodic face-to-face community meetings can help farmers in Whiteville, NC co-create data-driven insights for optimizing yields, prices, logistics, and so forth during planting and harvesting periods.

Is there a framework for ecosystems? Yes. Platform-based initiatives have been a driving force for building value-driving ecosystems—locally fostered and globally connected—in Europe, North America, Asia, and Africa. These platforms manifest in four different but complementary types, including:

- 1. *Transaction platforms* function as conduits for facilitating relationship exchanges/transactions between various users, buyers, and/or suppliers.
- 2. *Innovation platforms* provide foundations upon which various organizations develop webs of complementary products, services, and technologies.
- 3. *Integrated platforms* bring together transaction platforms and innovation platforms. Example would include Google's App Store, YouTube and other properties, and the vast ecosystem of users and developers that produce/contribute content for the platform.
- 4. *Investment platforms* are essentially holding companies that have internalized a platform portfolio strategy or investments based on such a strategy.





This conceptual project considers how communities can think globally and benefit locally. By utilizing platform-based initiatives, industry, government, and the people can co-create ecosystems that generate sustainable value for the long-term future.

TRÁCA

Keywords: Value, ecosystems, co-creation, value-driven relationships, innovation platforms,

Paper type: Academic Research Paper

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Session-17-#301-2(SS11 & SS13)

### Creative Attitude, Cultural Literacy, and Cultural Receptivity in an Era of Sustainable Development

Kwangho Jung (Seoul National University) Seung-Hee Lee (Southern Illinois University) Jane. E. Workman (Southern Illinois University)

#### Abstract

**Research Question:** Fostering creativity comes from various dimensions in terms of incentives, knowledge, and culture. Despite many diverse arguments on how to promote creative attitude and mind, there are two competing arguments about what factors promote creativity: economic and non-economic factors. Economic approach emphasizes that various extrinsic incentives including performance payment, bonus, and promotion facilitate creativity. On the contrary, non-economic approach suggests that creativity is a function of various non-pecuniary factors including cultural activities (Leung et al., 2008) like cultural literacy and receptivity as well as community trust, reciprocal respect, and life satisfaction(Carr, 2011; Chae, 2016; Davis, 2009; Niu, 2014; Pannells & Claxton, 2008). While most research focusing on how tangible products based on economic incentives(e.g., patent, article) are related to creativity, less empirical research has discussed how intangible activities such as cultural knowledge and orientation influence creativity. Sustainable development involves not only economic prosperity but also cultural activities and diversities. It is necessary to identify how cultural elements are related to creative mind and attitude in order to deepen an understanding how to foster creativity.

**Research Background:** Creativity has increasingly become a core agenda to solve global issues including sustainable economic growth, business competitiveness and entrepreneurship, inequality, and human development (Bass et al., 2008; Barron & Harrington, 1981; Boden, 2004; Neumann, 2007; Nickerson, 1999; Šarotar Žižek et al., 2014). The creative mind and attitude is crucial to not only promoting digital economy in an ear of globalization but also to reaching an appropriate level of social and human development. Previous research has mainly focused on how creative elements embedded in people, organizations, regions, and culture are associated with innovation (Carmeli & Spreitzer, 2009; Rasulzada & Dackert, 2009; Sawyer, 2011) or economic prosperity. For instance, such conceptual instruments as creative class, creative city, and creative economy have been used as proxies to reflect the nature of creativity to uphold job, income, productivity, and innovation. However, most previous research has neglected how these non-economic factors such as cultural activities and knowledge can promote creativity.

**Research Method:** We, relying on a national representative sample in South Korea, empirically test whether or not there may be the significant relationships between creativity and cultural literacy, and between creativity and cultural receptivity. Creativity is measured as a proxy of creative attitude. In this





study, creative attitude consist of four items: orientation for newness, imaginativeness, receptivity to new ideas, and sensitivity. Cultural literacy is measured by an amount of cultural knowledge. This study use 9 items with a dichotomy measure(Yes or No) to test cultural knowledge whether or not respondents know culturally related questions. Cultural receptivity consists of four items: the degree to treat foreigners as neighbor, the degree to trust foreigners regardless their nationalities and ethnics, the willingness to participate in diverse events or festivals for foreigners, and the degree to agree on the point that foreign culture can prosper our culture. We will conduct multiple regression analyses of creative attitude, cultural literacy, and cultural receptivity, after controlling for age, gender, income, and education.

DGIST

**Expected Findings:** It is expected that there are significant relationships between cultural literacy and creative attitude, and between cultural receptivity and creative attitude. We suggest that public policy to promote creativity should concern about various non-economic factors, especially culturally related intangible elements including cultural literacy and cultural receptivity

Keywords: Creativity, Economic Incentives, Non-economic Factors, Cultural Literacy, Cultural Receptivity

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Session-17-#301-2(SS11 & SS13)

### The rise and fall of RFID-using food waste meter rate system: A case of Gangnam district in South Korea

Kwangho Jung (Seoul National University) Sabinne Lee (Seoul National University)

#### Abstract

This paper examines how the application of RFID technology for food waste disposal adopted, implemented, and terminated in Korean municipal governments. This case story of policy termination illustrates that even public policy based an attractive new technology can be terminated due to various organizational and human barriers. Since 2012, South Korea has adopted food waste meter rate system among the autonomous local districts. Some local governments have still used a conventional food disposal bag with a volume based fee system but others adopted the RFID technology for food waste disposal. The adoption of the RFID system has increased following an early diffusion model of new technology. However, few local governments have adopted at an early policy period of a volume based food waste disposal but terminated it after implementing due to various problems. For instance, Gangnam district, one of the wealthiest districts in South Korea, adopted RFID technology in food waste meter rate system in the early 2012 but returned to its traditional way of waste disposal, a garbage bag about a year later. We investigate, relying on interviews, Schilling's Technology Lockout Model, and Q-Methodology, the whole process of RFID adoption which is composed of 5 sectors of Gangnam districts and identified several key factors to contributed to locking out of the RFID system. We have interviewed public officials, apartment complex residents and head of security office of apartment for in-depth case study. More specifically, we found key barriers to implementing the RFID system, including lack of core managerial capabilities, absorptive capacity, insufficient installed base, timing of entry, and policy network. Q- statements from Q-Methodology allows us to display various aspects of the locking out case and factor analysis provides key factors to look at this policy termination case. This policy case suggests that an innovative policy idea based new technology like RFID may face various organizational and human obstacles in the process of implementation and be terminated.

Session-17-#301-2(SS11 & SS13)

### Higher Education Promotion for knowledge-based Innovation: focusing on Brain Korea 21 Program in Korea

Kwangho Jung (Professor, GSPA, Seoul National University)Donguk Kim (Professor, GSPA, Seoul National University)Chanwoo Kim (Ph.D. Student, GSPA, Seoul National University)

#### Abstract

The purpose of this paper is to examine current status of higher education reform in Korea by focusing on 'Brain Korea 21 (BK21) that leads to knowledge-based innovation in Korea. The BK21 has been a major higher education reform program initiated by the Education Department in central government to cultivate Korean human resources for the 21st century for over the decade. Fostering world-class graduate schools and high quality scholars by providing funds to higher education institutions, the BK21 has outperformed a knowledge-based innovation in public education field by competing researchoriented performance among graduate schools.

In this paper, we explores the roles of the BK21 on knowledge-based innovation in higher educational field by describing societal, economic and educational changes which led to the initiation of BK 21 and its implementation processes. Then, we analyze the knowledge-based performance among graduate schools participating in the BK21 over decade period. Also, we will suggest knowledge-based innovation policy in higher educational field based on the BK21 program cases.

This paper will contribute to provide policy suggestions driving policy makers to cultivating knowledgebased innovation by supporting higher education human capital. Also, this suggestion will be applicable for developing nations that need to catch up developed nations possessing knowledge-based innovation system within graduate school.





# Trends of phenological responses to climate change and urbanization in South Korea

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#### Abstract

Phenological dynamics have been recognized as key attributes of plants and animals that are being affected by a warming climate (Parmesan & Yohe 2003; Root et al. 2003; Cleland et al. 2007). As a result of rising temperatures, many plant species are leafing out and flowering earlier in the spring, many animals are active earlier, and many migratory birds are arriving earlier at points along their migration routes (e.g., Inouye et al. 2000; Fitter & Fitter 2002; Cotton 2003; Miller-Rushing & Primack 2008). However, the changes vary considerably among species; some species are changing dramatically while other are not changing at all (Fitter & Fitter 2002; Lehikoinen et al. 2006; Sherry et al. 2007; Miller-Rushing & Primack 2008). Climate change could, thus, disrupt relationships among some species and their environments, causing ecological mismatches. Even if they were to occur only during a short period of time, mismatches among species in their phenological responses to climate change could potentially lead to the decline and even extinction of species. Current studies are either region-limited, sole species or short researching period so the studies about various species are necessary throughout South Korea. In this study, trends of change the budding and flowering dates of spring plants in South Korea by climate factors such as temperature and precipitation according to the climate change and urbanization. Four species such as Forsythia koreana (forsythia), Rhododendron mucronulatum (azalea), Prunus yedoensis (Yoshino cherry) and Prunus mume (Japanese apricot) are focused during the period from 1973 to 2008. Three types of regions were divided by plant species and phenological events. Finally, budding of Forsythia koreana, Rhododendron mucronulatum, Prunus yedoensis and flowering of Prunus mume are defined as Type I, and flowering of Forsythia koreana, Rhododendron mucronulatum, and Prunus yedoensis were grouped as Type II. Prunus mume budding was different from others so that it defined as Type III. There are no differences cluster 1 of between Type I and II. The region is cold and dry area that affected by Siberian high atmospheric pressure, on the other hand, cluster 2 and 3 are humid and warm coast areas even in winter season due to the southeastern wind.

There were the advancements for 3.1 days of *Forsythia koreana*, 5.5 days of *Rhododendron mucronulatum*, and 6.5 days of *Prunus yedoensis* and 18.6 days of *Prunus mume* during the research period. These phenological events are due to climate changes. The most changes were occurred in Jan minimum temperature and Feb maximum temperature and precipitation change was not significant. But in cluster 1 of type II, the precipitation significantly impacted on plant flowering events. Precipitation would be the lowest in early spring in South Korea, and especially the flowering of plants were impacted

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by few amount of precipitation in this region. Also, if precipitations after budding are over 1mm for *Forsythia koreana* and *Rhododendron mucronulatum*, 2mm for *Prunus yedoensis* and 7mm for *Prunus mume*, flowering was done in over 80% of regions.

South Korea has a small land and high density population in cities so it gets huge influence by global warming as well as urbanization. Seven metropolitan cities and Suwon that has over 1 million populations showed more remarkable phenological events and changes of climate factors than the other regions. Especially in case of shrubs, the phenological events were delayed in urban areas during this research. These phenomena are the evidence to explain the quality of the air and decreasing of the amount of light from buildings were the factors for impacting on shrubs. Literature Cited

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# Open innovation of industrial ecosystems – some Chinese cases

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#### Abstract

**Purpose**/ **Research Question**: The paper will argue why the evolution of industrial ecosystems can be considered as open innovation by taking some eco-industrial parks cases in China.

**Key Literature Reviews (About 3~5 papers)**: Industrial ecosystems are complex engineering systems composed of many as well as different types of components and links. From dynamic perspective, open innovation contributes to the evolution of industrial ecosystems. We can find many innovation measures in the classical Kalundborg industrial ecosystems, such as waste exchanging, cascading usages and infrastructure sharing. All these innovation measures were incorporated into an open innovation system or cycle due to the openness of industrial development.

#### Design/ Methodology/ Approach: Case study and complex network method.

The first case is the Ningbo Economic and Technological Development Area (NETDA). Another case is the Yixing Environmental Industrial High-tech Park. After these case studies, we also uncover some structural complexity and functional complexity embodied in these industrial ecosystems by adopting complex network method. These agencies are described as nodes in networks, and relations as links, such as supply chain, competition and cooperation relations.

#### (Expected) Findings/Results:

The first case is the Ningbo Economic and Technological Development Area (NETDA). Since its establishment in 1985, NETDA has gradually formed into a comprehensive industrial base including petrochemicals, energy, steel, paper, automobile, ship and other six port industrial clusters. These heavy industries contribute to rapid economic growth, but also bring huge resource and environmental burdens. Since 2005, NETDA explored a sustainable development model according to circular economy principles and achieved remarkable results. In 2008, NETDA was awarded the title of the Best Practices of circular economy in Zhejiang Province. In 2013, NEDTA listed as the pilot circular economy for the industrial parks. By uncovering the evolution of key industrial sectors and ecological infrastructures, we can observe the model of open innovation and also find the roles of technological improvement, market evolution and environmental governance.

Another case is the Yixing Environmental Industrial High-tech Park. After more than 30 years of development, Yixing has become the largest environmental industrial base in China, with more than

1,000 firms and industrial output of 3 billion dollars. Yixing also attracts more than 100 R&D agencies, including Tsinghua University, Nanjing University, Harbin University of Technology and others. Together with promotion centers, information centers and financial institutions, these agencies form an open innovation system, just like an ecosystem with highly woven relations.

**Research limitations/ Implications**: Through survey on enterprises, we got around 100 samples with information about supply chains, competition and cooperation relations. By defining the predation, competition and symbiosis relations between agencies, the Yixing environmental industry can be viewed as a network of ecological system. Then we use network analysis, one of the powerful method for complex systems, to uncover the centricity, the hierarchical features and the community structures.

**Keywords**: Open innovation; industrial ecosystems; complex network





## **Business Model for Innovation within Circular Economy**

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#### Abstract

Business model must be adaptive over times in response to changing the markets, technologies, environmental, and economic circumstance. For companies, being increasingly scarce in resources business model is becoming business constraints. Under the circular economy the principles of a new approach to business modelling is necessary. Limited exploitation of the resource in earth planet forces firms to change their business model. The aim of this paper is to suggest pertinent business model in circular economy. To fulfill it, a qualitative methodology is used. This paper suggests five business models: green-loop model, pass-loop model, having-loop model, being-loop model, and hybrid-loop model. In the beginning phase, while it takes a long time for them to become mainstream, it is conceivable that firms be adopted step by step to a minority of existing business. In the long run, this new approach can give rise to the evolution of new business model. Business model in circular economy contain the principles of maximizing energy use efficiency by minimizing the total energy consumption of producing products or services. Cost and convenience for both firms and consumers are the key critical factors to be channeled in the new business model for innovation to achieve the greening and efficiency objectives.

Keywords: business model; green economy; circular economy; circular business model; innovation;

### Analysis on determinant affecting open innovation of Korean Network Service Industry

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#### Abstract

When it comes to information, communication and technology (ICT), Korea is the one of the fast mover countries. It is no exaggeration to express that Korea is the fastest smart socialization country taking both industries and life pattern into consideration. The smart society as a results from utilization of ICT changes how people live, work and play. Our interactions are mediated by machines. The objective of this paper is to find determinants of open innovation on network service industry in Korea. To fulfill it, this paper utilizes logistic regression model and AHP methodologies to estimate the research hypothesis. Data set was collected through conducting the survey for 300 firms, which compose of 92 network smart industry sectors, and smart home industry sectors. From the empirical findings, we propose new concept evolved innovation system based on open innovation, value-centered innovation system (VEIN). VEIN can ignite open innovation more easily due to the advent of smart era based on using the network service industry. This findings can contribute to study open innovation in both practical level and academic level.

JEL Classification Numbers:

Keywords: Open innovation; Information, communication Technology (ICT), Innovation, Network service industry, Korea.





# Agro-economic situation in the worl<sup>1</sup>d and domestic markets of agricultural and food products in the CIS countries: Russia, Ukraine, Kazakhstan and Belarus

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#### Abstract

The Commonwealth of Independent States is one of the global\_intergovernmental regional economic unions, the development of which overlaps with the major global trends - globalization and regionalization. At present, the CIS faces the problem of finding a niche for itself in the context of changing configuration of the modern world, increasing competitiveness of the national economies, and transforming the Commonwealth into a regional economic union able to play a significant role in the global economy. The Commonwealth of Independent States has significant resource capacity. It covers 16.4 % of the world territory with approximately 4.4 % of the world population. The CIS owns about 20 % of world oil reserves, 40 % of natural gas, 25 % coal, 10 % of electricity production, 25 % of the world forest resources, almost 11% of the world renewable water resources and 13 % of all arable land. Transportation and communication systems of the CIS states are playing an increasing role in global transport channels. Significant capacity is a sufficient basis to increase production, ensure economic stability and improve the livelihood in the CIS states.

During 1992-1995, the volume of agricultural production in the CIS countries was decreasing by 7.5 % annually, during 1996-2000 - by 1.4 %. Subsequently, there was an increase of agricultural production. During 2001-2005, the average annual growth rate of agricultural production amounted to 3.8 % in the Commonwealth, and during 2006-2010, it reached 1.9 %. For twenty years the total area of arable land in the CIS decreased by 14 %. The number of cattle over the years has decreased by 52 %, including 42% of cows, pigs - by 51 %, sheep and goats - by 41 %. Cattle and poultry for slaughter (slaughter weight) produced during this period decreased by 27 %, milk – by 28%, eggs - by 5%.

There have been positive trends in the development of agriculture in the CIS countries during the last ten years. The sown area of grain and legume crops expanded by 12%. In 2012, the Commonwealth milled more than 157 million tons of grain, which is 18 % more than in 2000, sunflower (grain) – by 1.7 times more. The harvest of vegetables increased by 44 %, sugar beet - by 36 %, fruits and berries - by 24%, while the gross harvest of potatoes declined by 11 %.

In 2001-2013 the situation with livestock (pigs, sheep and goats) as well as a poultry production has been improved, which allowed the CIS increase the production of livestock and poultry for slaughter (slaughter weight) by 1.7 and the gross eggs production by 1.5 times. At the same time, the number of cattle has been reduced (January 1, 2013 compared with January 1, 2001 - 10%), including cows (16%).

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The increase in production of milk over the last 10 years in the Commonwealth increased by 11% due to the improved productivity of cows. In current conditions, Russia gains a particular importance for the prospects of dynamic development of economic relations with the CIS countries, determining largely its geo-strategic position in the post-Soviet and Eurasian region, as well as at global level. Russia is a major investor in the economy of the Republic of Belarus. The maximum complete realization of mutual export opportunities of Russia and Belarus is directly related to the prospect of modernization of the Belarusian industrial sector and the active participation of Russian capital in the privatization of Belarusian enterprises. Its share in the economy of Belarus is about 80%.

**Crop production**. In October 2012, the Russian Federation had prices for feed grain higher on 169.8-256.3 %, bread wheat price - 88.2, barley – 79.5, oats - 112.6 % (Table 6) compared with the Republic of Belarus (at the exchange rate of the National Bank of Belarus). Whereas Ukraine grain prices were much higher (on 5.7-294.1 %) than in the Republic of Belarus. Kazakhstan grain prices were higher than in the Republic of Belarus (on 202.7-259.3 %).

**Livestock products**. In October, the purchase prices for cattle in slaughter weight (average and lower than average fatness), pigs (II and III category), as well as for milk production in the Russian Federation were higher than in Belarus: 29.3-50.5: 24.5-36.1 and 32.4 %, respectively (at the rate of National Bank of the Republic of Belarus). In Kazakhstan, the purchase prices for milk were higher than in Belarus by 60.9 %, and in Ukraine - by 6.9 %.

**Retail prices.** In October, Russian retail prices (at the rate of National Bank of the Republic of Belarus) for beef, pork and milk were higher on 31.4-44.2 % than in the Republic of Belarus, for potato and vegetables – 42.8-138.0; bread - 36.6; cheese - 20.4; sugar - 8.7; eggs - 5.7 %. In Ukraine, in comparison with the Republic of Belarus, milk was more expensive by 15.1 %, beef - 19.2%, pork - 19.2% (data for 2012). Ukrainian sunflower oil was cheaper by 9.5 %, rice - 37.6 %, poultry meat - 14.9%; sugar – 16%, cabbage - 2.4%; rye-wheat bread - 15.9%. In October, in Kazakhstan, milk was cheaper than in Belarus by 3.3 %, cabbage - by 15.2 %. It is to be recalled that in September in Kazakhstan milk was more expensive by 6.8 %, cabbage - by 17.7 %. Retail price growth was registered for the following products: beef - 11.9 %, potatoes - 128.8%; butter - 22.1%; sugar - 36.6%; sunflower oil was more expensive (by 6.8 %) in Belarus.

Despite the economic downturn in '90s and the subsequent global financial and economic crisis, there is a revival of growth in the economy of the CIS countries. Moreover, in spite of the successes achieved in the agricultural sector in recent years, economy is still under the strong influence of external factors, and the CIS countries still lag behind the leading producers of agricultural commodities. The key factors hindering the development and efficiency of domestic agriculture and livestock are the organizational and technological factors, including the lack of material and technical resources and production base. Positive returns of agro-industrial potential of the CIS countries can be achieved by a rational combination of strategies in sectorial and territorial development under optimal proportions of agro-industrial complex development, and with involvement of investment projects and state target programs on development of agricultural production and processing, and enhancement of sustainability of rural areas. Subsequently, the above mentioned countries have great opportunities and potential, not only to develop agriculture and livestock production but also to enhance the export capacity, which will contribute to a real economic growth and increase their impact on the development of the world economic system.





# Multiform Context Dynamic Cooperation Strategies of Enterprise Organization Knowledge Share

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#### Abstract

Under the research Canonical Form of dynamic cooperation game, the behavior characters of enterprise's knowledge share is analyzed, and the problem of knowledge share is divided into two strategy types: perfect and non-perfect information conditions according to enterprise's knowledge applying traits based on defining to cooperation mechanism accessories. Sequentially, the optimum knowledge transfer strategies of organization staffs (players) are studied in above two strategic types that include respectively two revenue objects : organizational revenue priority and individual revenue priority that means there are 4 different context constraints. Lastly, the knowledge cooperation behavior characters and rules have been concluded under different information conditions and different knowledge applying traits through comparing players' optimum knowledge share strategies in different contexts.

Global economy is converting from recession to recovery in present; there are a lot of uncertain factors in the complex and varied market environment. This means an unpredictable and high velocity circumstances for the organizations. In these conditions the possession of VRIO resources (valuable, rare, inimitable, non-substitutable, Barney, 1991) will not lead to competitive advantage. Although by building dynamic capabilities for the company can create success. Dynamic capabilities are the combination of organizational assets to create valuable product or services for customers and it includes three activity of sensing, seizing and transforming (Teece, 2011, Eisenhart and Martin, 2000). It involves cross-functional product development, R&D routines, technology and product innovation processes (Martin, 2000), strategic decision making capabilities (Rummelt, 2011). All of these initiatives are highly dependent on the cooperation and knowledge share of organizational members.

It also means that the strategies of business or R&D should highly focus on cooperation and hardworking in the organization, rather than only on individual's knowledge or intelligence. Undoubtedly, competitiveness of enterprise comes from sustaining and efficient organizational cooperation. Core essence of organizational cooperation is knowledge cooperation, which means activation, conversion and integration of organizational knowledge resource, and is necessary premise for enterprise to implement innovation strategies. Though knowledge cooperation in improving innovation and performance has been well accepted. (Szulanski<sup>[1]</sup>, 1996; Tsai<sup>[2],[3]</sup>, 2001; Lee<sup>[4]</sup>, 2005), in practice it is just in appearance, but not in essence; just has performance but not effectiveness. So it would not be helpful to enterprise in integration of knowledge deposit and breakthrough in innovation efficiency. For this, it is necessary to analyze the microcosmic mechanism happens of knowledge share systematically in an organization, and explain the psychological motivation of knowledge share among individuals combined with specific institution context deeply. The goal of this paper is to analyze the different individual factors of knowledge sharing process by using game theory methodology.

The existing research on knowledge cooperation is focused primarily on the exploration of the content and the process of knowledge exchange within the organization; or observe the effect of organizational support on the member's knowledge contribution externally. The researchers seldom analyze the knowledge cooperation of the members individually and the interaction motive from the micro level of inspiration mechanism, and they are lacking of consideration of the content constraints, which are critical to the systematical analysis of the mechanism of the efficiency of the organizational knowledge share. According to above researches, especially, the cooperative game analysis based on contexts' constraint, some research opinions and results, such as the optimization principle of dynamic cooperation strategies, the influence on organizational sustaining cooperation from organization rent allocation's justice and efficiency et al, have vital inspired sense to study knowledge share behavior characters of microindividuals, and in this paper the knowledge share behavior mechanism of organization individuals would be studied under the research canonical form of dynamic cooperation game study combined with multi-contexts constraint analysis method.

Enterprise knowledge sharing mechanism within the organization is essentially a typical problem of dynamic cooperative games, in this process, not only the organization's institutional constraints, the common interests among members which produced the cooperative efforts, but also the intention which members maintain their competitive advantage within the organization; maximize their own gain from production of knowledge resulting from acts of each strategy, all of these cause mutual strategies among players. The results indicate that: the process of dynamic knowledge sharing game, the players at any stage of the knowledge sharing efforts are based on the premise of the interests of specific target, the intensity to knowledge contribution is up to the completeness of information in organizational context, especially as follows:

Primarily, when organization members' behavior strategy and strategic income easily observed (perfect information context), knowledge members will strategically control the output intensity of their knowledge. On the perfect information condition, although the existence of "Punish" mechanisms ensure the continued sharing of organizational knowledge, the prerequisite of the knowledge recipient's effort to return their knowledge is able to get more competitive advantage in knowledge exchange, namely manifested as "knowledge transaction" obviously.

And then, in relation to perfect information context, in the intricate technical environment where members' behavior strategy and strategic income not easily observed (non-perfect information context), either organizational revenue targets first or individual first, Knowledge transferor and knowledge recipients by knowledge sharing will have shown a more conservative, more stringent control of the output of knowledge. It is worth noting that in an imperfect information environment, the knowledge recipient's effort is based on knowledge transferor who adjust by the amount of knowledge transfer flexibly in the first stage, but no matter from the point of the expected proceeds of organization or





individual, knowledge return within the organization has shown a higher "knowledge transaction" characteristics.

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Implications of these findings are: as a mechanism for dynamic cooperative games in essence, the emergence and persistence of knowledge-sharing in organization must have some necessary institutional components, e.g. statutory return rate and penalty mechanism to prompt staffs to share or return after obtain others' knowledge transferring. However, institutional components only means that the form of knowledge share will continually exist. the formal continuance to knowledge exchange, while can not reach and ensure the efficiency of knowledge sharing. In particular, for those organizations which technology application is relatively independent and knowledge transfer efforts and income is not easy observed, the validity of knowledge sharing is more complex. The strategic control of knowledge output, the "knowledge transactions" feature of knowledge return and output is a serious reality that the organization could not evade that restricts the efficiency of knowledge sharing. To this end, raise the "proceeds of knowledge", create a strong organizational culture, and increase perceived organizational support to staff to promote them and enhance the intensity of knowledge output would be feasible and effective to reduce knowledge output control, weak "knowledge transaction" behavior and to optimize the organizational knowledge-sharing mechanisms

Keywords: enterprise, knowledge share, cooperation game, context.

# Integrating Business Model Development and Open Service Innovations in Textiles and Clothing Industries: A Casebased Approach

Min-Ren Yan Po-Hong Lin Chia-Chi Hsu





### A comparative study between the heritage of the three states in Korea and the divine comedy in Italy. - Hidden Rules in Happiness Equations-

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#### Abstract

The mathematical analysis of the Nobel memorial prize winner in economics sciences Paul A. Samuelson's equation of happiness has been expressed as the product of the satisfaction function (X) and the desire function (1/X). It is worth noting here that the satisfaction function and the desire function have a relationship of proportional and inversely proportional to degree of satisfaction or degree of desire. If we look at the satisfaction function and the desire function separately, one more thing is that the degree of satisfaction or the degree of desire varies according to the degree of happiness. In the satisfaction, the same happiness can be obtained irrespective of the degree of satisfaction of each section, but the degree of happiness obtained according to the degree of desire by interval is significantly different in the desire function. The degree of happiness obtained by reducing desire to a certain degree by reducing desire is much greater than reducing desire in a state where desire is fully satisfied.

It should not be overlooked that there are difficulties in achieving satisfaction and desire in each section. In the satisfaction function, happiness does not increase any more (satisfaction of limit) when the degree of satisfaction is satisfied to some extent, and unhappiness (extreme satisfaction) when the absolute value of satisfaction is not satisfied. In addition, as the desire function increases, it is difficult to satisfy happiness (infinite desire). On the contrary, in the state of eliminating the desire to the extreme, one more vacancy (desire for transcendence) is a thing that is never desired, and it can be understood as the supreme enlightenment in Buddhism i.e. Daibori.

It seems that the time has come to rewrite the equation of happiness of the West which we have examined so far in our wisdom of our ancestors ("Samgukyusa: The heritage of the three states"). I would like to quote from China Eastern Airlines "History fathers future. Heritage mothers innovation." History and heritage should be considered at the same time. In this paper, we propose a new type of happiness equation. Happiness for all = Gross Domestic Product (GDP) / (1-Gross National Happiness

*(GNH)).* In other words, if you go to satisfy both the material economic value such as GDP and the mental happiness value such as GNH, you can get the value of true happiness that you eat well and live well. Both relationships should be seen as complementary to each other in numerator and denominator, and when they are together, the value of happiness is maximized.

**Keywords**: Happiness equation, Desire function, Satisfaction function, Divine comedy, Heritage of the three states

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### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 17(Saturday)

# Session-17-#301-3(SS1 & SS19)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 14:00~15:30)

### "Schumpeterian Dynamics"

- Chair: Andreas Pyka(University of Hohenheim, Germany)
- Paper 1: "Schumpeterian dynamics of products as agents" by Euy-Young Jung & Andreas Pyka
- Paper 2: "The Communicative Dynamic Model of Collective Intelligence in Risk Society" by DongKyu Won, Woon-Dong Yeo & Boong Kee Choi
- Paper 3: "An analysis on the relation between business keyword's trends and company's financial performance in Korea" by BangRae Lee, Jun-Hwan Park, Leenam Kwon, Young-Ho Moon & Han-joon Kim

### Session-17-#303-3(SS26 & SS28)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 14:00~15:30)

### "Towards Circular Economy: Innovations, Clusters and Entrepreneurship"

- Chair: Manuela Tvaronaviciene(Vilnius Gediminas Technical University, Lithuania)
- Paper 1: "Do Social Media Influence on Entrepreneurial Opportunity? an examination of a moderating role of social media use" by Joo Y. Park & Chang Soo Sung
- Paper 2: "Investigating the factors effect on corporate entrepreneurship in platform business" by Kyunghee Kyung
- Paper 3: "The Effect of the Accelerator Program on EO and Performance" by Chul Hyun UHM, Chang Soo Sung & Joo Y. Park
- Paper 4: "Americanization in Lithuania as a driving force for globalization" by Agnė Šimelytė, Renata Korsakienė & Deniss Ščeulovs







### **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 17(Saturday)

# Session-17-#321-3(GS1 & GS4 & SS 30)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 14:00~15:30)

### "Reciprocal and Accountable Open Innovation System: Connecting corporations and communities"

Chairs: Anil K. Gupta, Anamika R. Dey(Indian Institute of Management, India) & Sang C. Lee(DGIST, Korea)

- Paper 1: "The open, frugal and reciprocal innovations for climate resilience: incentives for partnership between formal and informal sector" by Anamika Dey, Gurdeep Singh & Anil Gupta
- Paper 2: "Analytic Framework of Critical Bargaining Power for Open Services Innovation in Printer, Publisher and Paper Merchant Alliance" by Min-Ren Yan & Jen-Ming Weng
- Paper 3: "A Study on the Interaction between Science & Technology and Society-Perspective of strong artificial intelligence-" by **Soo In Lee, Kwon Dong Kim & Sang C. Lee**
- Paper 4: "Detention and Liberation, the Constant Slip Related to Naming and its Consciousness" by Kwon Dong Kim, Doo Hyun Jang & Sang C. Lee
- Paper 5: "Mathematical approaches to dimensions" by HeungJu Ahn & Sang C. Lee
- Paper 6: "A Study on the Energy Performance Evaluation and Economic Analysis of Insulation materials" by Boeun Choi, Jihyun Shin, Jinhyun Lee & Younghum Cho

Session-17-#301-3(SS1 & SS19)

### Schumpeterian dynamics of artifacts as agents

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#### Abstract

Although the word *tool* appeared only in the 12<sup>th</sup> century, human beings use artifacts for more than 2.4 million years to satisfy human needs. Artifacts and the adaptation of the environment with them answers why human beings survived. Since we have developed the countertrade economy, artifacts have been created and developed in selective market environments. Innovative and imitative producers interact with consumers with changing needs and wants. Thus, one can state, that artifacts co-evolve with humans and their social organization. Today, the so-called Fourth Industrial Revolution is going to change substantially what artifacts are and what they are supposed 'to do'. Artifacts with artificial intelligence (AI) can pass information among them, act, based on what they learn from these messages, and even judge themselves like human. Consequently, an artifact no longer has to be a passive and dependent object, but eventually evolves into an independent agent.

This has to lead to drastic changes in the relationship between humans and artifacts. It is likely that artifacts will move away from the role of tools and be on par in many activities with humans. This indicates that the complementary relationship between humans and artifacts can develop into a substitutive relationship. In other words, the artifact may also be regarded as an object of cooperation, not a subordinate, and may even be subject to competition. This may unfold the utopia that human in cooperation with artifacts may work for 15 hours a week as already predicted by Keynes (1930). However, also a dystopia may unfold that leads to an unhappy life, mass unemployment and severe inequalities. In any case, we are going to observe massive changes in the Schumpeterian dynamics of artifact development as well as in to new organizational dynamics.

In this paper, we discuss the possibility of complementary and substitutive relationships between artifacts and humans. For this purpose, we analyze the effects of complementarity and substitution with artifact agents on the Schumpeterian dynamics of artifacts, humans, organizations consisting of humans such as firms, and organizations consisting of artifacts and humans, respectively. Finally, based on the results, we propose strategies and policies to reduce the negative effects caused by artifact agents and to foster the positive effects.

In particular, we focus on artifacts with AI having sensors, controllers, and actuators. Our discussion encompasses six capabilities in relation to artifacts: (i) natural language processing to enable successful communication, (ii) knowledge representation and storage, (iii) automated reasoning using the





stored information required for answering questions and drawing new conclusions, (iv) machine learning to adapt to new circumstances and to detect and extrapolate patterns, (v) computer vision to perceive objects, and (vi) robotics to manipulate objects and to move.

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These capabilities of artifact agents are related to the following characteristics: (i) autonomy to operate without other agents having direct control of their actions and internal states; (ii) social ability to interact with other agents in terms of competition as well as of cooperation; (iii) reactivity to perceive their environment and to respond to it; (iv) proactivity to exhibit goal-directed behavior by taking the initiative. These four characteristics resemble closely to Wooldridge and Jennings (1995) who set up this list to describe the characteristics of agents in agent-based simulation models.

In a next step, we consider the stage of development of artifact agents. In the early *weak* AI stage, artifact agents act as if they were intelligent. In advanced AI stages, AI artifacts start to think (not just simulating thinking). Today, this is called strong AI. When reaching this stage, the relationship between artifacts and humans will change drastically, which can be discussed in the framework of human conditions developed by Hannah Arendt (1958). Finally, an ultra-intelligent stage can be defined with machine surpassing the intellectual capacities of human beings (Russell and Norvig, 2010). Furthermore, the present status of artifact agents compared to humans, the speed of technology development, as well as the expected costs are relevant for our discussion.

For our analysis, we consider the occupation, tasks, and actions of humans. Frey and Osbrone (2017) estimate the probability of computerization for detailed occupations in order to examine how susceptible jobs are to computerization. Arntz et al. (2016) analyze the job automatibility for OECD countries based on a task-based approach. McKinsey Global Institute (2017) disaggregates occupations into constituent activities and rating each against human performance in some capabilities. We consider additionally the various needs of human agents. According to Max-Neef (1992), the fundamental human needs classifies as subsistence, protection, affection, understanding, participation, leisure, creation, identity, and freedom. Furthermore, needs are defined according to the existential categories of being, having, doing and interacting.

It is important that the relevant regulations, social acceptance, and ethical and philosophical issues are considered in this discussion. Regulations will have a vital role in developing and adapting technologies. Without proper social acceptance, another Luddite movement with English textile workers destroying weaving machinery in the 19th century becomes likely again. Also, we need to consider ethical and philosophical issues: artifact agents might be used toward undesirable ends such as weapons and they might challenge accountability as a major prerequisite for responsible behavior.

Keywords: Agent, Artifact, Complementarity, Schumpeterian dynamics, Substitution

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Session-17-#301-3(SS1 & SS19)

# The Communicative Dynamic Model of Collective Intelligence in Risk Society

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#### Abstract

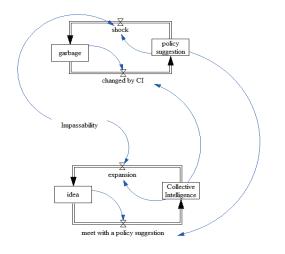
Until few years ago, wisdom was concentrated and represented just by lone geniuses, but now it is represented and performed by communicative or collaborating people which sharing their knowledge arrive to an enriched knowledge that generated collective intelligence.

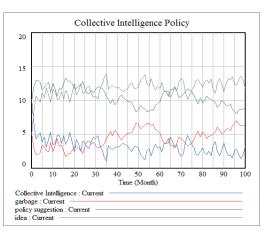
The creation of a collective intelligence platform can helps to collective absorption of a risk and a greater flexibility to give effectively solutions to the society, the policy and the market.

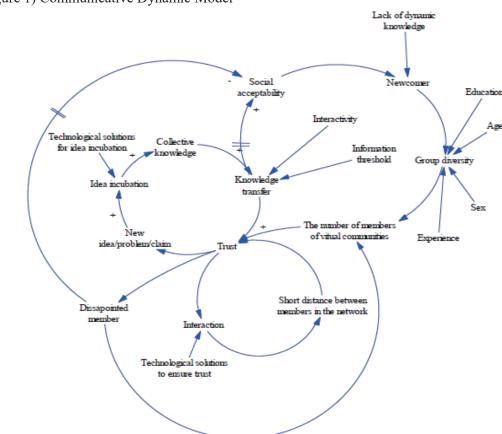
Many researchers have presented significant results in identifying the potential of collective intelligence to solve various societal problems or in modelling CI from a conceptual point of view, but they do not focus on an essential problem – "collective intelligence system design and optimization processes, through which collective intelligence will be able to emerge in a systemic manner."

Therefore, the main focus of this paper is not on a self-expedient analysis of collective intelligence (CI) as a phenomenon, but on the scientific identification of preconditions and the communicative dynamic model for collective intelligence to emerge, the enunciation of holistic conceptions, the prediction of possible development scenarios of collective intelligence for society.

Key Words: collective intelligence, communicative dynamic model, collective intelligence system design, optimization processes







(Figure 1) Communicative Dynamic Model

(Figure 2) System dynamic model of Collective intelligence

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Session-17-#301-3(SS1 & SS19)

# An analysis on the relation between business keyword's trends and company's financial performance in Korea

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#### Abstract

**Purpose**/**Research Question**: In this research, we aim to analyze the influence of the change of business keyword of major Korean enterprises on the financial performance by utilizing Korean corporate annual report. Also, supplementarily, we try to see changes in business trends by main industry through keyword change.

**Key Literature Reviews (About 3~5 papers)**: Feng L. used the Naive Bayesian Machine Learning Approach to analyze the future looking sentences of the management diagnostic analysis (MD&A) of the American 10-K, Annual report and 10–Q, Quarterly report. Feng L. used the Naive Bayesian learning algorithm rather than the dictionary based approach to analyze the future looking sentences of the business diagnosis. Specifically, he first classified 30,000 sentences of randomly selected future looking sentences into two dimensions. In other words, he classified them as positive and negative tone. He use this classified data as training data of the Naive Bayesian algorithm. According to n-fold cross–validity experiment (n changes from 3 to 50), this algorithm is 67% for tone (positive / negative / neutral) and





content (12 categories) and 63% success rate. In the actual analysis, he analyzed the 13 million future looking sentences in the 140,000 reports in the data of 1994-2007. As a result of analysis, the company with good current performance, small stock issue, small scale, lower market to book value ratio (MTB), low yield fluctuation, low Fog index of business diagnosis analysis, or longer history tends to show a positive tone on its future looking sentences. In the conclusion, this paper incorporates the following contents. The tone of the future looking sentence is expressed as a function of current results, issuance, company size, MTB ratio, change in profitability, Fog index of business management diagnosis, and corporate age. The tone of the future looking sentence shows the correlation between the future outcome and quantity and shows the explanatory power to other variables. Meanwhile, despite the continued efforts of the Securities and Exchange Commission, there was no systematic change on the informativeness of management diagnosis analysis. In other words, he criticized that detailed information was not provided. When managers warn about future performance in business diagnosis analysis, they also point out that there is less possibility that investors will incorrectly evaluate the issuance of shares. Meanwhile, when he measures the tone of the sentence by dictionary based method in the management diagnosis analysis, he found that it does not show the positive correlation between the tone and the future performance. However, if the Bayesian method is used, the tone positively correlates with the future performance and supposed to be strongly related to the future gain even when there is a limit of measuring the tone in the dictionary based method. Looking at these results, he argues that the dictionary-based approach can not be suitable for analyzing the tone of the company's documents.

Jihwan L. et. al analyzed the business model of the company by text mining the annual report. They used vector space model of keyword extracted from the nonstructural texts of the annual report. A general text mining process for vector space model is as follows: First is the process to establish the CORPUS. it is collect the documents to analyze with.; The second is the process of dividing sentences into individual words, which is called tokenization.; The third is called stop-word removal, deleting unnecessary words for analysis.; The fourth is stemming, extracting only the root word. The last is to create a termdocument matrix. The value of the cell on the term-document matrix indicates the frequency of occurrence of the term in the documents. The methodology of the research consists of the business model concept extraction and the business model evolution analysis. The business model concept extraction was implemented using PERL language. First, the process of establishing CORPUS is as follows. As a result of reviewing ITEM 1 and ITEM 7 in the 10-K report, only the ITEM 1 is used in the analysis because the depth of ITEM 7 differs for each company. They collected the entire 10-K filings from the EDGAR online database automatically using PERL's crawling module (LWP::UserAgent, WWW:: Mechanize). However, in order to extract only the necessary items, some techniques were utilized. Since the collected reports are in HTML format, they deleted unnecessary tags. Finally, the regular expression matcher was used to extract only item 1. After creating CORPUS, the next step is the sentence filtering stage. For this, they developed a word index to select only sentences related to the business model. That is, they selected the sentence containing 'we', 'our', 'us', 'registrant', 'strategy', or 'company' in the subject or 'allow', 'enable', 'sell', 'help' in the verb in the introduction sentence. The next step is to extract key-words from the selected sentences and extract only nouns using the "Lingua::EN::Tager" module. Meanwhile, this study omitted the stemming process to clarify the meaning and did not consider multi-word phrases. The final step is the process of creating a keyword vector. Second methodology of this research, the business model evolution analysis, is a process of analyzing the temporal change of key-words. The methodology provides a business model evolution map. The methodology generates the temporal keyword matrix which shows how often the keyword occurs in the related year. The next process is to calculate TF-IDF. The next stage is to measure the growth degree of the key-words using the temporal change of TF-IDF. This process uses the linear regression analysis and the result of the analysis takes the form of Y = a + bX, where b is the slope and can be used as the growth degree of the key-word. If b is positive, this means that the keyword is emerging. The last step is to put the individual key-words into a business model evolution map.

Xin Y. Q. et. al has developed an SVM-based forecasting model for the 10-year annual report for 30 enterprises. The research analyzed the company's past report and can possibly support the automatic prediction on the future financial performance. Three experts on financial accounting assisted the research. The analysis utilized the 1990–2003 Annual Report for 30 companies in three industries. In particular, in this research, the keyword vectors and the financial information are used for development of the models. This research used the return on equity (ROE) of financial information, and classified the financial performance of a company into Positive, Neutral, Negative based on the change ratio of ROE. As a result, this study argued that it showed the possibility of being used to predict the future short-term performance of the text classifier of the annual report.

**Design/ Methodology/ Approach**: We apply text mining techniques to business contents in annual report of Korean company and construct keyword–document vector. We use the keyword-document vector, ROE, capital investment, or other financial information in the analysis. The machine learning method or statistical analysis method is also used to analyze the relation between keyword's trends and corporate performance. We also look at the changes in key words by industry.

(Expected) Findings/Results: Company with many changes in keywords, much facility investment, or much research and development investment is expected to show high performance. However, it seems that characteristics will exist for each industry. We also expect to analyze changes in business trends by industry. If the experiment is successful, the relationship between keyword change and firm performance can be derived.

Keywords: Corporate annual report, text mining, financial performance, key word's trends





Session-17-#303-3(SS26 & SS28)

## Do Social Media Influence on Entrepreneurial Opportunity? an examination of a moderating role of social media use

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#### Abstract

#### 1. Introduction

Entrepreneurship scholars take a great consideration on exploiting competitive opportunities since opportunity recognition and exploitation in the turbulence and uncertain environment can be a source of economic profits and competitive advantages (Alvarez & Barney, 2007). Especially for entrepreneurs who try to create their own business and increase financial performance, one of the most challenges is identifying and capturing opportunities. Because the pursuit of opportunity is a core activities of entrepreneurs and they actively identify potential ways to achieve performance providing new products and services based on the opportunities that they find in the target market. Thus, many researches pay a great attention to how entrepreneurs recognize and seize opportunity and how they exploit the opportunity with required resources (Short et al., 2010, Li et al., 2015).

As to social media use in entrepreneurship, social media stands as an indispensable part of entrepreneurship practices since the platform provide changes and opportunities in business making. Network systems such as social media platform and application are often considered as a useful tool to recognize competitive opportunities. The use of social media offers opportunities to reach target customers and generate new ideas to startup business. Similarly, small scale entrepreneurs take advantages of social media in terms of having close and profitable relationship with peers, partners and customers. Since building a strong relationship is important for success of entrepreneurs and beneficial to share information and engage communities, entrepreneurs tend to encourage using social media to find better opportunity and increase social network through online communication. However, other entrepreneurs are not taking advantage of social media in opportunity findings or recruiting employees. It means practitioners' perception of social media varies from embracing potential benefits to being reluctant of downsides. Social media power on communication and opportunity discovery remains in question for its effectiveness in practice.

Regardless of an importance of how to exploit and recognize opportunities, little is still known about the factors and process underlying entrepreneurs' efforts to find opportunity. Moreover, little is known about the effect of social media use to exploit and create entrepreneurial opportunities. Therefore, we raise research questions such that what factors influence entrepreneurs to either find or create opportunities? How social media facilitate entrepreneurs' efforts finding opportunities? Integrating with social cognition theory, this research focuses on factors – prior knowledge, alertness and social media – may effect on two aspects of opportunity, opportunity discovery and creation. This study focuses on the investigation of a moderating role of social media use on entrepreneurial opportunities.

#### 2. Hypothesis development

Social cognitive theory developed by Albert Bandura (1977) provides reciprocal causation model to express individual's psychological behaviors. The theory stresses that a continuous interaction between behavioral, cognitive and environmental factors demonstrate the patterns of one's behavior (Bandura, 1986, McCormick and Martinko, 2004). Behavioral factors involve skill, practice and self-efficacy that influence one's thoughts and action. Cognitive factors, also called personal factors, involve prior knowledge, attitudes and expectations of outcome. Environmental factors comprise of culture and strategies, social norms, communications and communities. Based on social cognitive theory, we propose a research model as follow <Figure 1>.

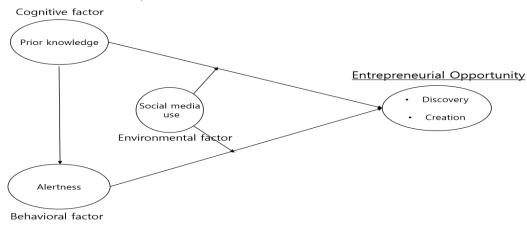


Figure 1. Proposed Research Model

#### 2.1. Prior Knowledge (cognitive factor)

Prior knowledge and knowledge-seeking behavior are the central factors of alertness. People who obtained knowledge from social network and prior experience will have a better opportunities to find new markets than the one who is not. Knowledge from business experience and management practice enhances one's alertness that enables the entrepreneur to identify a new opportunity. As Shumpeter's view on alertness, such new information and new combinations can lead to opportunity recognition (Siegel and Renko, 2012). Politis (2005) argues that experience and prior knowledge on market can lead to good customer relationship and influence new market opportunity recognition. Having obtained substantial experience and prior knowledge helps analyzing risk, coping with new things, and developing new products and services to meet customers' preferences. (Armstrong and Hird, 2009).

Different types of prior knowledge will affect one identifies opportunities (Venkataraman, 1997; Ardichvili et al., 2003). Shane(2000) illustrates that knowledge asymmetries play an important role in the process of discovering and creating entrepreneurial opportunities, and shows that knowledge about





existing market and customers' problems will influence the alertness of entrepreneurial opportunities. Market participants in various market conditions could access different market information and thus opportunity recognition can be different. He has classified three major dimensions of knowledge that influence alertness and market opportunities; knowledge of markets, knowledge of ways to serve markets and knowledge of customer problems. Craig and Johnson (2006) showed an interesting result in that individuals differ in recognizing entrepreneurial opportunity from their academic training. They found that individuals with business training were more proficient at recognizing opportunities than engineering training respondents. Siegel and Renko (2012) also reveal that both technological knowledge and market knowledge through education and experience will be more likely than other people to discover entrepreneurial opportunities.

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H1: Prior knowledge is positively related to entrepreneurial opportunities

H1-1: Prior knowledge is positively related to opportunity discovery.

*H1-2: prior knowledge is positively related to opportunity creation.* 

People are alert because they have access to knowledge that is distributed asymmetrically (Shane, 2000) and they possesses different information recognizing with a different perspectives (Kirzner, 1997). That is, prior knowledge fosters peoples' alertness to entrepreneurial opportunities. According to Baron(2006), the individuals' ability to recognize patterns in complex economic events is vary. Moreover, the individuals' knowledge influences one's interpretation of events and opportunities, that is one's knowledge can effect on alerting entrepreneurial opportunities. Such different knowledge and cognition factors effect on one's alerting process and could explain why a person recognizing opportunities that others can not recognize. Entrepreneurial alertness involves scanning and searching that refers to constantly searching for new information and changes in market environment (Tang et al. 2012). This elements of entrepreneurial alertness is a part of the cognition. Therefore, prior knowledge that people possess could make better able to scan, connect and judge information to discover and create entrepreneurial opportunities.

#### H2: Prior knowledge is positively related to entrepreneurial alertness.

#### 2.2. Entrepreneurial Alertness (Behavioral factor)

Alertness has been studied from many scholars in entrepreneurship field where opportunity recognition is a crucial process to create a firm. Entrepreneurial alertness is defined as "the ability to notice without search opportunities that have been overlooked" and "the sense to notice that which has not been suspected of existing at all" (Kirzner, 1997, 2008). Recent view on alertness is that it emerges from environmental, market and technological changes. (McMullen and Shepherd, 2006; Baron, 2006). Alertness is acknowledged as a main factor of opportunity identification and assessing the market changes that perceives potential entrepreneurial opportunities (Li, 2004). Entrepreneurial alertness impact on finding and creating new opportunities, which in turn, enhance performance and innovativeness. Tang et al.(2012) classified alertness as three distinctive dimensions such as scanning and search, association and connection, and evaluation and judgment. Some argue that entrepreneurial alertness involves action of moving toward creation and possibility for opportunities (McMullen and Shepherd, 2006, Tang et al. 2012). The behavioral action of evaluation and judgment of alertness reflects finding an opportunity that possesses profit or beneficial chances.

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Venkataraman (1997) address that awareness of entrepreneurial opportunities is significantly different matter from creating and exploiting the opportunities. Discovery depends on relative differences between people in their willingness and ability to search for and identify opportunities (Shane and Venkataraman, 2000). Hao et al. (2014) explores a positive relationship between alertness and innovation with an empirical analysis. Schumpeter's asserted opportunities are created by innovative entrepreneur by accessing new information and making recombination of resources (Buenstorf, 2007). Moreover, the relationship between sales person opportunity recognition and the performance of individual salespeople is affected by the presence of awareness, discovery, and evaluation (Bonney and Williams, 2009). Corbett (2007) asserted that people has to build capability of transferring and judging the information and knowledge that people acquire, and Fiet (2007) posits that a combination of one's prior knowledge and experience are the basis of the opportunity discovery. Accordingly, a person's entrepreneurial alertness can influence on finding and creating entrepreneurial opportunities.

H3: The entrepreneurial alertness is positively related to entrepreneurial opportunity

H3-1: The entrepreneurial alertness is positively related to opportunity discovery.

H3-2: The entrepreneurial alertness is positively related to opportunity creation.

2.3. Social Media Use (Environmental factor)

Using advanced technology and social network services can change the market trends and create new information. Social media technology can easily combine various source of information and make a new combination to create new information. Researchers reveal that knowledge obtained from social networks helps people to alert new information and seize new opportunities (Jiao, et al. 2014). According to McKelvie and Wiklund(2004), determining the market value of new technological changes has a positive effects on opportunity recognition. They also argue that increase communication in new technology between user and end-customer is important to discover entrepreneurial opportunities.

People with actively using social media should get more information and better combine and transform the information acquired. Social media can raise the awareness of market changes and customer behavior, and act as a trigger for creating opportunity that meets customer demands. Kolb (1984) explained that the acquired information can be transformed and combined with prior knowledge through socializing to search for the best information and avoid errors or to recognize as many chances as possible. In this process, social media use is the effective tool to combine, compare and evaluate information for entrepreneurial opportunities. Corbett(2007) also showed that those who transform many alternative and information recognize more opportunities than those who search for the best. Especially, young startups and entrepreneurs who begin their business with limited knowledge and resources would heavily influenced by the social media to sense trends and opportunities. Therefore, hypothesis are set as followings.

H4-1: the effect of prior knowledge on entrepreneurial opportunity discovery is positively moderated by social media usage.

*H4-2: the effect of prior knowledge on entrepreneurial opportunity creation is positively moderated by social media usage.* 

H4-3: the effect of entrepreneurial alertness on entrepreneurial opportunity discovery is positively moderated by social media usage.

H4-4: the effect of entrepreneurial alertness on entrepreneurial opportunity creation is positively moderated by social media usage.





#### 3. Methodology

#### 3.1. Participants and Data Collection

Data was collected from entrepreneurs who create their own company and employees who works in venture companies. Since opportunity discovery and creation are strategically important, these constructs are appropriate to our study for measurement of social media effects.

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#### 3.2. Measure of constructions

*Prior Knowledge* is considered as individual's experience or education that influence the ability to comprehend customer problems, market characteristics and the ways to serve markets (Shane, 2000). As Shane argues that the three major dimensions of prior knowledge are important to the opportunity discovery, we asked entrepreneurs knowledge on market, customer problems and market sales. We also asked the extent of industrial experience to measure prior knowledge of entrepreneurs.

*Entrepreneurial Alertness* refers to the capacity to recognize the changes in technology, markets and competition and assessed by alertness scale provided by Tang et al. (2012). Alertness scale consists of 13 items including three elements - scanning and search, association and connection, evaluation and judgement. Scanning and search involves preparedness and sensitivity to new opportunities, association and connection involves pulling distinct information together to sense new opportunities, and evaluation and judgement involves a decision of an opportunities whether it is valuable in a future market.

*Social media* is measured by the degree to which entrepreneurs are using social media in their work and perceive using social media to be useful (Leftheriotis and Giannakos, 2014). 6 items for social media are asked with questionnaires like "I often use social media to obtain work related information and knowledge", "using social media (e.g.facebook, blogs) for work is effective".

*Entrepreneurial Opportunity* refers to the process of which entrepreneurs seeks or creates the "something" that provide potential market value and benefits. Entrepreneurial opportunities are measured two dimensions as opportunity discovery and creation. Opportunity discovery is the perception of recognizing and identifying business opportunities rely on individual's knowledge and sense of market changes, while opportunity creation involves the perception of developing and reframing opportunities through new ideas to market. Adopting from questionnaires by Craig and Johnson (2006), respondents are asked whether they are likely to discover entrepreneurial opportunities in existing market with known information or develop new ideas and products to find new ways doing things in markets.

#### 4. Conclusion and Implication

This study aims to provide the importance of prior knowledge, alertness and social media in identifying entrepreneurial opportunity and their contribution to the success of entrepreneurs. Based on the social cognitive theory, entrepreneurial opportunity recognition can be influenced by cognitive, environmental and behavior factors – prior knowledge, social media use and entrepreneurial alertness.

The social cognitive theory can use to explain cues to model similar behavior in finding a better opportunity that others have not seen and serve to enhance one's weakness of discovering and creating entrepreneurial opportunities. Since behavioral, environmental and cognitive factors do not make equal contributions to behavior, we investigate which factor will have more impact on discovering or creating opportunity. The result of this study will support the view of social cognitive theory that an individual's ability to discover and create entrepreneurial opportunity can be enhanced if given factors are supported to develop one's ability. This study also tries to reveal whether social media is used to provide better opportunities for entrepreneurs and whether it is useful tool to support the role in discovering opportunity influenced by prior knowledge and alertness

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Session-17-#303-3(SS26 & SS28)



# Abstract

#### (Purpose)

- : The purpose of this study is to investigate the factors effect on corporate entrepreneurship in platform business.
- : We will examine the interrelationships between the factors effect(Organizational culture, staff rewards, social capital, social vale) and corporate entrepreneurship dimensions(innovativeness, risk -taking, proactiveness, new business venturing and self-renewal) in platform business.

#### (Method)

Sample : Platform business enterprises in Korea SMEs. Analysis : Structural equation model(Amos)

#### (Implications)

: This study will provide empirical evidence for the strong impact factors on corporate entrepreneurship in platform business, and we will contribute to the success for platform business.





# Introduction

- The emergence of new information and communication technologies(ICT) has brought growth in social network services and greatly increased the use of platform business model. The mobile revolution was triggered by the introduction of Apple' iPhone, the business environment around such platforms has brought about increased competition.
- The importance of platform business in the global market is growing, but platform business with a global competitive edge are rare.
  In order to secure future growth engines and achieve sustainable growth, the emergence of a platform business with a competitive edge is urgent.

# Introduction

- Recent studies of platform business show that platform business has a distinct difference from the existing industry, and therefore success factors are different.

Therefore, it is necessary to study the influential factors for the success of the platform business which is different from the existing industry.

- Corporate entrepreneurship is highly important for small and medium-sized enterprise to remain competitive. However, previous paper on corporate entrepreneurship is mainly focused on traditional business. Therefore, it is urgent to study the factors effect on corporate entrepreneurship in platform business with a competitive edge which is different from the existing industry.

- In this study, we want to investigate the factors effect on corporate entrepreneurship in platform business.

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# Literature Review and Hypotheses

After deriving CE-relevant factors from recent literature, we propose hypotheses concerning the interrelationships between the factors(Organizational culture, staff rewards, social capital, social vale) and CE in platform business

#### (platform business)

- A platform is a business model that creates value by facilitating exchanges between two or more interdependent groups, usually consumers and producers. -Successful platforms facilitate exchanges by reducing transaction costs and/or by enabling externalized innovation. Indeed, a large number of the world's most valuable companies by market capitalization in 2015 were platform business, including five of the top 10(Apple, Microsoft, Goolgle, Amazon, and Face-book).

# Literature Review and Hypotheses

#### (Corporate Entrepreneurship)

-In extant literature, there is a growing interest in entrepreneurship, especially CE(corporate entrepreneurship), as an antecedent to organizational performance.
(Kuratko,Ireland,Covin & Hornsby, 2005; Saly, 2001)
-Recent research has shown an corporate entrepreneurship (CE) is positively

related to organizational performance. Consequently, the view assumes that CE are important determinants of organizational effectiveness in a highly competitive environment.

-(Saly, 2001) The intensity of CE in an organization can be described by five different dimensions identified in a meta-analysis : innovativeness, risk-taking, proactiveness, corporate venturing, and self-renewal(Miller, 1983; covin & slevin, 1989; Lumpkin & Dess, 1996; Antoncic & Hisrich, 2003)





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(Corporate Entrepreneurship)				
Item definition Quotation				
Innovativeness	It has been identified as one of the essential enduring characteristics of entrepreneurs, and it focuses on the search for creative and meaningful solutions to operational problems and needs.	Covin & Slevin 1991; Thomas and Mueller 2000; Darling et al. 2007		
Risk-taking	Koh (1996) defines a person 's risk-taking propensity as his or her orientation towards taking chances in uncertain decision-making contexts.	Koh, 1996		
proactiveness	It involves taking initiative by anticipating and pursuing new opportunities and by participating in emerging markets	Lumpkin and Dess 1996		
New business venturing	It means "creating new business through market developments or by undertaking product, process, technological, and administrative innovations"	Zahra, 1993a		
self-renewal	It "the redefinition of the business concept, organization, and the introduction of system-wide changes for innovation"	Zahra,1993b		

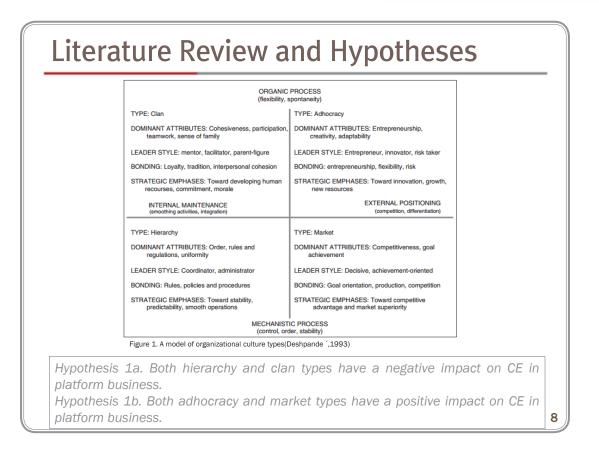
# Literature Review and Hypotheses

#### (Organizational Culture)

- Organizational culture is a complex phenomenon that shapes everyday organizational life and which has many different and competing definitions (Barney, 1986). It has also been shown to have significant effects on performance (Rashid et al., 2003; Mannion et al., 2005).

- This study applies the culture framework developed by Deshpande ´ et al. (1993).

Item	definition	Quotation	
clan culture	which emphasises cohesiveness, participation and teamwork; : CE can also be hindered by the clan culture's focus on traditions and internal maintenance	Deshpandé, Farley, and Webster 1993	
adhocracy culture	which stresses values of entrepreneurship, creativity and adaptability; : An <i>adhocratic culture</i> 's strategic focus on innovation, entrepreneurship, and risk-taking is expressed by dynamism, flexibility, creativity, and a strategic emphasis on growth, which, we argue, positively affects the degree of CE in the organization	Quinn 1988	
hierarchy culture	which highlights order, rules and regulations; : its focus on rules and policies that determine the behavior of the organization's members, the hierarchical culture contradicts the basic principle of risk-taking that is inherent in the opportunity orientation of EO.	Engelen et al. 2014	
market culture	which emphasises competitiveness and goal achievement. : Goal-oriented leadership and task accomplishment can lead to faster implementation of decisions in the market, and a competitive attitude, combined with achievement orientation, could secure a first-mover advantage for the organization.	Narver, Slater, And Maclachlan 2004	



# Literature Review and Hypotheses

#### (Staff rewards)

- Many studies have found that incentives that enhance positive attitudes and employee motivation can contribute to the organization's growth and performance (Bae, Chen, Wan, Lawler, & Walumbwa, 2003; Kaya, 2006). Adequate incentives can increase employees' risk propensity and motivation for innovation (Amabile, 1988; Huselid, 1995). Incentives are both financial and non-financial rewards in exchange for the employee's work performance (Morris & Kuratko, 2002)

- Previous studies have not agreed on how to design staff rewards, because financial and nonfinancial rewards have different effects on encouraging corporate entrepreneurship (Balkin & Logan, 1988; Saly, 2001). Creativity, risk propensity, investing time in innovative projects, and an increase in reputation based on entrepreneurial activities are all facets of the measurement construct for staff rewards.

Hypothesis 2: Staff rewards(financial and non-financial) have a positive impact on CE in platform business.





# Literature Review and Hypotheses

#### (Social capital)

- Recent research found that various resources and information are mainly provided to organization through social capital, which is a resource capital based on a network, and through corporate entrepreneurship.

Social capital comes from the relationship of individuals or organizations in a network and is referred to as the aggregation of the resources maintained in the relationship(Inkpen & Tsang, 2005)

- Larson(1992) empirically demonstrates that social capital like reciprocity norms, which is created in a network of entrepreneurial firms, facilitates knowledge acquisition, risk sensitiveness, and innovation. Simsek, Lubatkin & Floyd(2003) also assert that a firm-level network may have an individual or corporate effect on gradual and rapid entrepreneurial behaviors. So, it is very probable that a firm which has acquired more social capital or resource capital from a firm network will have resources and information which are necessary for corporate entrepreneurship.

Hypothesis 3: Social capital has a positive impact on CE in platform business.

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Literature Review and Hypotheses

#### (Social value)

- Recent research found that social value affected organizational commitment and performance(kang & Kim, 2016). Social value orientation means a tendency to recognize social problems, create desirable values, and contribute to the community through participation of stakeholders.(Helm & Andersson, 2010)

- Therefore, social value orientation will positively affect the creation of value among success factors of platform business.

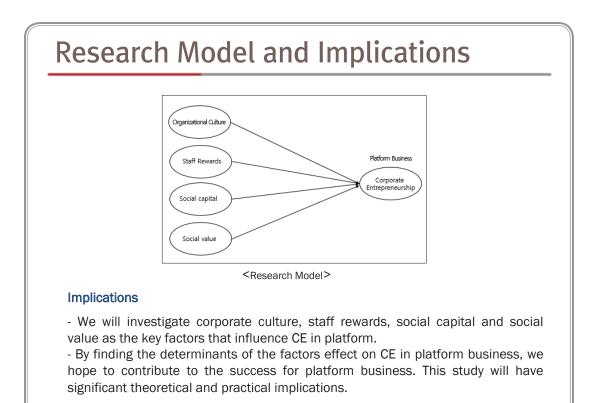
Hypothesis 4: Social value orientation has a positive impact on CE in platform business.

# **Research Method**

Sample : Platform business enterprises in Korea SMEs.

**Method**: We will use formative and reflective specifications for the constructs; therefore, the commonly used covariance-based SEM techniques, such as AMOS, could potentially lead to "identification problems, the occurrence of implied covariance of zero among some measured variable, and the existence of equivalent models" in the data analysis(MacCallum & Browne, 1993)

prporate htrepreneurship rganizational ulture	innovativeness risk-taking proactiveness New business venturing self-renewal clan culture	3 3 2 4 2 4	Covin and Slevin (1986, 1989) Antoncic and Hisrich (2001)
-	self-renewal clan culture	2	
-		4	
ulure	adhocracy culture hierarchy culture market culture	4 4 4	Deshpandé and Farley's (2004)
aff Rewards	Financial rewards Non-financial rewards	3 3	Saly (2001)
ocial Capital	marketing partnership technology partnership	1 1	Peng, Lee and Wang(2005)
ocial Value	Social value orientation	4	Helm and Andersson(2010)
)	cial Capital	aff Rewards     Financial rewards Non-financial rewards       cial Capital     marketing partnership technology partnership	Aff RewardsFinancial rewards3Non-financial rewards3cial Capitalmarketing partnership1technology partnership1







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Session-17-#303-3(SS26 & SS28)

## The Effect of the Accelerator Program on EO and Performance

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#### Abstract

#### **Purpose/ Research Question:**

The explosive growth of accelerators has given entrepreneurs and their startups the opportunity to reach resources such as mentoring and seed-stage funding. While business accelerators remain relatively unprecedented in the academic literature, there is a growing interest in understanding how accelerators work and where they provide value to entrepreneurs. In this paper, I focus on this question: Do accelerators play a central role in the startups' economy? I examine how resources such as human, technology, and financial resources provided by accelerator impact on entrepreneurial orientation (EO) and firm performance. I intent to exploit that the acceleration program will lead to positive accelerator outcomes along with entrepreneurial orientation, and, through them, to long-term successful outcomes for the startups participating in accelerators via value creation. Going forward, I will conduct an extensive survey and empirical study to validate these key findings. I hope that this study provides some insights into the efficacy of accelerator programs can have on the entrepreneurial ecosystem.

#### **1. Introduction**

The rise in startups and venture capital in recent years has triggered the emergence of a new player in startup ecosystems. Accelerators are new players in the entrepreneurial ecosystem and their specific impact on the ecosystem is still vague. Hence, I tackle some of the confusion surrounding startup accelerators by laying out a clearer picture of what they do.

Startup companies have difficulty raising funds because they are based on intellectual assets, and venture capital has severe uncertainties and limited returns. In order to improve the market avoidance area, each government supports the initial enterprise support policy (Mayer, et. Al., 2005). Startup





companies that have to raise funds for survival have many difficulties in attracting enough external investments when internal funds reach their limits. However, there still seems to be insufficient investment and support for venture companies, especially 'early' venture companies in the startup ecosystem.

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There are various government support policies to supplement this. In the case of Korea, it encourages investment in venture companies through the KVIC Fund launched in 2006 and supports technology development at the beginning of the business through the national R&D funding program. Although efforts to find new growth engines have expanded to the start-up and development of venture companies with innovative technologies and ideas, most companies still face difficulties in internal funding and external financing. This has a significant impact on the survival of firms (Shrader and Simon, 1997).

The global explosion of interest in entrepreneurship has spurred the growth of accelerator programs to service a startup culture no longer limited to Silicon Valley alone. As startups begin to proliferate beyond the traditional incubation centers, regional and national leaders are increasingly looking to these companies as a source of economic growth. As they do, officials are confronted with the reality that innovation-driven entrepreneurship differs significantly from traditional venture activity, meaning that cultivation strategies are radically different.

Against this backdrop, there is a strong need for "accelerating services" to support the acceleration of business, rather than the simple investment obtained through the failure cases that occurred during the process of concentrating on existing VCs, angels, and successful ventures. Accelerators are emerging as the key entrepreneurs and venture support organizations in Korea, and they in turn accelerate the success of venture businesses.

In this regard, regional development leaders need to recognize that ideas, talent, capital, and a culture of openness and collaboration are all vital to reach virtuous cycle of regional startup communities. While accelerators have rapidly emerged as the regional growth infrastructure and are viewed as playing a key role in the scaling-up of growth-oriented ventures in the entrepreneurial ecosystem, entrepreneurs, policy makers, and academics have continued to raise questions about their efficacy. For those reasons, they are worthy of assessment.

#### 2. Theoretical Background

#### 2.1 Accelerator Model

Accelerators are groups of experienced people who provide office space, guidance, mentorship, networking, management services, knowledge, and expertise to nascent companies to help them succeed in the early stages of venture life (Fishback, Gulbranson, Litan, Mitchell, & Porzig, 2007). It is an accredited private agency or corporation that supports entrepreneurship education and professional mentoring to increase startup's success rate and accelerate growth.

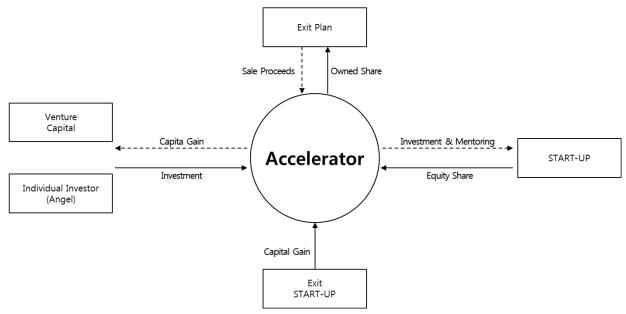
Accelerators assist with building the venture team, fine-tuning the idea, and mentoring through product development. Accelerators provide intensive, boot-camp training comparable to entrepreneurship classes at the collegiate level (Fishback et al., 2007). Accelerator contestants are selected from an open pool of qualified candidates led by start-up teams with stellar ideas.

In particular, it is important to cooperate with outside organizations in the early stage of the start-up, in which the human and material resources necessary inside the company for innovation are limited.

Chesbrough (2003) introduced the concept of open innovation and suggests the importance of utilizing external knowledge in the innovation process. With the role of accelerator as a key point of game changer, the accelerator can be viewed as a concept of innovative platform that doubles competitiveness of an entrepreneurial ecosystem.

Accelerators have clearly taken off in recent years, as evidenced by their substantial growth, geographic dispersion, and, more importantly, by the numbers and value of startups that accelerators have worked with. But it begs the question: Do accelerators play a central role in the startups' economy? And if so, are such effects more pronounced for certain industry sectors and stages?





Research into accelerators provides a unique opportunity to apply and enhance the resource-based view. This theory confirms that firms are a bundle of resources, talents, and capabilities that create unique competencies or competitive advantages (Penrose, 1959; Wernerfelt, 1984; Penrose, 2003; Ravenswood, 2011). The structural part of the theory focuses on unique resources (Wernerfelt, 1984; Barney, 1991) while the process part of the theory emphasizes all the internal processes that create efficiencies (Fiol, 1991; Hart, 1995; Miller & Ross, 2003).

The resource-based view (RBV) presents physical, human, and organizational resources (Barney, 1991), which focus on the importance of organizational resources among the various factors that affect organizational performance (Wernerfelt, 1984). According to the resource-based theory, the performance of an organization can be enhanced through the ability to retain specific resources or create new resources internally rather than external factors that can easily be accessed by other competitors.

Startup companies need various types of assets, systems, knowledge, and information in order to achieve their goals. They are expected to receive the resources in the accelerator program and to improve EO (Covin and Slevin, 1987). Cooper and Bruno (1977) found that entrepreneurial expertise is an important feature of a successful entrepreneur and that entrepreneurs with relevant experience are more likely to be found in successful entrepreneurs (Roure & Maidique, 1986).

Accelerators provide a "structure" of resources starting with boot camps then mentorship and angel





input followed by subsequent funding. Learning by doing is something that all founders eventually experience, but it is a highly inefficient process over time. The point of accelerators is to accelerate that process—speeding up the learning cycle in a time-constrained format. Finally, when an accelerator program is active, it concentrates a myriad of activity in a particular community—generating vibrancy around innovation in a dynamic environment.

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Accelerators match the nascent founder with mentors contributing real world experience in that market, idea, technology, or industry. The mentors provide additional human capital resources in addition to another form of external market validation – the mentor would discontinue if the idea was not feasible. Therefore mentors provide external validation that the idea should be further developed.

RBV is a model that considers resources as a core element of the outstanding performance of a company (Kraaijenbrink et. al., 2010). If accelerators enhance start-up success because of the added resources they provide, then the results of the study would add support to the resource-based view. These results would support the proposition that accelerator resources are relevant and, in fact, create a meaningful value for new ventures.

West and Noel (2009) believed that RBV confirms knowledge as a type of resource that gives a competitive advantage to the performance of start-up firms. Growth-oriented knowledge was a valuable resource for the further performance of start-ups. The knowledge and the skill of the business owner and manager have a positive effect on business performance (Akande, 2011; Moreno et al., 2012).

In addition to the various business development resources and funding given to the startups, the entrepreneurs significantly decrease their search costs in finding potential investors, mentors, etc. Allowing entrepreneurs access to networking gives them a considerable advantage in sustaining their business and potentially developing key relationships to scale and obtain additional rounds of funding.

#### 2.2 Five Characteristics of Accelerator

Defining what accelerators do is becoming more agreed upon in the recent literature. Accelerators are defined by five characteristics that are partially interdependent: (1) seed funding, (2) cohort-based admission and graduation, (3) co-location, (4) a structured program via open competition selection process, and (5) mentoring (Miller & Bound, 2011). Overall, learning is a coordinated effort from mentors, accelerator operators, start-up team members, and peers (Cohen, 2013).

One of the accelerator benefits to the region, in general, is the creation of an ecosystem (Christiansen 2009), which, to the participating startup, should turn into networks that include investors, successful entrepreneurs, mentors, and alumni (Littlewood 2011). Christiansen (2009) explains that one reason for building an accelerator is to build a startup ecosystem.

In order to achieve the innovation performance of start-up companies, it is necessary not only to have the main internal resources but also to have the innovation ability to efficiently combine and utilize resources (Hall & Begchi-Sen, 2002; Hoffman et al. Rather than having all innovation competencies, competencies that are the source of competitiveness are retained internally, while the remaining competencies are dealt with through external collaboration.

#### 2.3 Hypothesis

The hypothesis of this study is as follows: 1. The influence of the accelerator program on EO, 2. The effect of EO on performance, and 3. The relationship between accelerator program and EO by industry

and by stage.

*Hypotheses 1-1. The technical resources provided by the accelerator will give a positive effect to the EOs. Hypothesis 1-2. The human resources provided by the accelerator will give a positive effect on the EO relationship.* 

*Hypothesis 1-3. The investment resources provided by the accelerator will give a positive effect to the EOs.* 

Hypothesis 2-1. EO will have a positive impact on corporate financial growth.

Hypothesis 2-2. EO will have a positive effect on attracting investment.

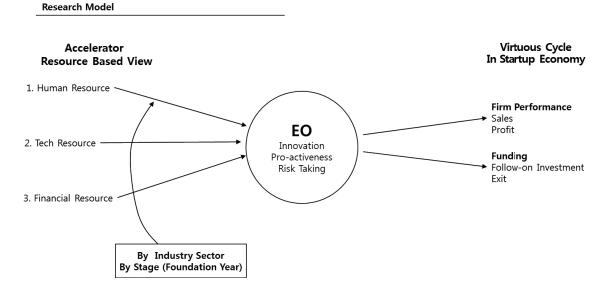
*Hypothesis* 3-1: *The relationship between the accelerator program and the EO will be different depending on the industry.* 

*Hypothesis 3-2: The relationship between the accelerator program and EO will be different depending on the stage of the company.* 

The purpose of this study is to find the relationship between the major resources provided by the accelerator program and the EO, and to elucidate various considerations to improve the performance.

#### 3. Research Model

The intent of this research is to examine accelerator companies' roles in assisting nascent stage firms, the start-ups. Specifically, the paper will address the following points: 1. The influence of the accelerator program on EO, 2. The effect of EO on performance, and 3. The relationship between the accelerator program and EO by industry and work.



#### 3.1 Sampling and Data Collection

This study defines human resource assets, technology resource assets, and financial resources assets as the leading factors affecting EO, and analyzes the effect of EO on financial performance and investment performance. In addition, we will analyze such effects more pronounced for certain industry sectors and stages.

The research subjects of this study are enterprises in the early stage (within 3 years) of the start-up, and aimed to be tested using the surveys sent to graduates of municipal graduate schools of SME





promotion Corporation. It is known that it is a first-time start-up support program that is recognized as a representative benchmark in Korea. It provides meaningful services by supporting startups with technology and finance necessary in an entrepreneurial ecosystem.

#### Session-17-#303-3(SS26 & SS28)

SOltmC & RTU 2017

#### Americanization in Lithuania as a driving force for globalization

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#### Abstract

PURPOSE. The purpose of the article is to analyze Americanization patterns in Lithuania by exploring socio-economic and cultural factors and to determine the impact of Americanization on the level of globalization of the country.

#### DESCRIPTION OF THE PROBLEM

Although there are very few studies, Americanization has been the object of research since the 19th century (Lauret 2013). America since at least the end of the 19th century has exported certain products, techniques, fashions, investment, and art, as well as people. Huebner (1906) and Butler (1920) described Americanization as the process of immigrants' integration into the society, assimilation and transformation into Americans. Due to the expansion of American corporations to Europe at that time, some of the European researchers saw Americanization as a threat to their customs and cultural values (Bonin, de Goery 2009). Americanization refers to cultural transfer (Kuisel 2010). Belgian economists Maes and Buyst (2005) claimed that Americanization, as internalization, is neither entirely satisfactory nor entirely avoidable. Later, Americanization was defined as the form of modernization (Tipps 1973) and a specific type of globalization (Craig et al. 2008). Maes and Buyst (2005) found some signs of Americanization in interwar Belgium and associated it with migration to U.S. in the 1920s. The evidence of Americanization can be found even in interwar Lithuania as worldwide acknowledged brands, such as Ford Motors, Wrigley, Chevrolet, Chrysler, Gillette and others, were well known at that time (Minkevičius 2015). WWII and the Soviet annexation suspended the process of Americanization as internationalization for fifty years. After the collapse of the Soviet Union, Lithuania joined the free market system, started privatization process, and reestablished a business relationship with American corporations, which dominated during the interwar period. From the 1990s the expansion and penetration of American corporations into the Lithuanian market, in the forms of foreign direct investment (FDI) and international trade, made a remarkable impact on the economic growth. Even more, these significant changes went beyond the economic impacts. The movement of goods, capital, information and labor across the borders has transformed social and cultural habits. Recent study (Pekarskiene, Susniene 2011) showed that all Baltic States have reached a high globalization level. In the meantime, Lithuania faced





emigration and brain drain problems. The level of emigration has been increasing since the 1990s. Thus, it might be assumed that emigration and brain drain are the consequences of globalization. The further research will focus on emigration related decision-making and the choice of a country for emigration. Particular emphasis will be drawn on the factors determining emigration to the U.S. and immigrant's abilities to adapt to the American culture.

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METHODOLOGY/APPROACH. The research employs both qualitative and quantitative methods by using primary and secondary data. Further descriptive statistics, correlation regression, and factor analysis will be applied.

Primary data was collected by carrying out the survey. Secondary data was drawn from the World Bank and Statistics Lithuania

#### OUTCOMES.

The obtained and analyzed information on the spread of foreign capital, culture and their impact on social and cultural life in the host country which results in emigration and brain drain problems. On the other hand, the research allows us to examining the behavior of Lithuanians and their abilities to accept new culture and social life on the basis of own wealth.

The project comprises three scientific areas: sociology, economics and mathematics. It is unique as it extends to the theory of globalization and synthesizes both understandings of Americanization: immigrants' integration into society and assimilation, as well as Americanization as the form of internalization.

#### ORIGINALITY/ ADDED VALUE

It is an interdisciplinary research, which covers three scientific areas: sociology, economics and mathematics.

It is unique as it extends to the theory of globalization and synthesizes both understandings of Americanization: cultural assimilation and Americanization as the form of internationalization.

Keywords: emigration, brain drain, globalization, immigrants, Americanization.

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Session-17-#321-3(GS1 & GS4 & SS 30)

# The open, frugal and reciprocal innovations for climate resilience: incentives for partnership between formal and informal sector

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#### Abstract

Climate resilience requires flexible, frugal and functional open innovations accompanied by sustainable institutions and technologies. In the context of climate fluctuations, coping strategies of communities require a blend of collective action and individual entrepreneurial strategies. We discuss a framework in which frugal solutions when disseminated through open accessible and accountable formal and informal channels can help to build resilience.

The paper presents several examples of coping strategies evolved by communities with or without support of formal institutions in high risk regions of India. The portfolio of incentives for wider sharing of successful strategies depends upon access to a reciprocal culture which matches mutual expectations and affordability brackets. We present a scheme which can help design different kind of incentives at different stages of innovation value chain. Some of these lessons could be relevant for corporate and community partnerships also. Lack of reciprocity among actors in formal and informal sector, we have argued earlier, may lead to loss of trust and social capital, so vital for resilience in coping with climate and other fluctuations in the environment. We provide a checklist in the end which may help assess viability of various policy, institutional and cultural exchanges and networks available/or designed in future. These networks may help in restoring trust, renew social and ethical capital and reinforce collaboration across institutional boundaries to promote resilient climate adjustments and adaptations.

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# Analytic Framework of Critical Bargaining Power for Open Services Innovation in Printer, Publisher and Paper Merchant Alliance

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#### Abstract

Strategic alliances have become one of the most efficient governances to build competitive advantages in various industries. With the extending scale and intricacy of project, a separate company can no longer manage a complicated project alone with the business environment has become more challenging (Yan & Yang, 2012). The substantial increase of importance for firms to form strategic alliances in their business activities has been attributed to the strategic responses to rapid environmental changes and uncertainly. Through strategic alliances, a firm can gain access to desired strategic capabilities by connecting with a partner with resources; competencies, skills and knowledge therefore the company can obtain enlargement of competition, promotion of technology advancements, magnification of required investment and worldwide markets (Yasuda, 2005, Solesvik & Encheva, 2010). Moreover, it can be used as strategy in order to minimize transaction costs, deal with unpredictable environments, diminish their reliance on resources outside of their governance and maintain competitive position in dynamic market (Das & Teng, 1996).

It is observed that strategic alliances have become central to competitive success in fast changing global markets as well as innovative business solutions to obtain synergistic competitiveness in the high competitive market (Yan & Yang, 2012). That are the reasons why researches on strategic alliances have blossomed greatly in the past few decades, reflecting the popularity and the importance of Strategic Alliances has grown dramatically across all business sectors. Previous studies have proposed that the interest in interfirm cooperation for innovation that alliances are relevant to open innovation — and vice versa. The focus of open innovation has been on interfirm cooperation, allowing firms to improve their innovation performance by leveraging innovation creation and commercialization paths outside their firm boundaries (Chesbrough, 2003, 2006; West, Vanhaverbeke and Chesbrough, 2006).

The main goal of this study is to propose an analytic framework of critical bargaining power for open services innovation in printer, publisher and paper merchant alliance. Taiwanese companies and the business in grand China area were benchmarked as research sample. In the past decade, Taiwan paper merchants, distributors and agents, sandwiched between paper mills and customers in printing and





publishing industries, have suffered great profit loss from excess capacity, rapid technology development, and low birth rate. To improve business performance and identify critical factors of bargaining power, the study aims to build a structure of criteria of bargaining power and evaluate the relative effectiveness of each criterions.

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In this study, first we summarized 22 criteria of customer and supplier value proposition from previous literatures and conducted a questionnaire to generalize 3 main criterions and 9 sub-criterions using AHP and Delphi method. And then we conducted a second round survey with experts discussion to confirm the reliability and validity. Finally we statistically calculate the relative weighting of different factors of bargaining power.

The research result suggests that customer value proposition is very different from supplier value proposition. The top 3 criteria for customer value are: (1) Technical support and service, (2) Professional abilities, and (3) New product development ability; while top 3 for suppliers are: (1) Financial ability, (2) Marketing leading ability, and (3) Technical support and service. On account of the apparent difference of customer value proposition, suppliers must take the customer's point-of-view, emphasize on internal training and provide products and services which meet customers' needs. In this way, customer becomes more dependent on suppliers, and as a result, suppliers have more bargain power to improve their business performance.

Keywords: strategic alliance, bargaining power, open service innovation, AHP, decision making.

Session-17-#321-3(GS1 & GS4 & SS 30)

## A Study on the Interaction between Science & Technology and Society - Perspective of strong artificial intelligence –

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#### Abstract

It is a general view that science and technology and society are inseparable. However, how technology and society are influencing each other has been constantly controversial and has not been adequately discussed in more realistic and concrete cases (such as the viewpoint of artificial intelligence). This is because the artificial intelligence has had a considerable impact on our society in recent years. Until then, artificial intelligence technology was a weak artificial intelligence. This has become a concern for everyone, as artificial intelligence (AI) technology is mentioned as one of the key technologies that will lead the fourth industrial revolution.

It is time to think about what kind of influence science/technology/society will have and how we should look at artificial intelligence. The European Parliament has already acknowledged the legal status of the AI in order to prevent such problems beforehand. However, the academic community's efforts are far beyond that of the interest. Recent papers are mainly about simply predicting positive and negative changes in artificial intelligence (AI) technology. In this paper, we try to distinguish the viewpoints of interaction between science and technology and society, viewpoints of artificial intelligence through the analysis of previous researches, and propose a viewpoint to look at artificial intelligence. Through this, we will be able to draw the stage of artificial intelligence in future society.

Keywords: Artificial intelligence (AI), Fourth industrial revolution, Science and technology,

Acknowledgement: This work was supported by the DGIST R&D Program of the Ministry of Education, Science and Technology of Korea (17-IT-01, 17-FA-07).





Session-17-#321-3(GS1 & GS4 & SS 30)

## Detention and Liberation, the Constant Slip Related to Naming and its Consciousness,

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#### Abstract

The human 'naming' consciousness has always existed for 'calling', and the semantics of naming is always a discourse based on the consciousness of 'social man'. Through language, humans recognize and communicate each other's existence, and move toward meaningful existence. However, because the language constantly slips, the signifier and the signified do not always coincide. In this sense, the meaning of human language can be said to be shared for the reproduction of meaning. The reason is that language is to express some thoughts but the use of language is not so permanent. Human language cannot avoid concepts but there is no concept in the crying sound of a bay bird.

Early on, Chuang-tzu said, "If there is anything, the thing does become 'that' and the thing does become 'this,' too." Explaining his mention, the meaning of 'that' is not revealed from its situation itself, but as you get any knowledge by 'this,' it can lead us to know 'that.' So, as he added that "'that' comes out of 'this' and 'this' too comes from 'that,'" this statement means that 'this and that' can be said to have come together. For example, if there is life, there is death, and if there is death, there is life. If there are things possible, there are things impossible, and if there are things impossible, there are things is wrong, there is wrongness because there is rightness, and when something is right, there is rightness because there is wrongness.

In addition, along with Hui Shi, ancient Chinese philosopher in the Warring States Period, Gongsun Long representing the School of Names among schools of Chinese philosophy said that "if there is anything, it always points something." Gongsun also hinted that human perception is made not through things themselves but through and with the concepts of directing at them. When he discussed on his famous statement "the white horse is not a horse," he stands on the same contextual line. He makes it clear that two different kinds of concepts indicating color and shape are strictly in separation. There are not only white horses but also black horses and yellow horses, and the black horses and yellow horses are not included in white horses. Therefore, he claims that the 'white horse' can be only a 'white horse' and it is never a 'horse'. In other words, because there is a gap, wider or narrower, between the concepts of 'white horse' and 'horse,' it cannot be stated that 'the white horse is a horse.' Also, according to his view, if 'a horse' means something when various colors are subtracted from colored horses, one of 'white horses' is of white hue added to uncolored horses. Therefore, it can be claimed that the white horse is only a white horse and not a horse. In other words, the general concept 'horse' and the particular concept 'white horse' cannot be equated.

Long Gongsun's 'White Horse dialogue 'the white horse is not a horse' is a figurative expression to emphasize that the relationship between concepts and objects is strictly classified on the bases of their different standards and layers. And this is not an expression of mere a sophistry, but also this has been a representation of political ethics that the name cannot be confused with the reality and that right politics can be realized by correcting the relationship between the two. Moreover, from a hybrid point of view, we can look at this related subject; that is, as "the positive as the concept referring color" and "the positive as the concept of the form" melted together, the term 'white horse' came into being.

Keywords: Hybrid, Chuang-tzu, Hui Shi, Gongsun Long, White horse dialogue

Acknowledgement: This work was supported by the DGIST R&D Program of the Ministry of Education, Science and Technology of Korea (17-IT-01, 17-FA-07).





Session-17-#321-3(GS1 & GS4 & SS 30)

## Mathematical approaches to dimensions

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#### Abstract

Recently, Mayumi and Giampietro (Ecological Economics 69, 2010, pp. 1604–1609) have suggested the dimensional non-homogeneity of equations and absurdity usage of transcendental functions (especially logarithmic one) that are used in Economics. After that, Baiocchi (Ecological Economics 75, 2012, pp. 1–9) refutes Mayumi and Giampietro's arguments by introducing hidden homogeneity and dimensional constants to justify the usage of the Taylor series in dimensional analysis by claiming that zero is considered having no dimensions.

In this talk, we would like to suggest more mathematical and systematical methodology to overcome this kind of issues in dimensional analysis by defining *dimension algebra* 

$$D = \{ u_1^{q_1} u_2^{q_2} \cdots u_7^{q_7} : q_1, q_2, \cdots, q_7 \in \boldsymbol{Q} \} / \sim$$

as the equivalence class over *multiplicative commutative free group*. Here, the bases  $\{u_1, u_2, \dots, u_7\}$  is the set of 7 SI units in physical system. Each element in *D* is called *derived dimension*. Some derived dimensions have explicit physical meanings and some do not have, or we don't know the exact meaning until now. We also define the transcendental dimension  $[f(u_k)]$  for transcendental function f(x) like logarithmic functions, trigonometric functions, and etc. With these mathematical tools, we will show that the Taylor series of f maintains the dimensional homogeneity such as [f]. Further, without proof, we claim that any equation expressing physical law can be naturally transformed into another equation if we change the related dimensions. The special relativity theory can be understood as a typical example of a dimensional transformation between distance[m] + time[sec] fundamental dimensions and velocity $[m*sec^{-1}]$  transformed dimension. With this point of view, from one physical law, we will obtain many physical laws explaining the secret of nature.

Keywords: SI units, dimension, dimensional analysis, dimensional homogeneity, relativity theory

Acknowledgement: This work was supported by the DGIST R&D Program of the Ministry of Education, Science and Technology of Korea (17-IT-01, 17-FA-07).

Session-17-#321-3(GS1 & GS4 & SS 30)

## A Study on the Energy Performance Evaluation and Economic Analysis of Insulation materials

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#### Abstract

#### **Purpose/ Research Question:**

The purpose of this research was to develop a methodology and decision support system which makes it possible to evaluate energy conservation measures for buildings in Korea by using the ECO2 (Building energy efficiency rating program) and establish passive Energy Conservation Measures (ECMs) of insulations which meet the national regulations.

#### Key Literature Reviews:

Kim et al. remodeled of the insulation for the study of economic evaluation to carry out insulation work to conform to the strengthening of legal insulation standards. Yeom et al. aimed to present and evaluation method of economic feasibility of sustainable technologies using LCC Analysis, in which energy cost and CO2 emission trading cost are considered. In this study it is expected that the result can be used as a decision making tool for selecting sustainable building technologies during the initial building design stage. In residential sector, air conditioning system takes the biggest portion of overall energy consumption to fulfil the thermal comfort need. Aditya el al. aimed to gather recent developments on the building thermal insulations and discuss about the life-cycle analysis and potential emissions reduction by using proper insulation materials to address the issue. Favoino et al. design and control optimizing adaptive insulation for office building by minimizing the total primary energy use and thermal discomfort. Also this study applies this framework to explore the potential of adaptive insulation. **Design/ Methodology/ Approach**:

In this study, Energy Conservation Measures (ECMs) were constructed focusing on the construction sector (Passive) of insulation materials as the basis for the domestic situation. An economic efficiency databases for the constructed alternatives was built, the target building was set, and the Passive





ECM List for the target building were derived. The energy consumption evaluation and economic efficiency analysis were performed for each of the constructed alternatives, and this research aimed to propose a methodology for guiding energy efficiency decisions, on the basis of the performance evaluation results, and derive the optimal Passive ECM List of insulation materials for the target building.

#### (Expected) Findings/Results:

Through this study, Energy Conservation Measures (ECMs) and economic evaluation of construction sector (Passive) of insulation materials were built. Based on this, a methodology for guiding energy efficiency decisions is proposed, and the ECM List of insulation materials for the target building derives on the basis of the performance evaluation results.

#### **Research limitations/ Implications:**

Since the proposed Energy Conservation Measures were applied only to small business facilities, future studies will need to review the proposed process by evaluating various buildings by region, size, and usage. In addition to adding and complementing passive ECMs, further studies on alternatives to active and renewable systems will be needed.

**Keywords**: Energy Conservation Measure (ECM), Primary Energy Consumption, Economic Analysis, Decision Support Process, Insulation Materials







## **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 17(Saturday)

# Session-17-#301-4(SS1 & SS19)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, Time: 15:40~17:10)

### "Complex Innovation strategies for intelligence society"

- Chair: Boong Kee Choi(KISTI, Korea)
- Paper 1: "ANT (Actor Network Theory) Simulation Model for Making R&D Policy" by Boong Kee Choi, Woon-Dong Yeo & DongKyu Won
- Paper 2: "Analysis of industry trends using financial information of company from ORBIS database" by Jun-Hwan Park, Bangrae Lee, Yeong-Ho Moon & Lee-Nam Kwon
- Paper 3: "Evolution of clinical trial collaboration network of Novartis for 29 years" by Hyuck Jai
   Lee & Heyoung Yang
- Paper 4: "Transformations of Economic Systems: The Bioeconomy Case" by Andreas Pyka

## Session-17-#303-4(SS26 & SS28)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 303, Time: 15:40~17:10)

## "Innovation & Technology Entrepreneurship-educational and nascent entrepreneurs' perspective"

- Chair: Chang-Soo Sung(Dongguk University, Korea)
- Paper 1: "CLUSTERS, SMART GROWTH AND ENERGY SECURITY: IF CONSITENT PATTERNS COULD BE TRACED" by Manuela Tvaronavičienė
- Paper 2: "The Effect of Sustainable Entrepreneurship on Entrepreneurial Intention: Focus on the Moderate Effect of Market Orientation" by Chang Soo Sung, Joo Y. Park & DaeEop Kim
- Paper 3: "Entrepreneurship Education and Innovation performance: The moderating effect of Team\_Based Learning on the Innovative personality in relation to Team Innovative Behavior and New Venture Idea" by Jiyoung Kim, Dae Soo Choi, Joo Y. Park & Chang Soo Sung
- Paper 4: "Case Study on the course of 'Google YouTube multimedia creation and business' from the aspect of entrepreneurship education" by Tae Hyun Lee, Chang Soo Sung & Joo Yeon Park







## **SOltmC & RTU 2017** June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

## June 17(Saturday)

# Session-17-#321-4

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 15:40~17:10)

#### "On-Line Presentation(SS10 & GS2)"

Chair: Jeonghwan Jeon(Gyeongsang National University, Korea)

- Paper 1: "The Influence of Perceive Quality on Word of Mouth as Mediated by Perceived Value (Social, Emotional and Functional) Study of Zara's Customers in Surabaya, Indonesia" by Januar Heryanto & Bezaleel Hadinata
- •Paper 2: "HOW INNOVATION CONDITIONS THE SEARCH FOR EXTERNAL KNOWLEDGE: A STUDY OF NIGERIAN FIRMS" by **Abiodun Egbetokun**
- •Paper 3: "ICT-Enabled Platform-based Business Ecosystem for WEEE Recycling: structure and characteristic" by Chang Wang, Qiao Sun, Lihong Zhang, Ivshui Zuo & Hai-Iin YAO
- Paper 4: "A Value Co-creation Mechanism Research in a Platform Empowerment-based Entrepreneurial Ecosystem-A case study of Taobao.com" by Wenhui Zhou & Yifang Zhou

Session-17-#301-4(SS1 & SS19)

# ANT (Actor Network Theory) Simulation Model for Making R&D Policy

Boong Kee Choi (KISTI), Woon-Dong Yeo(KISTI), DongKyu Won(KISTI)

# Abstract

Actor-Network Theory (ANT) is rooted in science and technology studies. It has been developed from the 1980s by Bruno Latour, Michel Callon and John Law. Since the 1980s ANT has been used in multiple variations. Although ANT carries 'theory' in its name, it is better looked at as a method for doing research. Still ANT does carry some substantive elements in it that cannot be neglected when doing ANT driven research.

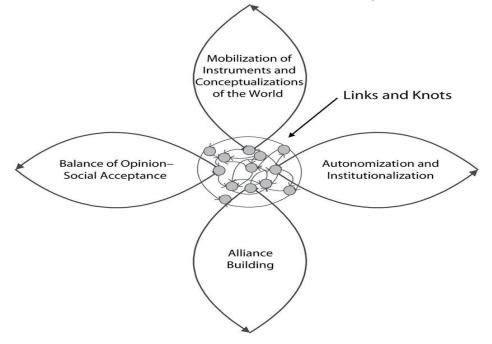
In short, ANT can be defined as a research method with a focus on the connections between both human and non-human entities. It describes how these connections lead to the creation of new entities that do not necessarily practice the sum of characteristics of constituent entities.

This thesis aims to address the following.

The use of ANT will help to answer the following research question:

"What needs to be done in order for NT (nanotechnology) of national R&D to be successfully implemented in Korea?"

The process of institutionalizing NT national policies has been broken into 3 overlapping stages: autonomization of the issue, contest to determine the solution, and convergence on solutions (resolution).







(Figure 1) The key processes in an actor-network theory analysis.

Source: Latour B. Pandora's Hope—Essays on the Reality of Science Studies. Cambridge, MA: Harvard University Press; 1999.pp99-111

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Through our analysis, we identified approaches to help overcome some systemic barriers to the solution of the NT R&D policy problem and comment on other complex transnational problems. Overall, it is the hope of this thesis that the use of ANT can help in plotting a successful path for the NT policy of national R&D.

Key Words: ANT (Actor Network Theory), NT(nanotechnology) policy, R&D Policy, Autonomization,

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Session-17-#301-4(SS1 & SS19)

# Analysis of industry trends using financial information of company from ORBIS database

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#### Abstract

Purpose/ Research Question: Since industrial trends are being changed very quickly with the globalization of world economy in recent years, it is quite important to find the opportunity of business fields by analyzing the tendency of various industry areas. In order to search for the promising industries, the financial information of corporation has received a great deal of attention recently. This is because the value of enterprise and the trend of industry can be very closely related to the financial data of companies such as operating revenue (turnover), operating profit and loss (P/L), research and development (R&D) expenses, and so on. In addition, the financial data of companies in the whole world which are used in this study are obtained from the ORBIS database of Bureau van Dijk. The purpose of this research is to establish the basic methodology for developing the analysis service of industry trends and business opportunity by using financial information of firms from the viewpoint of public institution. Also, the final goal of this work is to establish the intelligent system of information analysis performing the role as a business advisor based on the financial data which can be used as the quantitative evidence.

Key Literature Reviews (About 3~5 papers): Malichov? and ?uri?ov? (2015) evaluated the financial performance of companies operating in the sector of information technology (IT) using the setting of financial indicators including return on assets (ROA), return on equity (ROE), return on sales (ROS), and so on. By utilizing those financial indicators, they analyzed the operating results of firms and suggested the identification of significant aspects to accomplish high performance with continuation of observing their changes of financial performance in IT sector. Lee and Choi (2015) analyzed the effect of the





financial structure of pharmaceutical enterprises on the R&D investment in order to make a profit source in the next generation or develop the cost-effective medicines for increasing the value of company. From their study, the results about the influences of various factors on the R&D investment were as follows: (a) a positive effect of the current ratio, (b) a negative influence of the debt ratio, and (c) little effect of the net sales growth rate. Kretschmer and co-workers (2016) used the financial data such as sales and assets of companies from the ORBIS database in order to study the cloud adaptiveness within the sectors of industrial fields by merging them with the technology data provided from the Harte Hanks technology database for 13 countries in Europe from 2000 to 2007. Castellani et al. (2016) investigated the influences of multinationality on the productivity of enterprise by using the database of ORBIS. In addition, they found a positive effect of multinationality on the R&D intensity defined in their research as the ratio of R&D investment of company to the number of employees. Braganza and co-workers (2017) utilized the ORBIS database for enterprises in the whole world as one of various data sources about companies, venture capital transactions, academic papers, patents, and so on. They developed an archetype business procedure for the initiatives of big data and the roles needed to manage the resource of big data effectively.

Design/ Methodology/ Approach: The financial data of companies in the whole world which are utilized in this research are based on the ORBIS database having them of all industrial areas. The number of firms in the ORBIS database is about 189 million and it contains the financial information of both listed and unlisted enterprises. In this study, (a) operating revenue, (b) operating P/L, (c) P/L after tax, (d) R&D expenses, and (e) ratio of R&D expenses to operating revenue are used as financial indicators of firms. Also, the search conditions to obtain the list of active enterprises in all industrial fields are as follows: (a) disclosure of financial statements (companies with consolidated accounts only, companies with both types of accounts, and companies with unconsolidated accounts only), (b) accounting practice with International Financial Reporting Standards (IFRS) or Local Generally Accepted Accounting Principles (GAAP), and (c) accounting template of industrial corporations, banks, and insurance companies (excluding branches). In addition, the United States Standard Industrial Classification (US SIC) primary codes are utilized as a classification system to analyze the trends of all industrial areas and the business opportunity.

(Expected) Findings/Results: By investigating the financial information of companies including operating revenue, operating P/L, P/L after tax, R&D expenses, and ratio of R&D expenses to operating revenue, it is expected that the industrial fields showing the high growth rate of financial indicators can be found and then they can be recommended as promising industries providing the greater business opportunity than other industrial areas. Furthermore, it is possible to observe the industry trends such as the area showing the high growth potential, profitability, and stability by analyzing the financial data of enterprises for all industries in the world with the primary codes of US SIC. Moreover, the industrial fields having the high R&D investment based on the US SIC can be found easily through the investigation into the financial information of all active companies in the whole world. In addition, it is possible to analyze the financial data by geographical world region (Asia, Europe, North/South America, Africa, Oceania, and so on).

Research limitations/ Implications: It can be very difficult to obtain the standardized finance data of corporation because the criteria of making the financial statement by country are different in the world. Also, the coverage of financial information for the selected indicators (operating revenue, operating P/L,

P/L after tax, R&D expenses, and ratio of R&D expenses to operating revenue) can be low. In particular, such tendency can be found in the financial data of small and medium-sized enterprises (SMEs) and unlisted companies. Although those research limitations are anticipated, this study is able to be very helpful for observation of overall industry trends in the world and discovery of business opportunity based on the financial information of corporations operating in all industrial areas. In addition, it is significant to consider the financial data of company as the quantitative evidence for the analysis of industry trends and business opportunity. Furthermore, in the viewpoint of R&D investment, it is expected that the efficiency of national R&D expenses can be enhanced by using the results of this research.

Keywords: Industry trends, Financial information, ORBIS database





Session-17-#301-4(SS1 & SS19)

# Evolution of clinical trial collaboration network of Novartis for 29 years

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# Abstract

Purpose/ Research Question: New drug development is a key topic of recent R&D. As well as governmental and public R&D expenditure in the new drug development area has been increasing, pharmaceutical companies have been investing huge amount of R&D expenditure. DiMasi et al(2016) examined new estimates of R&D costs in the pharmaceutical industry, where cost estimate with 2013 dollars is 2.87 billion dollars while cost estimate with 2000 dollars was only 802 million dollars. The productivity crisis in pharmaceutical R&D is a well-known problem because of the lack of a corresponding increase of new drugs, in spite of increasing investment in pharmaceutical research and development (Pammolli et al, 2011). For this reason, there is a growing demand for innovation, especially open innovation as a way to overcome the productivity problem.

The purpose of this study is to understand collaborative strategy of the biggest multinational pharmaceutical company Novartis using clinical trial study database, ClinicalTrials.gov with Social Network Analysis method. We test availability of clinical trial database as a material for understanding open innovation strategy of pharmaceutical industry by analyzing trends of network characteristics for about 30 years and study data-based mechanism of open innovation for Novartis.

Key Literature Reviews (About 3~5 papers): Previous studies on open innovation in the pharmaceutical field can be broadly divided into two categories. First, some studies make models for open innovation and draw conceptual diagrams based on data from interview with industry experts or data from corporate annual reports (Bianchi et al, 2011, Schuhmacher et al, 2013). Second, some studies conduct statistical analysis of partnership data and apply Social Network Analysis method to the partnership data then figure out characteristics for players (companies, universities, research institutes, etc). These partnership data would be alliance data between firms and co-authorship of publications (Gay and Dousset, 2005, Rafols et al, 2012).

Bianchi et al(2011) performed an exploratory analysis based on two rounds of interviews with industry experts carried and investigated open innovation for the top 20 worldwide industry players in the biopharmaceutical industry. The authors conceptualized open innovation modes and partnerships along

the phases of new drug research and development including clinical phases, then they discussed of how biopharmaceutical companies have used different organizational modes i.e. licensing agreements, non-equity alliance, purchase and supply or technical and scientific services.

Shuhmacher et al(2013) mentioned that pharmaceutical companies have been facing the vast challenges of R&D productivity and opened their R&D organizations to external innovation. The authors described four types of innovation model and examples of each represented by the pharmaceutical industry based on the annual company reports. They presented Sanofi, Bristol-Myers, Squibb, AstraZeneca, Merck&Co., Amgen as companies with 'Knowledge integrator' model which is one of open innovation models, Shire as companies with 'Knowledge leverager' model, Roche, Novartis, Boehringer Ingelheim as companies with 'Knowledge creator' model, and Pfizer, GlaxoSmithKline, Takeda, Eli Lilly as companies with 'Knowledge translator' model. The criteria divided by the four innovation models are proportion of externally acquired R&D projects (high vs low) and preference in innovation management (extroverted vs introverted).

Gay and Dousset(2005) analyzed SDC alliance data (Securities Data Company's online databases from Thompson Reuter). Their data sample covered 739 alliances carried out by 557 firms and institutions from 1987 to 2004, categorized into supply, joint venture, royalties, manufacturing, marketing, licensing, and R&D. The authors constructed networks for time periods of 1990-1996 and 1997-2004, and found out three hubs on the network of 1997-2004, Medarex (USA), Abgenix(USA) and Cambridge Antibody Technology(UK). They also presented numbers of alliances made by three hubs through time, which show movement ups and downs with time.

Rafols et al(2014) studied a bibliometric perspective on big pharma's R&D dynamics by examining the publication activities of major European (GlaxoSmithKline, Novartis, Hoffmann-La Roche, AstraZeneca, Sanofi-Aventis, Bayer, Novo Nordisk and Boehringer Ingelheim) and US (Pfizer, Merck, Eli Lilly, Johnson & Johnson, Abbott, Bristol-Myers Squibb and Amgen) pharmaceutical firms (Big Pharma) during the period 1995-2009. They constructed the subject network with nodes represent subject categories based on the papers (a total of 160,841 publications) authored by 15 major big pharmaceutical firms. They constructed the subject networks with increasing rate of publications and with decreasing rate of publications by firms in subject categories in order to investigate which scientific areas the big pharmas concentrate their R&D. They also made collaboration network of pharmaceutical firms and showed geographical communities.

In the previous research, publications and annual reports were used as an information source to identify the cooperative relationship of companies. However, these information sources have limitations. As Rafols et al (2012) mentioned, "publications cannot be assumed to be a reliable proxy to describe the dynamics of research in a private firm," because they influence the publication strategy depending on what their scientific discovery is, sometimes publishing is limited to protect core knowledge of the companies. Corporate annual reports have similar limitations. Since the company's annual report is primarily for investors, there are aspects to persuade investors. Therefore, there is a possibility that the company's R&D activities or open innovation strategy can not be shown truthfully.

Design/ Methodology/ Approach: In this study, we will use clinical trial database from ClinicalTrials.gov as a material to understand the current status of open innovation in pharmaceutical field. Social Network Analysis is applied as the analytic methodology. Clinical trial data, as mentioned Glass et al (2015), is a





very good database for characterizing pharmaceuticals, but there are not many cases that have been properly analyzed. Regardless of the success of the trial, clinical trials must be published in advance of the registration system of clinical trials in order for the new drug to be marketed and approved after clinical trials. Therefore, it is the database which has the widest coverage regarding the development of new drugs. Currently about 230,000 clinical trials in 195 countries are registered. Clinical trial data constitutes many variables of study identification, protocol and study design including partnership information of lead sponsors and collaborators of clinical studies. We use this information to construct a collaboration network in the pharmaceutical industry and to study status of open innovation from the collaboration network. Our research target is Novartis, which has been ranked No.1 among global pharmaceutical companies in recent year. It is meaningful to analyze the status of leading company to obtain insight related the productivity and open innovation in pharmaceutical R&D. The number of Novartis' clinical trial studies registered in ClinicalTrials.gov is 3,633 from 1989 to 2017 with study start year. We apply Social Network Analysis to sponsor-collaborator relationship data of Novartis clinical trial studies from ClinicalTrials.gov, about 3,600 trial studies for time period of 1989 to 2017. We construct collaboration networks in three time periods (1989-1999, 2000-2009, 2010-2017). We analyze remarkable players on the network, network parameters like size of networks, density of networks etc. We observe the change of these characteristics of Novartis clinical collaborative networks and the major players for each decade in time series. We examine network properties, community features, characteristics trends of each network for each time period. Statistical analysis is performed to examine the study conditions, study type, phase stages, funding information, etc. About 3,000 clinical trial data of Novartis data (totally 3,633) contain information of collaborators.

(Expected) Findings/Results: We figure out major players by each time period in Novartis-centric collaborative networks. We understand its collaborative strategy and change of structure for partnerships by each time period. We also compare characteristics of Novartis-centric collaborative networks with whole collaborative networks of ClinicalTrials.gov data.

Research limitations/ Implications: We expect the results could help us to understand status and trends of open innovation of big pharma Novartis and find out implications for open innovation strategy in pharmaceutical industry. Meanwhile incomplete data and huge numbers of node (institutes and companies having been participating clinical trial studies) could be obstacles to network analysis. Data cleansing process of collaborator list could be a difficult task and the accuracy of the results may be affected.

Keywords: Novartis, clinical trials study, collaboration network, open innovation, ClinicalTrials.gov.

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# Transformations of Economic Systems: The Bioeconomy Case

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#### Abstract

To improvesustainability,the global economic system has to undergosevere transformationprocesses. This chapter deals with the possibility of an innovation-triggered transformation towards a knowledgebased bioeconomy,which is supposed to overcome the current lock-in into afossil fuel-based CO2intensive production. To do this, a Neo-Schumpeterian view is applied that highlights the complex interplay in knowledge-generation and -diffusion processes between firms, consumers and government institutions.By applying the Neo-Schumpeterian approach it becomes obvious that innovation and economic growth are part of the solution and not part of the sustainability problem. The shift from quantitative growth –prevailing in textbook economics –to qualitative development –prevailing in Neo-Schumpeterian economics –makes the difference and affects all agents and institutions in an economic system,which needs to be designed as a dedicated innovation systemsupporting the transformation towards a knowledge-based bioeconomy.

#### 1. Introduction

After more than200 years of industrial production, large parts of the world populationare richerthan ever before. Simultaneously, past industrial production is closely linked with the exploitation of natural resources and the strong accumulation of environmentally harmfulgreenhousegases, thereby endangering human survival. It isevidentthatthings cannot continue as before. But how can future development be shaped without threateningour natural basis of life and contributing to a high and increased level of welfareat the same time?At the beginning of the 21stcentury, many economies all around the worldplace big hope in the so-called knowledge-based bioeconomy. Is this a possible way out? Can economic growth and development, widely the cause of the problem, also become part of the solution? The following contribution discusses the possibility of transforming the globalproduction system towards a knowledgebased bio-economy from the perspective ofmoderninnovation economics.

Almost alleconomists agree that technologicaldevelopment substantially triggers quantitative growth in income per head. However, there is less consensus with respect to the qualitative characteristics of economic development: whereas mainstream-oriented parts of economics -often summarized under the headingneoclassical economics -focuses only on quantitative aspects and thus shows a short-term orientation, Neo-Schumpeterian economics focuses on qualitative aspects and thus on a change of fundamental economic structures over longer periods.





Generally, change can be either of an incremental typein terms of smallimprovements along well-known trajectories, or it can be more fundamental, leading to structural changes like the emergence of new and the disappearance of old industries. To simplify, we assume that incremental technological changes are based on existing technological solutions, whereas radical technological changes question major existing production processes. They might lead to massive changes of the global production system in the sense of "creative destruction" (Schumpeter, 1943).

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This chapter deals with a fundamental transformation of production systems: overcoming the lock-in situation of present production systems towards fossil fuels (Unruh, 2000) and establishing a knowledgebased bio-economy at the same time (Pyka, 2017and Pyka and Buchmann, 2017). Without doubt this transformation process isradical, qualitative, and effective in the long-runonlyand it has to be considered under the Neo-Schumpeterian approach toinnovation economics. It was alreadyin his work Business Cycles, publishedin1939, when Schumpeter revitalized Kondratieff's Theory of long wavesin order to explain this process as a regular processin long-term economic development. His illustration of this change, which is characterized by its discontinuous nature, is famous: "Add successively as many mail coaches as you please, you will never get a railway thereby" (Schumpeter, 1934, p. 64). Industrialization around the year 1800 represented the first long wave and was fueled by the steam engine and by cotton processing. Then, startingaround the year 1850, the widespread availability of steeland the diffusion of railwaysconstituted the second long wave that was again, at the beginning of the 20th century, replaced by electrical technology and the chemical industry. In the middle of the previous century, the third long wave momentum by mass productionand the automobileas well as thepetrochemical gained industries. Thus, manufacturing activities focused on oil as a second fossil fuelapart from coal. Since the 1980s,one refers to the fifth long wave,which isreflected in the fast and ubiquitous diffusion and application of information and communication technology solutions.

Now, at the beginning of the 21st century, another paradigmatic change is in the air, being characterized, however, by onemajor difference to previous revolutions: whereas previous cycles were driven bytechnological bottlenecks and their overcoming, humans the 21st century face the vital question of how to restore environmental sustainability of economic activities. The knowledge-based bio-economyplays a key-role in this transformation process which, of course, like previous radical changes is characterized by fundamental uncertainty (Knight 1921).

Today, literature provides many alternative terms for the massivechange shaking global production systems:Freeman (1991) and Dosi (1982) call themtechno-economic paradigm changes, Sahal (1985) uses cartographic analogies and refers to technologicalguidepoststhat are pointing to technological avenues. All authors highlight the confrontation with profound changes economic systems are faced with overlonger periods of time which questionall established production approaches. Not a single technology is responsible for this phenomenon, but several complementary developments that include, apart from package of mutually dependent technologies (e.g., combustion engine, petro chemistry, assembly line production), numerous infrastructural developments (e.g., road structure, filling station network), behavioralchanges (e.g., suburbs and commuter flow, shopping malls outside the city centers) as well as institutional changes (e.g., spatial planning and commuter allowance, etc.). The old paradigm will not be

replaced by the new one until all these elements interact.

The Neo-Schumpeterian approach provides us with crucial hints on the process of the forthcoming change.For this purpose, we introduce in the second section to the economic discussion of transformation processes and shortly outline the consideration of growth-pessimistic approaches that enjoy great popularity, such as post-growthor de-growthapproaches. These are contrasted with the growth-optimistic approaches that cherish Schumpeter's intellectual heritage and rely on the creative forces of capitalistic economic systems to overcome the fundamental problems of the human society. Innovations are supported by the discovery and successful spread of new knowledge. Therefore, knowledge-based economies organize innovation systems composed of different actors which establish a creative environment for mutual learning andknowledgecreation. That is what the third section of this chapter is about. No innovation would have ever been established if it had not attracted consumers' interest and if it had not been leveraged by their purchasing power. We will focus on these questions in section four. Knowledge-based societies considernew concepts in the sense of 'responsible innovation' that are decisive in bringingan entire economy on a new sustainable trajectoryshaping growth and development. Section five deals with the massive economic impacts originating from these technological and knowledge-driven changes.It requires, besides technological change, also institutional change in a co-evolutionary fashion, if new sustainable technologies areto achieve the aspired transformation of the economic system.

### 2. Limits togrowth

The sustainability of a capitalistic organization production, as it has been set up in western industrialized economies since the beginning of the industrial revolution at the end of the 18th century, has been questioned at the latest since 1972 when "The Limits toGrowth" was published by the Club of Rome(Meadows, 1972). Since then, two fundamentally different solution strategies are being discussed within society: conservation of resources by the abstinence from growth on the one hand or decoupling of growth and resource exploitation the other hand. The supporters of the first approach (Blewitt and Cunningham, 2014, Kallis et al., 2014), summarized under the headings of "abstinence" and "downscaling", claim a renunciation of a way of life that is based on consumption and increasing deployment of resources. According to these approaches, market-oriented economic systems are not believed to manage endogenously a change towards sustainability. There are considerations that even call fora return to small-scale regional agriculture or subsistence economies, respectively. This is considered the only way to enable a sustainable and resource-friendly lifestyle and form of economic activity. To summarize, it is easy to see that these approaches arebased on the neo-classical line of thought with the underlying assumption stable economic structures and an understanding of economic growth as a sheer quantitative process.

The second approach, instead, is strongly characterized by the observation that innovations, market forces, structural change, and urban ways of life are both, part of the problem and part of the solution to the sustainability problem. This second approach is assigned to the Neo-Schumpeterian perspective with its qualitative perspective on economic development. Innovation-triggered development is characterized by both, a quantitative, i.e., income-increasing dimension and a qualitative, i.e., structure-changing dimension. In particular, at the end of the 20th century and at the beginning of the 21st century, capitalist-oriented





economies have demonstrated impressively their global power of change: in a short time more people are brought out of poverty (one of the 17 objectives othe UN'sagenda 2030) by creativeentrepreneurship in free markets than before by fifty years of development policies.Obviously, these developments have aggravated the resource problem and pollution to some extent; however, higher income economies move along the environmental Kuznets curve and organize cleaner production (Fagerberg et al., 2015).New creative solutions are able to reform our future economy in the sense of sustainability, thereby supporting the achievements of the UN'sobjectives towards a sustainable development and ensuring growth and development at the same time (Mazzucato und Perez, 2015).

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The leadingidea of a knowledge-based economy is based on the notion that abstinencein the sense of economicdown-scalingis neither the first northe only solution. In principle, the opinionis shared–which includes both demand side and participatory elements –that, in accordance with the supporters of the first method, certain past patterns of production and consumption require urgent adjustments. Especially concepts resultingin a more intensive use of goods and therefore contributingto the economization fresources (,sharing-economy')are important. The same applies for closed-loop material cycles, recycling systems, and intelligent waste treatment. These concepts are perfectly applicable to triggeringlearning and behavioralchanges on the demandside. However, the core idea consists of supplyingand demandingnew technological solutions within a comprehensive economic transformation process (Geels 2002), i.e.,different goods and services are produced and demanded in different ways, which are characterized by sustainability. Realizing the technological possibilities ofthebio-economy not only creates new investment opportunities but is also the prerequisite for a necessary socio-economic and cultural change. The consumers' acceptance ofbio-based products andtheir demand are a conditiosinequanonfor a successful change.Consequently, innovations, functioning markets, and changed consumer attitudes are complementing conditions for the creation of a sustainable production system.

Supporters of the Neo-Schumpeterian school (Dosi et al. 1988; Lundvall 1992, 1998; Nelson 1993) emphasize the systemic character of innovation processes in knowledge-intensive economic sectors. So-called innovation systems consist of different actors (companies, research institutions, political actors, consumers, etc.) and linkages between these actors (flowsof goods, R&D cooperation, knowledge transfer relationships, user-producer-relationships, etc.). These linkages are required to ensure mutual learning and common knowledge development to solve complex innovation challenges. Such systems are characterized by their dynamic and co-evolutionary nature and are thus enormously complex, as both actors and their knowledge and linkages and interactions between actors may change over time. Dosi (1982) takes this systemic conception as a starting point in definingtechnological paradigms as "[...] set of procedures, or a definition of the 'relevant' problems and of the specific knowledge related to their solution". Transferred to the knowledge-based bio-economy, the core ideais substitution, i.e., replacing carbon-based materials and energy withbio-based materials and energy. This can only be achieved by applying a variety oftechnological processes in the entire breadth and depth of the value-added chain.In this process he exploration of economic complementarities in terms of cross-fertilization of different knowledgefields matters. For example, to a large extent, digitalization allows for anextension of value chainsby increasing the added value in new sustainable production sectors in a CO2-neutralway(e.g.,by electric mobilitybased on renewables, by development of smart grids, etc.). The concept of technological

paradigms also illustrates that a paradigm shift is not possible atany time. A window of opportunity will only occasionally be opened and allow for a paradigm shift when several interconnected technologies are established and the creation of conducive demand-side and institutional conditions happens simultaneously. This, of course, holds for the emergence of a new bio-economic innovation system, too.

#### 3. Innovation Systemsand Knowledge

The theory of industrial life cycles, which emphasizes the strong dynamics in the emergence and declineof industries, gives a first hinton the meaning of the development of a dedicated innovation system supporting the transformation towards a knowledge-based bioeconomy. Typically, industrial development is divided intofour stages: i)a development phase (new knowledge creates prerequisites for innovation), ii)an entrepreneurial and growth phase (many market entries of smaller innovative firms), iii)a saturation phase and consolidation phase (formation of industrial standards, mergers and acquisitions as well as market exits), iv)a downturn phase (oligopolistic competition in only lessinnovative industries)(Audretsch und Feldman 1996). Although thebio-economydoes not represent a well-defined industrial sector, understanding the theory of industrial life cycles is ofcrucial importance to structure the transformation process towards the knowledge-based bio-economy. Without doubt, the bioeconomy has to becharacterized ascross-sectional. On the one hand, several new sectors will emerge, e.g., in the fields of bio-plastic, waste management, orbio-refineries. On the other hand, already existing sectors in the fields of vehicle construction, battery technology, pharmaceuticals, etc., will gain new momentumby the arrival of bio-economic approaches. Therefore, we argue that new sectors will emerge by establishingbio-economicaltechnologies, and development dynamics of some already existing industries will receive new impetus at the same time.Adjustments of old and development of new institutions (e.g., in Germany the Renewable Energy Act, the Greenhouse GasEmissions Trading Law,etc.), adjustments of consumer habits, and the emergence of new educational opportunities in terms ofco-evolution will accompany these processes and establish the institutional, the industrial, and the consumer pillars of a dedicated innovation system.

The patterns and nature of new businesses in the Bioeconomyare thus stronglyinfluenced by national institutions or ganizations (Casper, Lehrer undSoskice 1999; Whitley 1999). Institutions are defined as 'a set of rules, formal or informal, that actors generally follow, whether for normative, cognitive, or material reasons'. 'Organizations aredurable entities with formally recognized members, whose rules also contribute to the institutions of the political economy' (North (1990), Hall and Soskice (2001)). In this interplay between organizations and institutions, the knowledge-base of an economy is created by theeducation and research system andrepresents one of the most important prerequisites for the transformation towards a bio-economical production system(Geels 2002). This automatically relatestoa high level of uncertainty in particular concerning the required rightfuture competences. In this complex process numerous individual knowledge fields arepotentially relevantfor the transformation and are already identified, e.g., synthetic chemistry, process engineering, genetic engineering, food technology, or informatics. It is decisive tounderstand the dynamics of these knowledge fields and the possibilities of their recombination with other knowledge fields and adequate actors in order to create an innovation system. In many cases, linkages of different knowledge fields (,cross-fertilization') are responsible for the emergence of extensivetechnological opportunities: for instance, a complete new industry, bioinformatics,





has been initiated by the fusion f two so far unrelatedknowledge fields:database technology and molecular biology.Consequently,because linkbetweendifferent knowledge fields fields often implies true uncertainty, governmental innovation policies matter a lot. Knowledge about future potentials is essential for supporting research and innovation policies: the analysis of knowledge and network dynamics allows for the identification of development trajectories showing sectors requiring public attention and support concerningresearch and development in order to close existing knowledge gaps and build bridges between still unconnected knowledge domains (Burt 2004; Zaheer und Bell 2005).

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# 4. Innovation in knowledge-based societies

It has already been mentioned thatalso consumer knowledge playsanimportantrolefor the development and establishment of sustainable consumption patternsina knowledge-based bio-economy(Geels 2002). Therefore, the analysis of the transformation process has to include interaction of technological development, demand, and acceptance of innovative solutions as well associological variables. The latter include, e.g., education, age, income and gender. All are important explanatory factors determining attention and readiness to deal with bio-economicissues. A bio-economic innovation will only be successful whenconsumers accept it. The direction of the transformation processis, comparable to the importance of the policy realm, determined by consumers and their demand, i.e., an important question has to deal with consumers' openness tobio-economics and itsproducts.

Finally,(real and virtual) social networks matterfor the establishment of new consumption patterns. They can contributesignificantly to adiffusion of consumers' behavioral patterns and values (Robertsonet al.1996; Valente 1996; Nyblom et al. 2003; Deffuantet al.2005). Recent studies show that attitudes are substantial for the development of social relationships and that in turn, social relationships considerably influence behavior and attitudes. In the field of renewable energies, for example, the initiative of municipal utilities' customers has ledin many cases to a 'green' orientation of regional power supply. In some cases, citizens' networksfinally transformed to investment companies that energies in wind farms.

Critical issues are tobe dealt with in democratic processes in order to be widely accepted. Not everything that is technically possible is also socially desirable. In the field of the bio-economy, this may, for instance, include the use of genetically modified organisms in agriculture. In fact, these organisms promise efficiency advantages with regard to the consumption of land and wateretc., but their long-term health and environmental risks cannot be completely (as with any new technology) anticipated. Accordingly, technological developments require consumers' acceptance and attitude and thus depend on the level of education inan economy. This raises the question of a society's openness towards innovations that are fundamentally associated with uncertainty. The concept of Responsible Innovation summarizes the future-oriented organization of development and is currently discussed with a high priority by European policymakers and institutions. A comprehensive working definition has been developed by von Schomberg (2013). He describes responsible innovations "atransparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)." This means that innovations are not exclusively evaluated by their economic

efficiency, but different aspects (e.g., consumer protection or ecological aspects) also matter and are to be evaluated. Discussions on fossil fuels ('fuelvs. food') show that both, a pure economic and a one-dimensional ethical perspective is not sufficient. The quality of these discussions depends on the discussants' mutual understanding which in turn depends on the participants' level of knowledge.

Modern plant breeding and production of seeds arebio-economical fields of innovation in which issues of responsibility are frequently and controversially discussed. German consumers are skeptical about interference with the genome of food crops, but individual points of criticism remain unclear. New breeding techniques introduced, e.g., Genome Editing, enable scientists selectively modify DNA strands of crop plants. These techniques are considered innovative as they may allow breeding of potentially efficient plants in fast and cheap ways. Species developed in this way hardly differ from those of conventional breeding. The Central Advisory Committee for Biological Safety does not classify these techniques as genetic engineering, especially becauseno new combinations of genetic materialare made. As the Genetic Engineering Act does not explicitly address these techniques, legal clarificationis still necessary to whether these techniques are classified as genetic engineering at all. Dissemination potential and acceptance are influenced by this result. Here again, the necessity includeed ucation and information policies becomes evident to support the transformation towards a knowledge-based bio-economy.

The concept of ,Social Innovation'(e.g. Hanusch and Pyka, 2013) emphasizes the importance of active citizenship in innovation. Thus, according to the understanding of the European Commission, this term includes innovations that are social, both in relation to their objective and their instruments. In particular, this includes innovations referring to the development and the application of new ideas (for products, services and models), covering at the same time social demand and creating new social relationships orcollaborations. The whole society benefit contribute to generatenew impetus for improvement. Social innovations can make a major contribution to rural development and promote economic inthese regions y strengthening cooperative behavior. Rural cooperatives (e.g. regional producer and marketing associations, winegrowers' cooperatives, tourism associations etc.) can help to develop regional competitiveness considering ecological and social aspects. As a consequence, within the framework of a bio-economy, rural regions that are notably affected by the already imminent demographic changeand subsequent depopulation receivenew opportunities for economic development.

#### 5. The Economics of Change

The sections aboveillustrate that atransformation of the prevailing economic systemtowards a bio-based economy isan extremelycomplex process. Various different actors participating in different rolesare contributing different pieces of knowledge. In this process, innovative adjustments in already existing industries as well as the emergence of new and the disappearance of mature industries canbe observed simultaneously. In addition to the substitutive relations of new bio-based industries to traditional oil-based industries, there arenumerous essential complementary relations giving furthermomentum for the transformation process. First and foremost there are the possibilities and application fields of digitalization. Digitalizationallows to replace many oil-based products and energy-intensive services simplyby bits and bytes. Simultaneously, digitalizationoffers a wide range of opportunities by





coordinatingdecentralized andvery detailed bio-economical technologies and processes such as energy productionand distribution. This affects the composition of individual sectors where a coexistence of large diversified companies and small high-specialized technology companies is a likelysolution. Finally, digitalization also offers consumer platforms to efficiently organize 'sharing economy'-approaches.Finally, successful knowledge generationand diffusion of relevant bio-economicknowledge depends on dynamic innovation networks (Pyka, 2002) in which different actors jointly share and createnew knowledge.The consumers, represented,for example,by consumer associationsor politics, will play a key role in these innovation networks and will help to establish networks in early stages of technology development.

DONST

In a knowledge-based bio-economy, investments and economic growth still represent a crucialelementfor employment, international competitiveness and income generation. The bio-economy can make important contributions accelerate investments by providing new investment opportunities generated fundamental innovations and thereby bringing currently available large quantities of liquidity to a productive use. This, in turn, accelerates the technological paradigm shift (Perez 2010).

The time path of the transformation process represents another critical component andhas been explored only partially so far. On the one hand, it is high time to reduce carbon-based production methods. On the other hand, there will be frictions in the transformation process being caused for example by a lack of specialistsand required competences. In this context, the so-called sailing shipeffects(Howells 2002), frequently observed with radical innovations, could be madegood useof. In the middle of the 19th century, when the existence of the established sailing ship technology was threatened by the arrivalof new steam ships, shipbuilders -not having changed their technologies for many decades, if not centuries -began to innovate again. Due to the threat of innovative technologies, adjustment reactions in predecessor technologies can be observed with the aim to prevent the ancient technologies to be quickly replaced. Such adjustment reactionsare, for example, fuel-efficient combustion engines and hybrid technologiesasareaction to the emergence of electric vehicles. These adjustments are advantageous since they pursue the same environmental objectives (e.g., inner-city fine dust and noise reduction, etc.) and thusprovidemore time to developnew technologies. Accordingly, the transformation process will for longer periods of time featurea co-existenceof traditional and bio-based industries. Furthermore, it will be important to concurrently steerthe relevant innovation processes in traditional technologies. This coexistencefurther increases complexity. At the same time, innovation policy is given room for insufficientlydevelopedtechnologies maneuverandyet are prevented from being introduced prematurelywhich might cause promising approaches to fail.

Distributional effects of the transformation process are important for social acceptance. A bio-based economy on an industrial scale will largely represent a knowledge-based economy. Consequently, additional demand for high-skilled workers arises whereas opportunities forlow-skilled workers decrease. This means potential loss of jobs for less skilled workers in traditional industrial production.But apartfrom that, there will be demand for different goods and services whose compensation potential with regard to added value and employmentis still unclear, though. Moreover, it remains opento what extent companies are prepared for this transformation into thebio-economy. Transformation processes will lead

to a devaluation of competences so far responsible for economic success. How doestablished companies deal with the so-called 'not-invented-here-syndrome', overcome operational blindness and shape transformation processes actively in order to obtain added value at their established locations? From this follows that distributional effects have an important regional dimension: doesthebio-economy strengthen divergence processes between regions or does it help to achieve more convergence? The approach of creating networks in the sense of the so-called 'smart specialization principle' (Foray et al. 2009) connecting regional strengths along value-added chains in the best possible way, is promising but only sparsely implemented so far. Thus, in general, polarization tendencies leading to economicas well as political and cultural concentration power and resulting in strong center-periphery structures can be avoided. But it still remains unclear, how strong and operational meaningful politically induced networks are in comparison to self-organized networks when political support is withdrawn(Green et al. 2013).

Transformation towardsaknowledge-based bio-economicproduction system is supposedtoterminate the existing negative relations betweeneconomic growth andenvironmental pollution, use of resources, climatechange and energy consumption, and to promote a sustainable economy. The following questions are closely linked to thebasic uncertainty of innovation and cannot be answered ex ante: 'which contributions are to be made by individual sectors? ','what complex feedbacks for national and international competitiveness are to be expected? 'and 'do so-called 'rebound effects' possibly reduce or even overcompensate positive effects of the transformation?'Institutional rules, such as a self-commitment of oil-producing countries reduce their outputs due to the declining demand caused by bio-economics, are a way to reduce these uncertainties, at least partly. It remains necessaryfor all actors, companies, households and policy makers to refrain fromoptimization approaches and profit maximization in thistransformation process. The complexity and uncertainty of this process requires the awareness of all actors to experimental behavior (,trial-and-error')which always also includes the possibility offailure.

# 6. Conclusions

Socio-economic systems have been exposed to permanent transformation processes since the industrial revolution. While development processes farhave been driven 'only'by result-oriented innovation processes, the character of the bio-economictransformation process is clearly concretized by society and politics. In the past, mainly bottlenecks caused by scientific-technological restrictionswere overcome by vast technological revolutions, shifting thesocio-economic system onnew trajectories without giving direct instructions to the direction of the development process. At the beginning of the 21 stcentury, however, the massive accumulation of greenhouse gases in the atmosphere since the beginning of theindustrial revolution and the vulnerability of our present ecosystems reveal that global thresholds are almost surpassed. Thus, the levelof freedom forfuture developments is restricted in order not to irreversibly damagenatural conditions for human life and biodiversity. It is yet unclear whether this transformation process succeeds in the desired wayand how it can be governed by political influence to achieve existential objectives of the global human society.

New technological developments alone are not enough to transform the socio-economic system. In a first





step, they only create the necessary potential for radical changes affecting the economy as a whole. Converging trajectories and synergies that may finally introduce the paradigm shift necessarily require a broad social consensus on a specific use of these technologies. This means aninitiation of a direction of development which connects investment decisions, innovations, and the tackling of basic uncertainty by politics (Pérez 2013). The 'green growth paradigm' based on bio-based technologies can be such a direction bringing together the potential of different technological developments and exploring their full potential. This requires political decisions supporting new-orientation of research and innovation activities, exploitation of new energy sources, improvements in productivity of natural resources and new sustainable ways of living and producing (Pérez 2013). Moreover, in such a transformation process catching-up economies have to be provided withnewopportunities for economic development without overstretching global natural resources and environment. Thus, apolitical and social direction is essential for a successful transformation process (Mazzucato und Perez 2015).

DEVIST

Examples include the development of new products within emergingbio-economic innovation systems. In this perspective, innovations require an interplay of actors along value added chains which might leadto the development of new industries. In the past, for example, theprovision of cheap electricity ledto the spread of fridges and freezers in private householdswhich brought innovations in the fields of frozen food and packaging. Similarly, the creation of a ,Sharing Economy maylead to new digital coordination platforms and the creation of sustainable designs by product manufacturers in the bio-economy. Planned obsolescence, a phenomenon wasting resources and shortening product life cycles, would be eliminated this way and new sectors, for example, in the field of repair and maintenance services are initiated. Important determinants shapinglong-term development are networks and clusters. They help to reduce uncertainty and support self-reinforcing effects. Furthermore, social changes and changing lifestyles are both, an expressionand adriver of thistransformation process (Mazzucato und Perez 2015).

Therefore, the role of governmentsis not only restricted to the correction of market failures. In fact, by ensuring investment safety and reducing risks and uncertainty, government instruments prepare the emergence and flourishing of new markets (Mowery et al.2010). A crucial task forpolicies in the realm of innovation and entrepreneurship is the transition from invention to innovation, i.e., the expansion of bio-economical activities in amarket. Correspondingly, agrowth path based on bio-economics is more than a mere replacement of crude oil by renewable resources or renewable energies. It rather needs adedicated innovation systemcreating synergies, knowledge transfer, and networks between manufacturers, suppliers, and consumers. Itrequires a comprehensive reorganization that includes the entire economy and renewsproduction and consumption patterns their present forms, which wereshaped by previous transformation processwithin the oil-based paradigm.

The technological potential of a bio-economy is a necessary but insufficientcondition for this transformation process. It also requires democratic consensuson the broad development and wide application of this technological potential. This includes the exploration of new trajectories and the fusion of new and existing technological trajectories. Markets in which innovations are profitable do not arise on their own but rather need feedback loops between political decisions, corporate strategies, and consumer preferences.

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# CLUSTERS, SMART GROWTH AND ENERGY SECURITY: IF CONSITENT PATTERNS COULD BE TRACED

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# Abstract

In the presented paper specific aspects of clusters' role in energy security enhancement are being discussed. An assumption of role of clusters as driving force of smart growth with respective effect on service sector development is being raised and discussed. It is claimed, that smart growth will contribute to expansion of service sector; i.e. will accelerate the processes observed now. The analitical part of the paper is devoted to long range forecasting (until year 2050) of energy intensity of service sector in selected countries of different development. The aim of such forecasting is to reveal if energy intensities in service sector, will diminish and converge as result of innovative processes affected by clustering of stakeholders, wich are business companies, universities, state and society. We claim that clustering of listed stakeholders through technology and consumption culture transfer affect energy intensity change trends in service sector and pushes it down. We argue, that interrelationships among clusters, smart growth and energy security (through diminishing energy intensity in service sectors of differently developed countries) could be traced. We assume that indicated interrelationship does not depend of level of countries' development; anyway less developed European countries benefit mire from clustering phenomenon.

**Keywords:** clusters, energy security, service sector, sustainable development **JEL Classification:** O1; O33 **Conference topic:** Sustainable Economics Development

# Introduction

Discussion about the role of clusters in regional development has become contemporary classics. When we recall this classics, as the first association comes Porter, one of the most prominent scientist from Harvard Business School. In order to pay a tribute to this well-known scientist, let us start discussion about clusters from his definition of a cluster. According him "clusters are geographic concentrations of interconnected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters

also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions—such as universities, standards-setting agencies, think tanks, vocational training providers, and trade associations—that provide specialized training, education, information, research, and technical support (Porter 1998). What is peculiar about Porter's approach towards clusters' impact assessment, that he emphasizes exceptionally positive effect for their members and outsiders: Let us go through main highlighted insights provided by the author in Harvard Business School Review of year 1998. According the prominent author, "a cluster allows each member to benefit *as if* it had greater scale or *as if* it had joined with others without sacrificing its flexibility" cluster members feel "peer pressure, pride, and the desire to look good in the community"…"at the intersection of clusters, insights and skills from various fields merge, sparking new businesses"...

"clusters offer a constructive way to change the nature of the dialogue between the public and private sectors" (Porter 1998).

After these insights were formulated, a lot of papers on clusters have been published and economic policies fostering clusters implemented. In the research a focus has shifted into analysis of clusters composition; attempts to measure efficiency and even benchmark performance of different clusters can be noticed (Manuela Tvaronavičienė, Kristina Razminienė 2015; Tvaronavičienė et al. 2015; Ignatavičius et al. 2015; Fuschi, Tvaronavičienė 2016; Akhmadeev, Manakhov 2015). Technology transfer phenomenon now is mainly associated with clusters' activity (Tvaronavičienė, Černeševičiūtė 2015). Technology transfer is associated to innovations of various origin, i.e. both, technological and social innovations. The role of both ones in the process of sustainable innovative development is higly emphersized in resent literature (Dobele et al. 2015; Oganisjana, Surikova 2015; Olaniyi, Reidolf 2015, Prause 2015; Lace et al. 2015; Oganisjana et al. 2015; Rosha, Lace 2015; Dlugoborskytė et al. 2015; Štitilis et al. 2016; Boonyachut 2016; Gasparėnienė et al. 2016; Baronienė, Žirgutis 2016).

If to discuss areas, in which clusters are being found, we need to admit, that there are no specific areas, which could be indicated as especially characteristic for clustering activities. Nowadays clusters emerge in wide array of areas; actually in any area or field of activity clusters can emerge naturally or be established. Not an area of activity here is of importance; value added, which can be created by cluster members - that is what matters, and triggers clustering activities.

We focus our research to area of energy use – efficiency and intensity- factors, which impact sustainable economic development and are widely discussed in contemporary literature (e.g. Baublys et al. 2015; Tvaronavičienė 2016, Strielkowski 2016; Jefremov, Rubanovskis 2015; Balitskiy et al. 2014). Since our target is as well energy security, basing on considerations provided above, let us try to find out what is clusters' role in energy security enhancement, if any. Let us provide our argumentation how we see clusters' impact on energy security.

At first, let us clarify what we mean by energy security in this context. Energy security can be perceived in very different ways, depending on what stakeholder – public or professional - expresses his/her opinion (e.g. Tvaronavičienė 2012.; Leonavičius et al. 2015; Miškinis et al. 2013; Espona 2016; Tvaronavičienė et al. 2014; Tvaronavičienė et al. 2015; Narula; Reddy 2015; Corneliu, Tamošiūnienė 2015). In the context of our research, in which possible effect of clustering phenomenon is discussed, we use energy security concept as synomimous to energy efficiency. Further in this paper we will try discuss



tendencies of change of energy intensities in service sectors in selected countries, meaning that energy intensity, ultimately, is joint resut of energy efficiency and behavioural patterns in energy consumption. After this clarification we can move with our research further. We raise an assumption that clustering phenomenon due to its innovative potential serves as driving force for smart growth. Despite smart growth can be observed in any sector of economics (Prause 2016; Tvaronavičius, Tvaronavičiene 2008; Vasiliūnaitė, R. 2014; Vosylius et al. 2013; Tvaronavičienė et al. 2015; Tvaronavičienė 2016) the most suseptible sector for innovations remains service sector (Dudzevičiūtė et al. 2014). Technological innovations, and more frequently, social innovations affect fast development of service sector. Dynamics of service sector development is provided below in Figure 1.

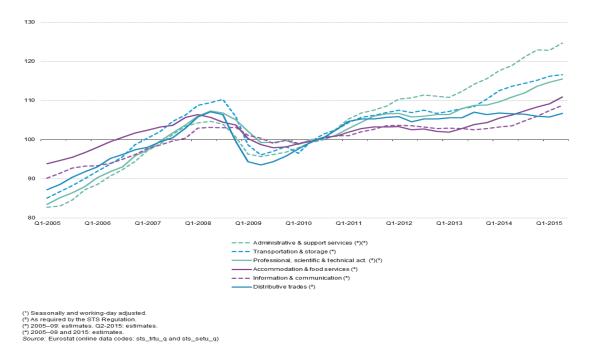


Fig. 1. Development of service sector in Europe during the last decade (Source: Eurostat)

Further in this paper we will analyse energy intensity of service sectors in selected papers. Before doing that let us clarify what palce to energy intensity is attributed in Sustainable Development Indicators provided by Eurostat.

Hence, Energy intensity is listed as one of indicators of sustainable development and atributed to Socioeconomic development group. Eurostat comments on overall energy intensity in the EU in the following way: "Energy intensity in the EU has improved. It declined by 15.9 % between 2002 and 2013 as a result of absolute decoupling of gross inland energy consumption from economic growth". Energy intensity in Eurostat is seen as related to innovations, since the next indicators to energy intensity is R&D expenditure as a share of GDP, which is supposed to be related to number of papents. Sustainable consumption and production is seen as another group of sustainable development indicators. The following comment is provided about the final energy consumption: "Final energy consumption in the EU has been rising since 1990. The strong contractions in final energy use in 2009 and 2011 not only

brought final energy consumption in 2013 down to pre-2000 levels, but also pushed the EU ahead on its projected path to reaching the 20 % energy saving target (Eurostat). Here we needed to add that drop in energy consumption in yaer 2009 most likely was very closely related to world crisis in year 2008. It is much better when energy consumption decreases because of technological innovations, and beavioural change. If technological solutions are constrained by achieved level of technology, behavioral change still has hudge potential for change. Clusters, we believe, is driving force, which can facilitate changing energy consumption culture and switch it towards enery stewardship and therefore enhanced energy security.

# Coverage of analyzed problematics in the latest literature

Before we go to forecasting results let us clarify if other scientists are interested in analysis of relationships between clustering phenomena and energy security. Let us look at the latest literature on the topic. At first we searched Thomson Reuters Web of Science database using keywords "clusters" and "energy efficiency". Results are provided in Figure 2.

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Fig. 2. Results of sources' search in Thomson Reuters Web of Science database using keywords "clusters" and "energy efficieny"

(Source: authors' inquiry in database Web of Sciences)



The major contributor to the selected topic is China. That could be easily explained by population size in this country. Another message, which is being sent by the clip from Thomson Reuters webpage (same the Fig. 1) is that, the topic embracing clusters and energy efficiency issues is existant but still in very ealy stage of development. The discussion mainly spins around smart grids and IT systems. We encountered one paper, which tackled energy efficiency and clustering phenomena in such energy intensive industry as chemical industry.

This approach does not embrace variety of clustering actors, which is emphasized in our study. Here clustering phenomena is limited to concentration of simiclar technologically related productive facilities. Let us examine SCOPUS database using the same keywords. The search results are provided in Figure 3.

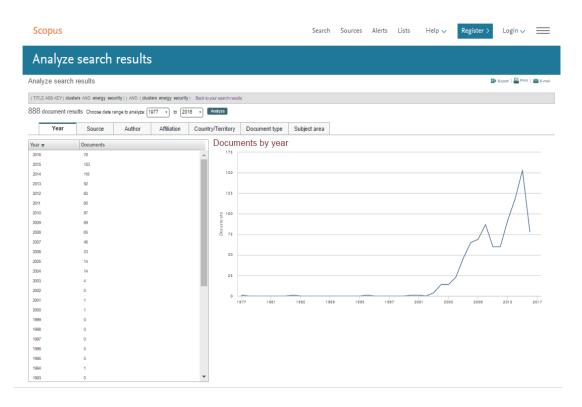
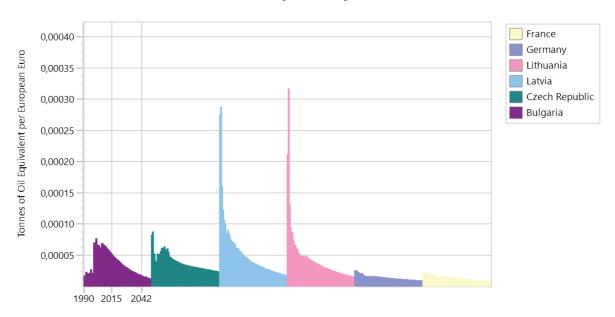


Fig. 3. Results of sources' search in Elsevier SCOPUS database using keywords "clusters" and "energy efficieny" (Source: authors' inquiry in database SCOPUS)

Data about publishing on the provided topic suggests that the research interests in it is increasing, because number of papers devoted to interrelation between clustering phenomenon and energy consumption is sharply raising. The published papers in SCOPUS database similarly like in Web of Science Core Collection database are mostly devoted to energy efficiency in IT: the search results indicated that during 2012- 2016 year there were 888 papers containing key-words "clusters" and "energy efficiency"; 566 out of them were attributed to computer science, 376 to engineering, 95 to mathematics, 54 to energy and 47 to physics and astronomy. Provided information, despite its sporadic nature, is sufficient to verify that research ared devoted to relationship between clustering phenomena and energy efficiency is emerging.

### Long-range forecasting of energy intensities of service sectors in selected countries

Let us look at energy intensities forecasted for service sectors until year 2050 for selected countries. For forecasting we will use the Long-range Energy Alternatives Planning System (LEAP), is a widelyused software tool for energy policy analysis and climate change mitigation assessment developed at the Stockholm Environment Institute (Heaps 2016). Forecasting is based on current trends, we use ceteris paribus assumption. We select the following countries: the best developed European countries are represented by Germany and France, and comparatively less developed countries in our empirical research are represented by Check Republic, Lithuania, Latvia and Bulgaria. By selecting the two groups of countries and representatives for those groups we aimed to check if consitent patterns can be found, and if we can conclude that some general tendencies could be distinguesed and explained. The results of forecasting are provided in Figure 4. The following generalities could be revealed: the first, energy intensities in both more developed European coutries - France and Germany - are considerably lower than in all countries representing group of less developed European countries. The observation holds for he whole considered period, i.e. from year 1990 to year 2050. We can calaim that observed trends let us reaveal one consistent pattern: better developed countries due to technological advance perform much better in energy efficiency area, therefore their energy energy intensity, as resulting indicator, much better. Here we can assume that behavioural patterns in energy consumption can be characterized by one of the two formulated statements: the first, behavioral patterns are oriented to energy stewardship, either, the second, behavioral patterns are not sequently oriented to energy stewardship. In the latter case, technological innovations, remain the major driver conditioning increasing energy efficiency, and therefore diminishing energy intensity.



# All: Final Energy Intensity (Tonnes of Oil Equivalent per European Euro) Scenario: Baseline, Region: All Regions

Fig. 4. Energy intensities of service sector in selected countries; year 1990-2050 (Source: authors, obtained using software LEAP)



Let us take a closer look at behavior of service sector and its energy intensity in Lithuania (Figures 5 and 6), Bulgaria (Figure 7) and Germany (respectively Figures 8 and 9). It is observed the same general tendensy of service sector expansion. Energy intensities of service sector in long term change in different way: in Lithuania diminishing is more intensive, in Bulgaria energy intensity changes rather similarly like in Lithuania with one difference: energy intensity never had achieved hights of Lithuania. In Germany energy intensity sequently diminishes, and since aproximately year 2020 stabilizes and further diminishes very gradually. We can conclude that at currently achieved level of technology Germany does not have much potential to diminish energy intensity further, unless behavioral changes, oriented to energy stewardship were implemented. Here social innovations resulted from clustering of different stakeholders could be employed. Returning to Lithuania (the same holds for other countries similar to Lithuania according their level of development, e.g. Bulgaria), it has to be noted that both – technological innovations, and social innovations for energy efficiency will remain of importance for couple of decades, at least.

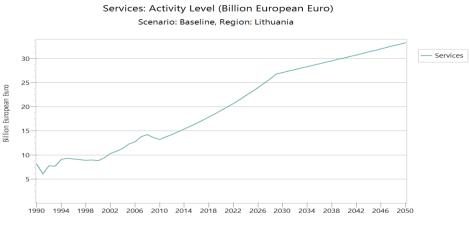


Fig. 5. Expansion of service sector in Lithuania until year 2050 (Source: authors, obtained using software LEAP)

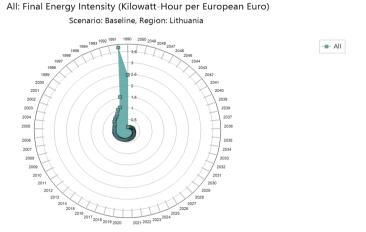
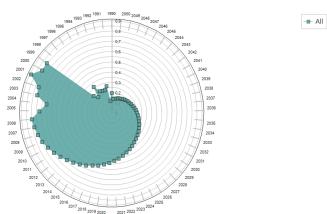
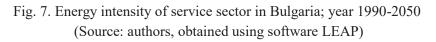


Fig. 6. Energy intensity of service sector in Lithuania; year 1990-2050 (Source: authors, obtained using software LEAP)



All: Final Energy Intensity (Kilowatt-Hour per European Euro) Scenario: Baseline, Region: Bulgaria



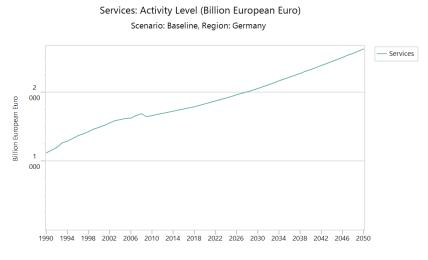


Fig. 8. Expansion of service sector in Germany until year 2050 (Source: authors, obtained using software LEAP)



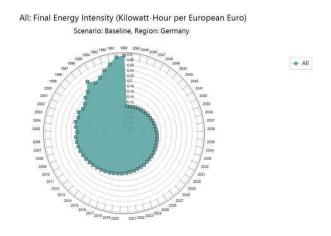


Fig. 9. Energy intensity of service sector in Germany; year 1990-2050 (Source: authors, obtained using software LEAP)

# Conclusions

As the result of presented research the following insights are formulated:

- clusters affect smart growth, especially in service sector;

- service sector in European countries is expanding, energy intensity is gradually diminishing and *ceteris paribus* will diminish until year 2050 both in developed, and less developed European countries;

- energy intensity is dependant on tangible (patents, technology) and intangible (e.g. clusters affecting behavioural change) factors. Since absolute level of energy intensity remains much higher in less developed European countries, clustering due of its resulting effect is more beneficial for less developed European countries.

#### **Disclosure Statement**

Author does not have any competing financial, professional, or personal interests from other parties.

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Session-17-#303-4(SS26 & SS28)

# The Effect of Sustainable Entrepreneurship on Entrepreneurial Intention: Focus on the Moderate Effect of Market Orientation

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# Abstract

# **Purpose/ Research Question:**

The purpose of this research is to examine the relationship between sustainable entrepreneurship and entrepreneurship intention and activity focusing on the moderating effect of market orientation.

# Key Literature Reviews (About 3~5 papers):

Sustainable Entrepreneurship is the process of discovering, evaluating, and exploiting economic opportunities that are present in market failures which detract from sustainability, including those are environmentally relevant. (Dean and McMullen, 2007). According to the previous research, the critical issue in sustainable entrepreneurship is to discover and exploit problems accrued from market imperfection and environmental destruction and solve them to sustain environments. Although many researchers pay attention to sustainable entrepreneurship, few research have focused on HOW to find such opportunities in market and to alert market changes from the environmental destruction. The study of entrepreneurship intention for university students by Kuckertz and Wagner (2010) reveals that sustainable orientation has a significant impact on entrepreneurship intention not for business students but for science and engineering students. They explain business experience would have hindered entrepreneurship intention by sustainable entrepreneurship for business students, which brings us the research question such that how potential entrepreneurs capture an opportunities and why the difference occurs by academic subjects.

Drawn from this research issue, we consider the role of market orientation capability along with sustainable entrepreneurship to find out the factor enhancing entrepreneurship intention and actual activity for potential entrepreneurs. Market orientation should be complement to entrepreneurship in identifying market information and generating learning from it (Slater and Narver, 1995). That is, entrepreneurial values and market opportunities become explicit and clear when marketing orientation supports entrepreneurship.

# Design/ Methodology/ Approach:

Based on the data from 452 of university students registering Entrepreneurship courses, we analyze our theoretical model through PLS path modeling using SmarPLS 2. All the survey items are drawn from previous research. (Kuckertz and Wagner, 2010; Van Gelderen et al. 2015, Eggers et al. 2013, Kajalo and Lindblom, 2015).

# (Expected) Findings/Results:

We find that sustainable orientation is not directly associated with entrepreneurship intention and entrepreneurial activity. However, market orientation shows a strong moderating effect on the relationship sustainable orientation and entrepreneurship intention and activity. This findings suggest that potential entrepreneurs should possess the capability to understand customer needs and alert market changes in order to acquire opportunities and pursuit sustainable entrepreneurship. (Further analysis by student major and level of business experience are expected in next stage of research).

# **Research limitations/ Implications:**

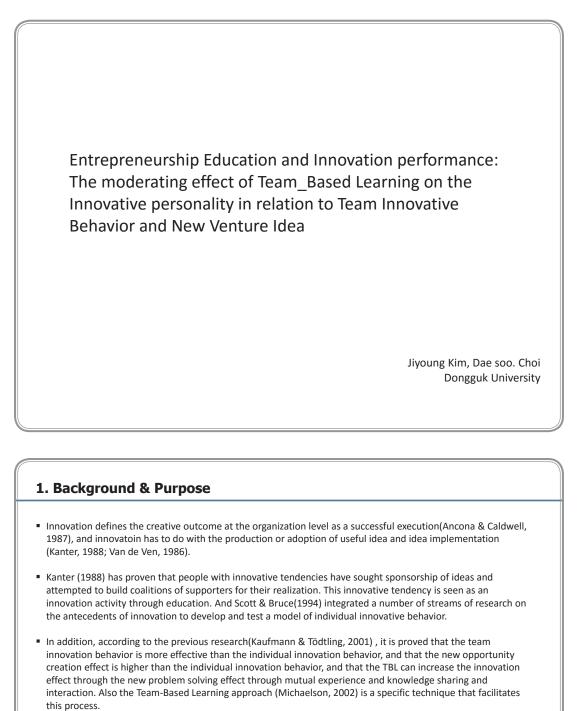
Our study helps in finding the factor underlying sustainable entrepreneurship and suggesting the way to boost entrepreneurship intention and activity. Further implications for theory and practice are discussed in the paper.

Keywords: sustainable entrepreneurship, market orientation, entrepreneurship intention.



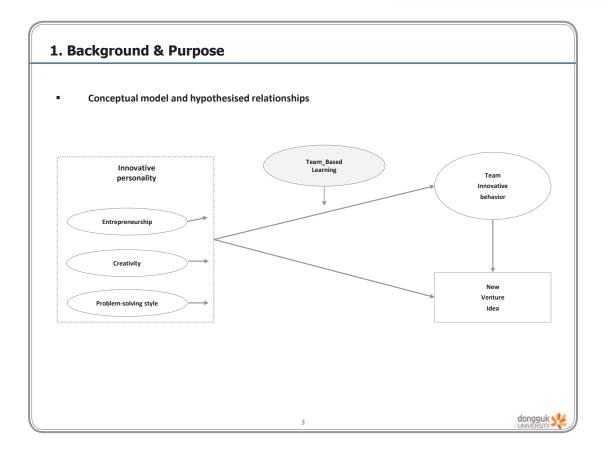


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- However, there is little research on whether the tendency of individual innovation influence on the development of venture idea, whether it is manifested as team innovation behavior through TBL, or leads to new business idea.
- This study will test the effects of innovative personality- creativity, entrepeneruship, and problem-solving
  styles- tendencies on the emergence of team innovation behavior and new venture ideas by TBL, reports a
  specific experience of using TBL in an first step of business unit for innovation, and calls for wider adoption of
  TBL in entrepreneurship teaching considering each of these elements





### 2. Theoretical and hypotheses

#### 2.1. Innovative personality and Team innovative behavior

Personality is a set of stable characteristics that determine the commonalities and differences(Hellriegerl, Slocum & Woodman, 1995)

Innovative personality is a change-oriented tendency to adopt and introduce new ideas without being tied to existing methods(Woodman et al.,1993).

Scott & Bruce(1994) & Kirton(1976) addressed problem-solving style on innovative personality and Woodmam et alt(1993) and Hellriegel&Slocum(1995) showed creativity on innovative personality, and entrepreneurship is known to be an important element of innovation(Hellriegel&Slocum, 1995), and Innovative personality will have influence on innovation behavior because they have self - efficacy and self – determination(Collins & Porras, 1994)

Therefore, to replicate and confirm early results linking innovative personality with Team innovative behavior, we suggest:

Hypothesis 1a : The degree to which an individual's Entrepreneurship is positively related to Team Innovative behavior Hypothesis 1b : The degree to which an individual's Entrepreneurship is positively related to New venture idea

Hypothesis 1a : The degree to which an individual's Creativity is positively related to Team Innovative behavior Hypothesis 2b : The degree to which an individual's Creativity is positively related to New venture idea

Hypothesis 3a : The degree to which an individual's Problem-solving style is positively related to Team Innovative behavior

Hypothesis 3c : The degree to which an individual's Problem-solving style is positively related to New venture idea

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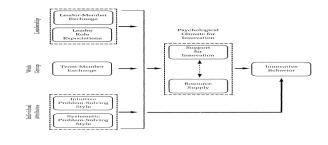


## 2. Theoretical and hypotheses

#### 2.2. Team innovative behavior and Team Based Learning

Innovation is the process of action in which a new idea is created or introduced internally to the adopted suborganizational unit, and it is implemented and utilized within the group over time. The root of innovation is the idea, and the subject that develops, Because it is a person (VandeVen, 1986), research into motivating or enabling an individual's or group's innovation behavior is important.

Scott& Bruce determined innovative behavior. The study provides evidence that innovative behavior is related to the individual attributes.

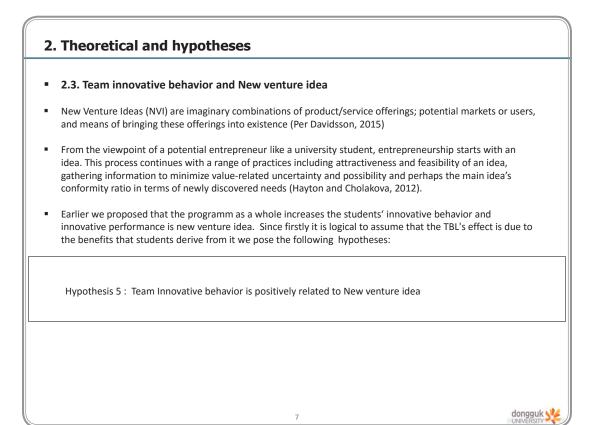


Team innovation behavior means team members' idea creation and sharing activities to promote team performance improvement( West and Farr,1 989). Teams are the core of organizational innovation, and these team processes are a key factor in innovation development (Taggar, 2002).

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### 2. Theoretical and hypotheses The difference between the innovation behavior at the individual level and the innovation behavior at the team level is that the innovation behavior at the individual level is to recognize the problem at the individual level and act to change it. At the team level, There is a difference in the recognition of shared change among team members and in the level of individual-level innovation behavior in that cooperative efforts of team members are required to carry out change. Kanter (1988) has proven that people with innovative tendencies have sought sponsorship of ideas and attempted to build coalitions of supporters for their realization. This innovative tendency is seen as an innovation activity through education. Team learning is increasingly viewed as a decisive factor in organizational ability to create economic value for organizational stakeholders(Thompson, 1995). And TBL is provided opportunities to show their thoughts and criticisms freely and the team members can think twice about the dominant logic that they have taken for granted (Prahalad & Bettis, 1986). Therefore, we can show a high innovation tendency to present a new and improved direction. Accordingly: Hypothesis 4a : TBL will moderate the relationship between individual's Entrepreneurship and to Team Innovative behavior Hypothesis 4b: TBL will moderate the relationship between individual's Creativity and to Team Innovative behavior Hypothesis 4c : TBL will moderate the relationship between an individual's Problem-solving style and to Team Innovative behavior dongguk 6



3. Methodology	
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#### 3.1. Sample

Students (more than 200) of entrepreneurship-related lessons in which founding ideas are included in the curriculum in Korea

#### 3.2. Measures

- a. Research Method : Survey Analysis
- b. Questionnaire implementation period: December 2016
- c. Composition of questionnaire contents
- innovative personality(Entrepreneurship, Creativity, Problem solving style)
   Team's innovative behavior: Self evaluation of team activity
   New venture idea: self-evaluation of business idea
- d. Questionnaire scale: 5-point Likert scale(1= not at all; 5= strong)
- e. Control variables: Team size, major field
- f. Analysis method: Multiple regression analysis including reliability and validation

Factor	#Item	Operational Definition	
Innovative personality	24	A change-oriented propensity to seeks to adopt and introduce new ideas beyond existing methods - Creativity - Entrepreneurship(Risk-taking, Progressive, Innovation) - Problem-solving Style	Rogers and Shoemaker (1971, p.27) Heliriegeri, Slocum & Woodman(1995) Hughes, M. & Morgan, R.E. (2007)
Team Innovative behavior	7	she or he generates new (novel or adopted) ideas and solutions, works to promote and build support for team, and produces an applicable prototype or model for the use and benefit of the organization or parts within it.	Scott & Bruce(1994) Thompson(1965) Kanter(1988)
New venture idea	7	New Venture Ideas (NVI) are imaginary combinations of product/service offerings; potential markets or users, and means of bringing these offerings into existence.	Per Davidsson(2015) Amason et al.(2006)
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#### 4. Expected result

- The effectiveness of Team Based Learning is expected to be proven in the entrepreneurial education.
- Individuals' innovative attributes (Entrepreneurship, Creativity, and Problem-Solving Style) are expected to influence team's innovative behavior and founding ideas.
- We will be able to see which factors have a greater impact.

### 5. Implication for practice

- This study will test the effects of innovative personality- creativity, Entrepreneurship , and problem-solving styles- tendencies on the emergence of team innovation behavior and new venture ideas by TBL, reports a specific experience of using TBL in an first step of business unit for innovation, and calls for wider adoption of TBL in entrepreneurship teaching considering each of these elements
- Also, this study will provided a course such as "New venture idea creation by team" in Entrepreneurship Education programs for undergraduate and graduate students. In this course, new methods and structures for finding new venture ideas
- Offering such courses at graduate levels (Junior levels) as an advanced course is another good option that policy-makers, higher education managers and employers would take it into consideration.



Session-17-#303-4(SS26 & SS28)

# Case Study on the course of 'Google YouTube multimedia creation and business' from the aspect of entrepreneurship education

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### Abstract

### **Purpose/ Research Question:**

Especially for youth, establishing a star-up these days is not as easy as you might think. Although there are a variety of government lead education and support programs for young entrepreneurs and early startups, which in some cases does not give real help to young people actually start with their own idea. For the reasons, academic training and practical support from the university has been increasing its importance and necessity.

Recently the emergence of new media platforms such as YouTube and AfricaTV create new occupation of individual content creator and new ecosystem where they can monetize creative content they have created. Furthermore, some MCNs made successful entrepreneurships and investments.

To catch up with these trend and help college student to understand the industry more practically, the world-class video services company, Google's YouTube and Chung-Ang University opened and have been co-operated a class 'Google YouTube multimedia creation and business' from the first semester of 2015. In this paper we describe and classify the configuration properties that this program has.

We examine the process of preparation and cooperation between Google and Chung-Ang University so that we can explore the implication and significance of the lecture from the entrepreneurship educational point of view such as three aspects of Entrepreneurship, Entrepreneurial intentions, Entrepreneurship Education Effectiveness.







## Design/ Methodology/ Approach: Case Study 1. MCN Creator Course as entrepreneurship education

### 1) Corporate needs

YouTube needs a constantly new professional video content creator so that more people can often get on YouTube. In particular, Google YouTube is a global No1 video platform seeking a strategy that focuses on university students in order to spread the ongoing creator ecosystem.

## 2) Overview

Chung-Ang University signed a Memorandum of Understanding with Google-YouTube in September 2014 to develop a customized curriculum together with Chung Ang University to cultivate video content specialists in Korea as a first mover. The student / team that they received will support various educational and global advancements to lead professional creators. In order to fulfill the MOU, the first semester of 2015 opened the "Multimedia Creation and Business" curriculum related with the trend of new media industry and the understanding of professional creator ecosystem.

## 3) Curriculum design

Google and CJ E&M Executives provide basic knowledge on marketing methodology and profit model creation using new digital media platforms. Yang Ting, and Sin-nim, who are professional creators working in the field, gave a lecture on the contents creation practice to the students and conducted an interactive education to educate students with their own entrepreneurial experience.

The midterm exam is a written test the creator ecosystem and the methodology of the profit model from a macro perspective. The final exam is to present their own video content produced during one semester.

## 2. Performance Creation Process

## 1) Stressors and Overcoming Processes

When designing courses with Google for the first time, it was designed to operate as a major course for students of the Department of Newspaper Broadcasting or Arts College, which possesses basic knowledge of new media and background knowledge on content creation. However, unlike the concerns that could not be selected as a major course, it was operated as a liberal arts course, so students with diverse backgrounds could take courses in education.

MCN Creator's start-up does not generally follow the success cycle of start-ups. In other words, there is an advantage that it can be easily passed to the stage of product development and commercialization without going through the Valley of Death at the idea stage.

## 2) Key achievements

Five excellent first semester students of the course visited to Youtube Space in Japan. One of them is working as a professional creator of 'Tamping Bear' on 'Naver TV' and founded a start-up which is the video production company 'Zakdang.co.kr'.

All of the students who came to the 2nd semester of the course visited at the headquarters of Google Korea, attended the presentation with their own video content which was created in the course and received useful feedbacks in front of the YouTube staff. Afterwards, the Team of Excellence was

awarded a touring privilege to Google headquarters in U.S. In addition, 4 students of the team called MSG are working as a professional creator and another 4 Students are recruited as interns and acquire initial competence as an expert with the support of a CEO of MCN who participated in the course as a lecturer.

### 3. Expected effects

Google YouTube will provide more fresh content to visitors through the influx of new creators as a result of the global industry-academy collaboration curriculum, expecting an increase in the number of visitors and an increase in advertising yields, and a professional creator, MCNs and related companies can expect to see the publicity effect through this course.

From a university perspective, students who have completed the curriculum can work as MCN creators with contents created based on their own creativity. They are not only a creator but also a producer or editor. We expect the students to grow as an expert in the media industry

### 4. Future prospects

Although many policy makers and scholars continue to emphasize the importance of the content industry and the importance of the global market, universities are not able to respond to rapidly changing market demand. Therefore, in the future, it is necessary to open a customized curriculum that meets the needs of various domestic and foreign companies and to open a course tailored to society that can connect students to entrepreneurship and recruitment after graduate selection.

## (Expected) Findings/Results & Research limitations/ Implications:

### Effectiveness of entrepreneurship education

Entrepreneurship and willingness must be clear to start a business. However, if you decide to start a business with a blind start-up in a situation where you are in the right position for start-up and lack of basic knowledge related to start-up business, you will have a chance to fail. Therefore, it is possible to cultivate basic knowledge and skills related with entrepreneurship through systematic and proper entrepreneurship education. Roles and successes can be taught through appropriate training programs (Anjan R. 2005), as evidenced by the successful start-up of a number of graduates who have completed entrepreneurship programs at MIT, Harvard, and Stanford universities in the United States. In addition, Thomas N Garavan and Barra O'Cinneide (1994) found that there is a significant relationship between entrepreneurship training and venture business start-ups, and that students participating in entrepreneurship training are more likely to start business. (1998) argue that entrepreneurs are created through entrepreneurship education, while entrepreneurial knowledge and skills encourage entrepreneurship. Kierulff said that the negative perception of entrepreneurship can be changed through education that replaces uncertainty with knowledge. In terms of the effectiveness of entrepreneurial education, the class contributed as follows.

First, the rapidly growing multimedia content business is the most creative and entrepreneurial in the world. First, the rapidly growing multimedia contents business field requires the most creative and innovative entrepreneurship. Through this class, students were given a way to do business using creative assets and creative entrepreneurship.





Second, Practical education is offered as a way of entrepreneurship, which has a relatively low risk to students and is likely to advance into the global market.

Third, Google YouTube employees, MCN officials, and successful first-time authors exposed their students through lectures, thereby enhancing their entrepreneurship and practical entrepreneurial education. Third, through the direct lectures of Google YouTube employees, MCN stakeholders and successful professional creators, the students' entrepreneurship and practical entrepreneurial education effects were enhanced.

Keywords: Entrepreneurship, Entrepreneurial intentions, Entrepreneurship Education Effectiveness, Content, Google YouTube, MCN, multimedia, Cooperation between Industry and Academia, Content Creators June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

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## The Influence of Perceive Quality on Word of Mouth as Mediated by Perceived Value

(Social, Emotional and Functional) Study of Zara's Customers in Surabaya, Indonesia

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### Abstract

The strict competition in fashion industri require a powerful marketing strategy. The numbers of brands are popping up, business is getting tougher and competitive. In order to survive in the competition, companies are required to do great marketing. The most valuable and powerful tool of marketing is word of mouth. This research aimed to identify the influence of perceived quality on word of mouth as mediated by perceived value, which is divided into social, emotional, and functional as intervening variables. Primary data with population of people ages 18-65, visited Zara at least once a year, and lived in Surabaya. Structural Equation Modeling analysis method was used as the method of analyzing. This research shows that perceived value has positive and significant effect on social value, emotional valur, and functional value. On one hand, social and emotional values, both have significant effect on WOM, on the other hand, functional value does not effect WOM significantly.

*Keywords-* Word of Mouth, Perceived Value, Social Value, Emotional Value, Functional Value, Perceived Quality

#### 1. Purpose/Research Question

This research observed the effect of perceived quality on perceived value. The researcher also will divide perceived value into three values which are social, emotional, and functional. Finally, this research observed the effect of social, emotional, and functional values towards WOM.

#### **Research Problem**

From the information gathered above, the proposed research problems for this study are as follow:





- 1. Does perceived quality significantly affect the social value of ZARA's customers in Surabaya?
- 2. Does perceived quality significantly affect the emotional value of ZARA's customers in Surabaya?

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- 3. Does perceived quality significantly affect the functional value of ZARA's customers in Surabaya?
- 4. Does social value significantly affect the WOM of ZARA's customers in Surabaya?
- 5. Does emotional value significantly affect the WOM of ZARA's customers in Surabaya?
- 6. Does functional value significantly affect the WOM of ZARA's customers in Surabaya?

### **Research Objective**

Based on the proposed research problems, then the research objectives of this study are as follow:

- 1. To know the effect of perceived quality on social value of ZARA's customers in Surabaya.
- 2. To find out the effect of perceived quality on emotional value of ZARA's customers in Surabaya.
- 3. To understand the effect of perceived quality on functional value of ZARA's customers in Surabaya.
- 4. To determine the effect of social value on WOM of ZARA's customers in Surabaya.
- 5. To know the effect of emotional value on WOM of ZARA's customers in Surabaya.
- 6. To discover the effect of functional value on WOM of ZARA's customers in Surabaya.

#### 2. Key Literature Reviews

#### 2.1 Theoritical Framework

Underlying the subject matter in this study as well as strengthening the existing exposure, here is presented the literature review regarding WOM, Social Value, Emotional Value, Functional Value, and Perceived Quality.

### 2.1.1 Word of Mouth (WOM)

Word of Mouth is probably the oldest terms of exchanging opinions on various goods and services offered by market. Many researcher admited the power of Word of Mouth (WOM). Starting with Katz and Lazarsfeld (1955), they believed that WOM was seven times more effective than newspaper ads, four times more effective than direct sales and twice as effective as radio advertising. Then, Day (1971) stated that WOM was nine times more effective than advertising in changing consumer attitudes. However, Morin (1983) showed that WOM was three times more effective than advertising in terms of stimulating purchases over 60 different products. Besides, these effects are amplified by higher customer loyalty.

Word of mouth (WOM) is inter-personal communication about brands, products or services that may be either positive or negative (WOMMA, 2008). In this sense, word of mouth marketing is seen as the type of marketing that specifically promotes natural interpersonal communication in the most diverse ways. WOMMA describes WOM is like giving people a reason to talk about your products and services, and making it easier for that conversation to take place.

Silverman (2001) described WOM communciations can occur face to face, by phone, email, mailing list, or any other means of communication. There are personal and impersonal sources of recommendations that have to be considered. Friends, family, and acquaintances are personal sources of

recomendations. Columns, articles, and commentary by journalist, columnist, and consumers found in newspapers and magazines, online discussion forum are regarded as impersonal reccomendations (Senecal et al., 2005). Consumers should not perceive any marketing or commercial intent behind these statements above. If that is not the case, these communcation cannot be considered as WOM. Thus, a WOM communication can be based both on personal and impersonal sources.

Based on all the statements above, can be concluded that Word of Mouth is an interpersonal communication about brands that can occurs face to face or by communication technology. Based on the study of Goyette *et al.*(2010), Word of Mouth can e measured by using the following indicators:

- 1. Intensity
- 2. Recommendation to others
- 3. Variety of products
- 4. Quality of products

#### 2.1.2 Social Value

Social value is closely related to self-enhancement. A compelling social motive to engage in WOM is self-enhancement. Wojnicki and Godes (2011) show that consumers strategically use WOM to signal or enhance their perceived expertise. To achieve this purpose, positive WOM is more effective than negative, because experts are expected to identify high-quality products better than novices. Thus, consistent with prior evidence (Amblee and Bui 2008), it is expected that the higher the esteem or quality associated with the brand, the more likely consumers are to engage in WOM about it. Another aspect of self-enhancement is status signaling. People use their purchases to signal their social status to others, either to their own social group or to other groups. This study suggest that consumers can signal a high social status not only by purchasing but also by talking about luxury goods. Therefore, this study hypothesize that brands that are perceived as premium will generate a higher level of WOM than what people refer to as value brands.

Specifically, brands that are highly differentiated from others more easily enable consumers to project a unique identity or membership in a group. Therefore, this study hypothesize that the higher the degree of a brand's differentiation, the more likely it is to generate WOM. Desire to converse. The basic human desire to socialize, and thus converse, with others can lead to WOM (Berger and Schwartz, 2011). They also demonstrate empirically that a brand's visibility facilitates people's ability to use it in a conversation. Thus, this research model will account for the brand's visibility or observability. Another attribute that may make a brand suitable for conversation is whether it is relevant in the lives of many people. This study expect that as brands become more relevant to more people, they are more likely to spark conversation.

Based on the statement aboved, can be concluded that social value can be measured using the following indicators:

- 1. Differentiation
- 2. Premium Value
- 3. Relevance
- 4. Visibility





#### 2.1.3 Emotional Value

The emotional value is about consuming or thinking about a brand that evoke emotions that people might like to share with others to express or ease emotional arousal (Peters and Kashima 2007). Beside, many studies provide evidence That brands that evoke both very high and very low satisfaction levels receive higher levels of WOM than brands with moderate levels of satisfaction.

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Emotional value can be described as consumption emotion refers to emotional responses during product usage or consumption experience. Emotional value contains feelings or emotional reactions against factors such as conditions, products, advertisements, promotions and brands. The reaction consumers give against products. Emotional value can affect consumption preferences in positive ways such as loyalty, nostalgia, and excitement. And also in negative ways such as fear, anger and guilt. Notably, the role of a brand's excitement has been overlooked in this context (Aaker 1997). However, excitement is certainly a stimulating emotion that can be expressed through conversation, and thus, it is reasonable to expect that the higher the brand's excitement factor, the more likely people are to engage in WOM.

Based on the statement above, can be concluded that emotional value can be measured using the following indicators:

- 1. Excitement
- 2. Satisfaction
- 3. Involvement

#### 2.1.4 Functional Value

Lovett et al. (2013) described the functional value is about the product itself. Functional value is about the usability and features of the product. people may exchange useful and practical information through conversation, and brands are often the subject of that information exchange. In any such exchange, there is a person who needs the information and one who provides it. In the functional terms, people tend to recommend others if they are perceived to be functionally better. Wiedmann et al. (2007) developed the functional value contains uniqueness, quality, and usability value. Uniqueness is one of the critical features in developing a brand's characteristics and the brand's image that will be perceived by customers. The more unique a brand is, the more value will be planted in customer's perception. While, quality is seen as a fundamental characteristic in the functional terms. Wiedmann also stated that one of the reason why people buy the brand is because high quality reflected by their brand name. While, the core benefit of a product can be seen in its usability for satisfying consumer needs. In this case the author want to know from customers' perspective if the product have usable features and are they necessary for life.

Based on the statemet above, can be concluded that functional value can be measured by using this following indicators:

- 1. Uniqueness
- 2. Quality
- 3. Usability

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#### 2.1.5 Perceived Quality

Han and Monirul (2012) explained perceived quality is a consumer's opinion of a product's or brand's ability to fulfill expectations. Quality is also an important key competitive weapon in global market place. Quality can be overall evaluation of a product quality. Commonly it refers to degree of excellence or finesse to pre-established standard. The American society for quality control defines quality as the total of features and characteristics of a product services that bear ability to satisfy customers' need. Quality cannot be defined precisely, it is simple, unanalyzable property that can be learnt to recognize only through experience (Parasuraman et al., 1985).

According to Han and Monirul (2012), perceived quality is a consumer's opinion of a product's or brand's ability to fulfill his or her expectations. Quality is also an important key competitive weapon in global market place. Quality can be overall evaluation of a product quality. Commonly it refers to degree of excellence or finesse to pre-established standard. The American society for quality control defines quality as the total of features and characteristics of a product services that bear ability to satisfy customers' need. Quality cannot be defined precisely; it is simple, unanalyzable property that we learn to recognize only through experience (Parasuraman et al., 1985).

Kotler and Amstrong (2012) described quality is characteristics that bear on its ability to satisfy stated or implied customer needs. This definition means that a quality of product is measured on how good the product can fulfill needs of a customer, even when the needs are not explicitly stated. However, it depends on the company ability to explore the needs of customer. Kotler also stated that there are two dimensions of product quality, level and consistency. These dimension levels related to perceived quality as a major tools for positioning. Product should be positioned in a certain quality level; each product has its own market to serve. For instance, Mercedes Benz has high quality level; it has been made for people with high taste of luxury. Then Avanza comes with low quality level, it does not mean that it is bad quality product, it is made to serve customers with lower level that does not need the luxury things.

Perceived quality has a powerful effect on various variables about business' performances

### 3 Design/ Methodology/ Approach

#### 3.1 Research Design

This study, titled "Analysis of Perceived Quality through Perceived Value (Social, Emotional, Functional) on Word of Mouth of ZARA's Customers in Surabaya", has the purpose of study to hypotheses testing. Relationship of Word of Mouth, social value, emotional value, functional value, and perceived quality were studied using Structural Equation Modeling (SEM) as the methodology of analyzing. With the use of SEM as the method to analyze, not only relationship among variables could be observed, but also the degree of significant of each indicator for every variable was explained. AMOS Version 16 is the software that was used to help the researcher in completing the calculation.

### **3.2** Sample and Population

#### 3.2.1 Population

Population is a comprehensive collection of an object which is the concern of researchers (Kountur, 2007). Moreover, according to Sugiyono (2002) population is a collection of individuals or objects of the research that has the qualities and characteristics or specific traits





which are set to be studied and then drawn conclusions. In this study, a population that will be used is the customers of ZARA inSurabaya. Judging from the numbers, the populations that will be used in this study belong to the category of the population with an unknown amount.

### 3.2.2 Sample

In this study, the targeted population is customers of ZARA in Surabaya. The criteria used is selecting the samples are:

1. Awareness about Zara product

The author use the definition of awareness according to Oxford dictionary (http://oald8.oxfordlearnerdictionaries.com retrieved on 6 August 2015), awarenedd is defined as knowing something: knowing that something exists and is important; being interested in something.

- 2. Frequency of visiting Zara's store in Surabaya
- 3. Gender
- 4. Age
- 5. Monthly income

Number of sample has an important role in estimating and interpreting the calculation result in SEM. In the study, Ferdinand (2002) stated that in determining number of sample it should be based on:

- 1. In maximum likehood estimation, number of sample should be around 100-200;
- 2. Depending on number of parameter estimated;
- 3. Depend on the number of indicators used for all unobserved variables.

Number of the sample is generated from amount of indicators multiplied by 5 to 10. For example if number of indicators used is 20 then the sample is ranging from 100 to 200. There are 19 indicators used in this study, four from WOM, four from social, three from emotional, three from functional and five from perceived quality. Ideally, the number of sample should be ranging from 95 to 190, however maximum likelihood estimation was applied therefore 100 sample was used for this study.

In this study the sampling design was non-probability sampling designs, because the number of the whole population was unknown so it is impossible for each element of the population to have a known chance to be chosen as the subject if the study. Purposive sampling method was used in this study. In applying purposive sampling method, the judgment sampling was used. The sample chosen here was in accordance to the criteria set in this study.

### 3.3 Method of Data Collection

Researcher used two sources of data in doing this research, which are primary data and secondary data:

1. Primary data: from the calculation results of questionnaires through the question and statement that given to the respondents questionnaires distribution aimed to measure the validity and reliability of the research and also to answer the research problem, thus can clarify whether the elaborated hypothesis has positive or negative value.

2. Secondary Data: information or data is collected from academic journals, publications, and books.

Variable	Variable Indicators	
Perceived Quality	<ol> <li>Performance</li> <li>Features</li> <li>Reliability</li> <li>Durability</li> <li>Aesthetic</li> </ol>	Likert 5 Point Scale
Social Value	<ol> <li>Differentiation</li> <li>Premium/Value</li> <li>Relevance</li> <li>Visibility</li> </ol>	Likert 5 Point Scale
Emotional	<ol> <li>Excitement</li> <li>Satisfaction</li> <li>Involvement</li> </ol>	Likert 5 Point Scale
Functional	<ol> <li>Uniqueness</li> <li>Quality</li> <li>Usability</li> </ol>	Likert 5 Point Scale
Word of Mouth	<ol> <li>Intensity</li> <li>Recommendation to others</li> <li>Variety of products</li> <li>Quality of products</li> </ol>	Likert 5 Point Scale

#### Table 3.1 List of Operational Variables

The scale used in this study is a Likert scale, where the answers are provided at intervals of Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (AS). Inquiries made by using a scale of 1-5 to obtain data that is interval and rated as follows:

- 1. Strongly Disagree
- 2. Disagree
- 3. Neutral
- 4. Agree
- 5. Strongly Agree





### **3.4 Operational Definitions and Operational Variables**

This study will conduct 5 variables which are perceived quality, social value, emotional value, functional value, and Word of Mouth. the result of this study is to see whether the variables are effecting the Word of Mouth or not, so Word of Mouth is independent variable. Perceived quality is independent variable. And the interveing variable is social, emotional, and functional value.

### 4 (Expected) Findings/Results:

The results of this study explain there are six hypotheses that have been proposed; five of them have significant effect and one of them does not have significant effect. The results can be described as follows: Perceived quality has significant effect on social value with 0.593 regression coefficient and 4.592 C.R.; Perceived quality has significant effect on emotional value with 0.572 regression coefficient and 4.876 C.R; Perceived quality has significant effect on functional value with 0.384 regression coefficient and 3.374 C.R.; Social value has significant effect on WOM with 0.344 regression coefficient and 3.021 C.R.; Emotional value has significant effect on WOM with 0.594 regression coefficient and 4.306 C.R.; Functional value does not have significant effect on WOM with only 0.094 regression coefficient and 1.120 C.R.

WOM is affected by 3 variables, according to results, the effect of emotional value on WOM has the greatest effect with 0.594 regression coefficient, second is the effect of social value on WOM with 0.344 regression coefficient, and the last one is the effect of functional value on WOM with 0.094 coefficient regression. Based on the data, emotional value is the most variable which affect WOM most. This result is in accordance with the consumer behavior theory which stated that word of mouth emerge from emotional. When customer feel satisfied and fall in love with the brand, consumers will recommend it to others. While social value is the second greatest variable which affect WOM. Zara products are known as a premium brand that will give special value to the customers. Zara brand also make people looks different from the others, and attractive in their appearances. But how the value would appear when the brand itself is not visible or it is hidden inside the products? That is the power of brand. People who wear authentic brand tend to be more confidence instead of people who wears counter-fit or imitation brand. Consumers will see Zara as a pride that will enhance their social status and consumers tend to tell people around what they wear. Functional value does not affect WOM significantly. Zara sells fashion products which are sold elsewhere by competitors. Aside from the design, the consumers consider the functional terms of Zara are same with other brands. For instance, Zara shoes have same usefulness and quality with competitor's shoes.

Social, emotional, and functional value are affected by perceived quality. Based on the results, perceived quality gives the greatest effect on social value with 0.593 coefficient regression. A good perceived quality of product will enhance consumers' social value. Zara has varieties products that will make consumers feel attractive in dressed. Good durability and beautiful design from Zara will enhance their confidence in society as well. Second, perceived quality affects emotional value with 0.572 coefficient regression. A good quality of a product will lead to satisfaction. Zara provides a good quality fashion products, Zara also consistent in maintaining the quality of its products. Of course these things will bear positive impact on their emotional feelings like satisfaction, enthusiastic, and

involvement with Zara products. However, perceived quality does affect functional value significantly with 0.384 ceofficient regressionn. A good quality of products will lead to good comfort when consumers wear the products.

Perceived quality is measured by performance (X1), features (X2), reliability (X3), durability (X4), and aesthetic (X5). The most important indicator for perceived quality is performance (X1) with lambda loading 0.781 and second lowest mean 3.58. This means that Zara needs to improve its performance in accordance to form a great perceived quality. Zara needs to strengthen and tighten its Standard Operating Procedure (SOP) to maintain its product quality. To increase its performance, Zara should begin to minimize sales of winter jackets, or winter equipment and should focus on fashionable clothes based on country's climate.

The second important indicator is durability (X4) with 0.749 lambda loading and the average mean of 3.80 which is second highest. Durability is also an important indicator for perceived quality. Consumers surely will look for not-only beautiful design but also durable one. With average mean of 3.80, Zara has been proved to provide durable products to its customer and Zara need to maintain its products' durability.

Aesthetic (X5) is the third important indicator with 0.726 lambda loading and the lowest average mean of 3.45. The technology development in this era has brought people to greater expectation for their fashion designs. The development of social media includes fashion blogger insist Zara to keep innovating its product. With the lowest average mean, Zara has been proved still not enough to provide consumers needs in terms of designs. The designers of Zara should be even harder to do inovations of its products' design.

Features (X2) is the fourth important indicator for perceived quality with 0.720 lambda loading and the third highest average mean with value of 3.78. It means that Zara has done well in providing many vary products and Zara need to keep it up.

Reliability (X3) is the least important indicators compare to the other four. Reliability has 0.684 lambda loading, however the average mean of reliability is the highest with value of 3.81. It means that Zara has done well and consistent in maintaining its product quality.

Social value is measured with differentiation (Y1), premium value (Y2), relevance (Y3), and visibility (Y4). The most important indicator for social value is premium value (Y2) with 0.899 lambda loading and the second highest average mean with value of 3.52. It means that in consumers' mind, Zara already has a great premium value and Zara needs to keep it up or even improve it. The way Zara improve it is by keep selling premium products with premium price. Zara should minimize discount given to its product except clearance sale. So Zara will keep the premium value attached to its brand.

The second important indicator is differentiation (Y1) with 0.725 lambda loading, however it has the lowest average mean by the value of 3.21. It explains that consumers reckon that Zara still need to improve its differentiation. Zara should provide fashionable clothes in order to fulfill consumers' specific needs. Zara could place seasonal thematic spot in their store. For instance, sell Batik (January-March) and Christmas clothing (September-December).

Relevance (Y3) is the third important with 0.686 lambda loading with the second lowest mean with the value of 3.45. Zara needs to increase its variety of products to meet the needs of all circles. For





instance, Zara should have produced special size for obese people so all circles even small or big could express their fashion without any doubt.

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Visibility (Y4) with lambda loading 0.659 is the least important indicators for social value. However, visibility has the highest mean with the value of 3.54. It means that, Zara brand has done well in making people look classier by wearing their brand. Zara should keep it up.

Emotional value is measured by excitement (Y5), satisfaction (Y6), and involvement (Y7). The most important indicator for emotional value is excitement (Y5) with lambda loading 0.884. Zara has done well in terms of creating customers' excitement towards its product. It has been proved by achieving the second highest average mean with value of 3.66.

The second highest indicator for emotional value is satisfaction (Y6) with 0.873 lambda loading. This result is supported by the highest average mean with value of 3.68. This data explains that Zara has done well in satisfying the customer. Customers feel satisfied with Zara and should keep it up.

While the least important indicator for emotional value is involvement (Y7) with 0.561 lambda loading. However with the average mean of 3.49, it is not that bad for Zara to create consumers' involvement. According to the result, Zara should focus more on the other indicators (excitement and satisfaction) to provide more powerful emotional value to its customers.

Functional value is measured by uniqueness (Y8), quality (Y9) and usability (Y10). The most important indicator for functional value is quality (Y9) with 0.902 lambda loading. This result show how great is the role of quality in creating functional value of products. However Zara still needs to improve their quality by the reason of Zara get the lowest average mean value with only 3.21. Zara should provide different raw materials with higher quality. For example, provide women hand bag with more choices of leather (buffalo, crocodile, and snake) and should provide some tutorials to their employee and customers about how to keep and take care of the products to ensure its best quality.

The second important value is usability (Y10) with lambda loading 0.859 and average mean value of 3.21 same with quality (Y9). Usability is about how the product can be useful and give comfortable feelings whenever consumers wear the product. And Zara should provide many variations of raw materials so consumers can choose which material is suitable to wear.

And the third important value for functional value is uniqueness with 0.822 lambda loading. However, Zara get the average mean of 3.36 which is the highest among the other indicators. It means Zara has done well in making its products unique in excellence way. However; Zara should have focused more on its quality and usability because those two indicators have greater impacts on functional value.

Word of Mouth (WOM) is measured by intensity (Y11), recommendation to others (Y12), variety of product (Y13), and quality of product (Y14). The most important indicator for Zara is variety of product (Y13) with 0.877 lambda loading and 3.59 average mean value. It means that variety of Zara's products has been embedded in consumers' mind that makes consumers tell their opinions to others. Zara has been doing well in terms of variety of product and should keep up the good work.

The second important indicator is quality of its product (Y14) with 0.834 lambda loading and the highest average mean value of 3.69. It also means that Zara has done well in maintaining its quality. Consumers of Zara feel that quality of Zara is good and worth to share.

The third important indicator for Word of Mouth is recommendation to others (Y12) with 0.727 lambda loading and second highest mean 3.59. This data shows that Zara has done well in creating emotional

value between customers and products so that emotional value will grant a willingness to share and recommend Zara to other people.

The least important indicator for Word of Mouth is intensity (Y11) with lambda loading 0.532, and lowest average mean value of 3.45. Consider that this indicator has the lowest impact on WOM. Zara should focus on the other indicators that will give more impact on Word of Mouth.

### 5 Research limitations/ Implications

### Research Limitations

There are several limitations in this study that should be taken into consideration:

1. This study only limited in examining the effect of perceived quality through perceived value (social, emotional, functional) on Word of Mouth without considering any other factors that may affect the variables.

2. Object of this study is Zara located in Surabaya

3. Subject of this study is Zara's customers in Surabaya with specified characteristics.





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# HOW INNOVATION CONDITIONS THE SEARCH FOR EXTERNAL KNOWLEDGE: A STUDY OF NIGERIAN FIRMS

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#### Abstract

The use of external knowledge in innovation is widely acknowledged. However, there is limited evidence on how the innovative capacity of firms conditions their external search strategy. This paper presents fresh evidence from a developing country, Nigeria, on the use of external knowledge in the innovation process. The paper distinguishes between formal and informal search strategies that firms adopt and relates their complexity to the scope of firms' innovation. The data used is obtained from the first wave of the Nigerian innovation surveys. Tobit and ordinal logit regressions are applied to the data. The results support the conjecture that a firm's level of innovativeness conditions its external search behaviour. For informal interactions, a strong positive relationship is found between the diversity of innovative output and of external search. This relationship is absent in the case of formal search and in the manufacturing sector. The key policy lesson in this is the following. Policies and strategies aimed at enhancing firm-level innovation need to be aware of firms' current level of innovativeness and sectoral differences.

Key words: innovation; external knowledge; Nigeria; search complexity; formal and informal search

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## ICT-Enabled Platform-based Business Ecosystem for WEEE Recycling: the case of China

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#### Abstract

#### 1. Research Background and Research Question

Amount of WEEE is rapidly growing due to the production of electrical and electronic equipment (EEE) as well as reduction in lifespan of EEE (Akcil,2016)<sup>[1]</sup>. According to the report of UNU, the global quantity of e-waste generation in 2014 was around 41.8 Mt, and the amount of e-waste is expected to grow to 49.8 Mt in 2018, with an annual growth rate of 4 to 5 percent (The Global e-waste Monitor, 2014). China is the largest emerging market region in the world with both global manufacturing named "the world's factory" and consuming market. Rapid economic growth, coupled with urbanization and growing middle class, is expected to increase the consumption of EEE, thus increase WEEE rapidly in this region, posing a severe threat to the environment and sustainable economic growth (He et al., 2006)<sup>[2]</sup>. According to China's National Development and Reform Commission, the number of home appliances which should be scrapped is over 50 million units annually and with an average annual growth rate of 20%, so China have entered the peak of obsolescence of the electrical and electronic products.

But WEEE recycling industry in China is in its infancy. Today the majority of e-waste in China is recycled by the informal sector, which means individuals and uncertified groups. informal WEEE recycling is carried out by poor and marginalized social groups who resort to scavenging and waste





picking for income and survival (Wilson et al., 2006)<sup>[3]</sup>. In China, about 98% of the 700,000 people working in the e-waste recycling industry are employed by the informal sector. In reality about 88% e-wastes are collected by peddlers. They usually work on a door-to-door basis to buy e-waste from consumers at home, and then they sell it to refurbished people and recyclers.

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Leave aside the chaotic market and severe environmental and biological consequences ( Qu et

al.,2013)<sup>[4]</sup>,the traditional recycling method has been difficult to sustain under the new social background. On one hand, as the population ages and the improvement of China's education, fewer and fewer people engaged in recycling. On the other hand, the internet has already changed the way people live with the development of e-commerce. The traditional recycling method has not meet to the requirements of new situation and it faces new development opportunities with the rise of the internet. Many companies have begun to turn internet recovery mode. WEEE recycling internet platform began to flourish, such as aihuishou, taolv, huishouge, yizaisheng, zaishenghuo and other models. These companies build online platforms with Internet, use information and communication technology to carry out information collection, data analysis, flow monitoring, and adopt Internet of Things technologies such as QR code to track products and waste flows. Consumers, collectors, dismantlers, recyclers, and even EEE producers and remanufacturers establish mutual contact around platform and make use of shared platform to enhance performance, thus platform-based business ecosystem has been formed.

Yet despite its popularity, little is known about the various types of platform-based business ecosystem in China and the role of IT in enabling these ecosystems. This study addresses this multifaceted problem that requires a holistic view with an ecosystem-level perspective, so the research question is:

RQ: What are the structure in various types of platform-based business ecosystem in China and the role of ICT in enabling these ecosystems?

To answer this question, this paper maps the two platform-based business ecosystem via a within case analysis followed by a cross-case analysis. We identify the key actors in the platform-based business ecosystem and analyze the ties among them. We then compare these ecosystems with regard to the difference of structure and summary the role of ICT in enabling these ecosystems.

#### 2. Key Literature Review

#### 2.1 Platform-based Business Ecosystem

In the strategic management field, the ecosystem concept is increasing significance. An ecosystem is defined as "A biological system composed of all the organisms found in a particular physical environment, interacting with it and each other. Also in extended use: a complex system resembling this". The business ecosystem proposed by Moore (1993) <sup>[5]</sup>contains seven dimensions: customer, market, product or service, business process, organization, stakeholder, social value and government policy. The platform is playing an increasingly important role in the global economy , and there is a growing emphasis on platform-based business ecosystem. There are influential scholars who emphasize the significance of platform management and analyze the mechanism of platform dynamism, which represents the platform management perspective in business ecosystem. According to a recent review of platform research studies, there are manifold papers that analyze the platform mechanism of growth

and/or decline of the platform itself(Thomas,2014)<sup>[6]</sup> and platform dynamism. Mäekinen et al. (2014) make it clear that platform-based BES (PBES) is built around interconnected suppliers, complementary vendors, distributors, and (new product) development companies. Its competitiveness depends on member companies using the shared platform to improve performance for the service, especially develop new and valuable products and services for end-users<sup>[7]</sup>. Platform-based business ecosystem emphasizes: (1) the role of the platform, (2) the relationship between member companies. At present, the focus of platform business ecosystem lies in the internal and external competition and cooperation of the platform, the influence of external environment's change on competitive environment and overall structure of the platform, the resources and capabilities of the platform business network and the network effect of the platform business ecosystem.

Although there is a growing body of research emphasizing platform business ecosystem, but the focus remains on the high technology platform, such as enterprise software. WEEE recycling is a very traditional industry, but now it is combined with the most fashionable things- Internet. This type of platform ecosystem should have a different structure and enabling role of ICT will be different. In the present article, our particular interest is at the ecosystem level in the WEEE recycling.

#### **2.2 WEEE Recycling**

The platform-based business ecosystem for WEEE recycling has attracted significant public attention and ignited interest among researchers. In 2015, Chinese government promulgated the "The plan of promoting circular economy in 2015" and "Guidance on actively promoting the "Internet plus" action", which encourage internet companies to participate in the recycling of renewable resources, and promote transformation and upgrading of existing backbone renewable resources market with combination of online and offline operations. However, scholars still focused significant attention on the optimization of waste collection, the public awareness of WEEE recycling<sup>[8]</sup>( Cao et al.,2016) or consumer behavior(Sun et al.,2015)<sup>[9]</sup>, informal waste recycling(Chi et al.,2011)<sup>[10]</sup>.

From the existing research, most of the research still focused on the artificial recycling from traditional point, which face a lot of constrained factors and limitations. Online WEEE recycling has been totally missed in the current WEEE recycling literature, only in a few newspapers, our paper addresses the questions behind this trendy phenomenon.

#### 3. Methodology

### 3.1 Research strategy and design

We adopted a qualitative research approach with a multiple case design in order to ensure exposure to different forms of platform-based business ecosystem for WEEE recycling. Firstly, there is not systematic study about ICT-enabled WEEE recycling because it is a new emerging thing. Using case study method will help to show the model and mechanism in detail. Secondly, adopting multi-case study can find the similarities and differences among the different recycling models.

The choosing principles and how to screen cases is determined by research need, based on theoretical sampling rather than statistical sampling (Glaser & Strauss, 2009)<sup>[11]</sup>. The logic of exploratory indicates that choosing samples in case study according to their particularity, not generality(Yin , 2013)<sup>[12]</sup>.





In this paper, we chose Aihuishou and Yizaisheng as the objects of study following three principles:(1) its main business is or includes WEEE recycling; (2) it is representative in the industry and quite successful; (3) there are obvious differences among them and they can cover all the typical ICT-enabled platform-based business ecosystem for WEEE recycling almost.

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Aihuishou is the first C2B platform to provide recycling business based on biding pricing in China, establishing in April 2011, translating from a bartering website as bartering is not line with Chinese people' behavior. Aihuishou focus on recycling of mobile phones, laptops and other digital electronics. The main WEEEs collected through Aihuishou are mobile phones, laptops and other digital electronics. Firstly, after registering, consumers inquiry through telling the appearance and performance of the product which they want to be recycled. Secondly, Aihuishou sent the information to cooperative recyclers to obtain their offers and present them to consumers. If the consumer accepted one of the offers, they choose one logistic method to deliver the equipment. Then Aihuishou classifies these equipment into two groups. The WEEEs which still can be used will sell to customers again after repairing through Aihuishou or other recyclers such as Jingdong, Yihaodian and Xianyu. The scraps will be dissembled and processed with less pollution by professional enterprises. Aihuishou can recycle 200 thousand units every month, with twenty million users and 38 offline stores. Its website has a average daily IP is about 111000, average daily PV ( (last month) is 555000 and its App downloads reach 11312.

Yizaisheng is an B2B platform to provide online trading and payment for urban mineral, establishing in June, 2015, upgrading from a service platform for the whole industry chain. The investors and operators of Yizaisheng are Sound Environmental Resources Co., Ltd., which acts a pioneer in Chinese solid waste treatment and is engaged in waste recycling and sustainable development of environmental resources for long term. In order to resolve the pain points in urban mineral industry, Sound Environmental Resources Co., Ltd. take full advantage of online platform and offline industry, and creates Yizaisheng by constantly business model innovation. On August 1, 2016, Yizaisheng have officially launched online payment functions and provide financial, logistics and trade protection and other value-added services for customers by integrating various types of offline resources. On November 15, 2016, Yizaisheng strong offered five innovative products-Jiaoyibao, Rongyibao, Yimaiyimai, Yizhaoyipai and Xiaoyi Internet shopping mall, and four personalized service- credit rating, industry big data, integrated information and logistics. up to November ,2016, the number of companies trading on the platform has reached more than 600 with over 300 million yuan average turnover per month.

Case	Establishin g time	Main business	Types	Platform
Aihuishou	2011.4	recycling mobile phones, laptop and other digital electronics based on biding pricing	a B2C".COM" integrates its business into WEEE collection	Website、APP www.aihuishou.com
Yizaisheng	2015.6	Trading platform of WEEE	A B2B Recycling platform built by disposal company	Website, Wechat www.yizaisheng.cn

Table 1 Basic information of cases

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#### 3.2 Data collection

To ensure the reliability and validity, this study analyzed the cases by using multiple information sources based on the triangulation method. Data for the analysis came from three channels: (1) interviews with heads of companies, and directors, managers and technical officials from governments; (2) second hand data including company's documents, symposia materials and media coverages, and academic and industrial sources; (3) direct experience from using sample enterprise' website and mobile App.

#### 3.3 Data analysis

We used the induction method to dispose and analyze data (Eisenhardt, 1989)<sup>[13]</sup>. First, we encoded the data progressively to extract and refine business ecosystem. Then cases were analyzed based on coding result: (1) within case analysis. We identify each ecosystem's actors and ties; (2) cross case analysis. We summarized similarities and differences of two cases through comparison and integrated analysis.

#### 4. Expected Findings

Based on various illustrations of platform-based business ecosystems that were drawn from the interviews and second-hand data sets, we constructed synthesized illustrations of the ecosystems in Aihuishou and Yizaisheng, and analyzed the roles of actors and ties among them, thus map the structure of two platform-based business ecosystems for WEEE recycling.

The comparative analysis of ecosystem between Aihuishou and Yizaisheng reveals that their main differences are related to the business ecosystem structure, such as network center, network scale, network intension, network stability.

To summarize these two platform-based business ecosystems, we use the role of ICT based on three main dimensions: structure enablement, resource enablement, and psychology enablement.

#### 5. Research Implications

Theoretically, this paper contributes to the literature in two ways. The first contribution is to the waste recycling literature by introducing the platform-based business ecosystem perspective in waste recycling. Second, we contribute to the platform-based business ecosystem literature by examining a complex the waste recycling ecosystems and therefore extending the research of this field.

Regarding the managerial implications, enterprises should understand the current specific model and choose the right approach according to their existing resources and capabilities. Second, any entry companies should consider whether to complement or collaborate with these major actors when defining the entry business model for the WEEE recycling market.

Keywords: Platform; Ecosystem; WEEE recycling; ICT-enabled; China

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# A Value Co-creation Mechanism Research in a Platform Empowerment-based Entrepreneurial Ecosystem. A case study of Taobao.com

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### Abstract

In the traditional environment, business incubators have used external network to seek for potential customers, suppliers, partners and investors. However, it is difficult now to provide an effective business services when a business incubator lacks of supporting from the internet platform. Internet have overturn the previous business model for decades, as the e-commerce platform started empowerment both supply and demand to build a link of value creation and value delivery collaboration. Therefore, the entrepreneurial ecosystem of e-commerce platform can provide better entrepreneurial services to meet business needs.

Taobao.com is the China's largest e-commerce platform founded by the Alibaba group in 2003,

its ultimate goal is to establish a multi win entrepreneurial ecosystem worldwide. This paper use case study method and adopt Taobao.com with three branded stores as the objects to explore the method of building a business ecosystem for the e-commerce platform and maintain its development.

The study found that: under the environment of Internet, the construction of the business platform's entrepreneurial ecosystem has experienced the evolution of "line-surface-body". "Line" is the core layer of the construction phase, in order to form a simple business environment, platform is served as the core to empowerment and connect the bilateral market; "Surface" is an extended layer construction stage for the platform to expand main type and network structure formation by gradually open to attract more third parties. In general , different connection points can promote the transfer and sharing of resource information, which will assist platform to provide more entrepreneurial services for its members; "Body" is the related layer construction, with the purpose of building up a system with platform empowerment-based enterprise ecosystem and value co-creation, the platform must construct online services and extend the services to the offline. For example, implement regional development by using the online effect with mutual complement and cooperation to create a small front end, big platform and rich ecology environment.

The construction of the main stage of the core layer are the platform and the start-ups, mainly by pooling resources mechanism. Their construct elements include promotion demand, talents with technology, services and products, and market; the main stage of expansion layer construct added third party service





providers and strategic partners, mainly by value co-creation and sharing mechanism. The construct element is brand demand with additional scheme that connect the cooperation between third parties and the users; The main stage of related layer construction added financial institutions and government departments, mainly by the regulation of system allocation mechanism. The construct element is differentiated demand with funds and policies that could achieve the strong and weak ties connection between subjects. The whole process of the entrepreneurial ecosystem e-commerce platform shown in Table 1

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	The Construction of Core Layer	The Construction of Expansion	The Construction of Related	
	Stage	Layer Stage	Layer Stage	
Construction Feature	"Line" Connection: reach a consensus between the main subjects, e-commerce platform empowerment and build bilateral markets, connect key needs and core services.	"Surface" Expansion: attract more service agents to join, different strong and weak links between subjects, achieve information and resources sharing.	"Body" Formation: achieve strategic cooperation between different stakeholders, expand the scope of services, expand service channels, from online to offline.	
Evolutionary Process	Talents Technology Experiences Entrepreneurs Market E-commerce Start-ups Demand	Talents       Technology       Experiences         Entrepreneurs       Entrepreneurs         Market       Platform       Start-ups         Demand       Scheme       Third Party	Talents       Technology       Experiences         Entrepreneurs       Entrepreneurs         Market       Platform       Start-ups         Bank       Government       Demand         Scheme       Third Party       Start-ups	

 Table 1 The Stage Characteristics and Evolution Process of the E-commerce Platform's

 Entrepreneurial Ecosystem Construction

In the current literature, there are two main perspectives of empowerment: employee empowerment and customer empowerment. Employee empowerment emphasised that the executive team will decentralize the power and give employees more autonomy within works. Then it gradually evolved into three levels of structural empowerment, leadership empowerment and psychological empowerment. Structure empowerment emphasised the establishment of employee empowerment policy and system, which can guarantee the organization system to share power, and the power here mainly refers to the formal authority or the control of organizational resources. Giving employees the right to make decisions on their own behaviour; leadership empowerment is the leader in giving more options to their subordinates. Psychological empowerment is defined as the process control force, employees in the working process feeling the job value, ability and influence, enhance self-efficacy and confidence. Employees want and feel can influence and shape their work role and work environment, rather than passive acceptance to the environment. Customer Empowerment emphasizes that customers have more initiative in product service and participate in the enterprise marketing activities that these movements could influence the marketing strategy. The Internet has been subverted the traditional business model, customers are not passive

receivers in the market because of the rich information and opportunities. The status change of customers forced enterprises to establish a rapid, open and ongoing dialogue. Therefore, the enterprise began to more extensive customized services, for example, customer can decide the product design. This can also explain the impact of the platform empowerment. Taobao.com work as an e-commerce platform can be assigned to the member of the platform, whether it is a buyer, a seller or the third party are able to conduct independent trading activities in this platform. In addition, the customer empowerment also means that enterprises and customers to form a positive interaction and cooperation, to promote the interests of both sides of the optimization. The mobile Internet is to allow customers to open the self-centered content production era, the Internet is more open, responsive and customer-centric, in addition to the customer to obtain sufficient information, but also affect the network through the fans to express their views, and even on the network platform and other direct customer contact, benefit customer and the enterprise through integrating mobilization of resources and value co-creation.

Two research perspective on value co-creation came from Prahalad & Ramaswamy and Vargo & Lusch. Prahalad & Ramaswamy point out that value co-creation is the interaction between enterprise and customer through the creation process of customer experience, value is embedded in the personalized customer experience, customers can dialogue with enterprises and interact actively, even in the service to create their own experience; Vargo & Lusch proposed that value co-creation is the set up on the basis of the service which can meet consumer demand for manufacturers to provide products and services., the academic community has done a lot of useful exploration on value co-creation as a process. Gummesson and Mele divided the whole value creation process into two stages of interaction and resources integration, the higher the level of interaction orientation, the better ability to create customer value through customer resources integration, so as to bring long-term and stable profits to the enterprise.

About the antecedents of value co-creation, the interdependence between the enterprise and the customer relationship is the basis of value co-creation, both sides need to invest resources in common. Both relations creation cannot be complete without the need to express customer self- consciousness or through equal dialogue and service. In addition, Ramaswamy proposed only when the employee has the right to appear independent solution and customer interaction problems, value co-creation oriented enterprise can become better, further analyses the premise from the perspective of enterprise value co-creation. On the role of value co-creation, value co-creation can affect the brand image (Identities Brand) shape and bring the brand market effect.

This paper attempts to explore the platform empowerment evolution process of an Internet entrepreneurial ecosystem from a value co-creation perspective. The existing research on value cocreation focus on the enterprise and consumers, in the field of consumer experience in the marketing and has not been extended to the ecological system. And most of the value co-creation studies are based on the traditional market environment, lack of value co-creation research under the network environment. In fact, value and opportunities are more easily to create under the network environment as it is more interaction and experience, and different elements in the system is the process of value co-creation practice, but this has not caused widespread concern. Although some scholars have introduced the concept of value co-creation into the business ecosystem, but still lack of the combination about





entrepreneurial ecosystem concept, platform empowerment, and value co-creation.

The study use Taobao.com and 3 branded store as the dynamic interaction research objects, to explore the evolution process of the platform under the entrepreneurial ecosystem, and draw the conclusions as follows:

(1) the evolution process of the platform based enterprises in the entrepreneurial ecosystem is mainly through three stages: the core layer, the expansion layer and the related layer. The core layer includes building bilateral market demand by platform empowerment, transfer and integration of resources, construction of service market; extended layer includes third party service providers whom can provide diversified solutions for the service subjects; related layer includes division and different market segments to meet the entrepreneurial needs of users, tap the offline market potential, and form the industrial clusters, which is similar to the commercial ecosystem structure that has been study in other study.

(2) from the main point of view, the entrepreneurial ecosystem based platform make the platform as the core, and linking the bilateral market of start-ups and consumers, integrate with other entrepreneurial services and third party organizations (Governments, banks, universities, communities, etc.) have also become a part of the entrepreneurial ecosystem, different subjects plays a different role in the entrepreneurial ecosystem.

(3) from the building elements point of view, different subjects in the entrepreneurial ecosystem establish links through different elements within different stages of development. In order to achieve the value cocreation between various subjects and realize the value of sharing in the network, the main building between different subjects integrated related resources to provide services and products based on different needs, so as to expand the number of main entrepreneurial ecosystem, promote the development of entrepreneurial ecosystem improvement. Like, demand, talents, technology, services or products, markets, programs, funds, policy and other building elements for e-commerce platform's entrepreneurial ecosystem.

(4) from the construction of the mechanism point of view, the enterprise ecosystem's construction included policy encouraged, interactive guide, meet the needs to achieve the resources gain on the platform; resources transformation created value, open platform realized sharing; adjust the rules of order, and subject can adapt to system development.

June 15 (Thursday)

# Industry Visiting "Getlini EKO"



- (RTU → Getlini EKO) The bus departure
  - 09:30 at main gate of Rixwell Elefant Hotel
  - 09:50 at main gate of RTU dormitory(Azenes street 6, Kipsala, Riga)
- (Getlini EKO → RTU)
  - 12:30~13:30 (the arrival at RTU Canteen)
- Lunch Time: 13:30~14:30
  - Lunch will be booked but should be paid separately.

## How to apply: through email(openinnovationtmc@dgist.ac.kr)

• First 50 applicants can only participate in the tour.





## June 15 (Thursday) (Venue: RTU Campus, Time: 14:30 ~ 16:00)

# **RTU Campus Tour**



## RTU Introduction

- Riga Technical University (RTU) is an internationally recognized science and technology university situated in Riga, capital of Latvia, the largest technological university in the Baltic States, with rich history – 155 years of accumulated wisdom, experience and knowledge and clear future vision aimed at promoting excellence.
- Ranked 1st in Latvia by the Employers' Confederation of Latvia, this international and scienceoriented entrepreneurial university acts as a catalyst transforming science and technologies into innovation, creativity and business through excellence in studies and research, and in close cooperation with industry and international partners.
- RTU was established in 1862 as a multi-discipline polytechnic higher education establishment. Nowadays, RTU is an accredited, constantly developing European university which implements academic and professional study programs of advanced quality.
- RTU is the largest university in Latvia that specializes in engineering sciences and also ensures high quality education in social sciences and humanities as well as business education. The study process at the University is implemented by 9 faculties that realize appropriate study programs.

June 15 (Thursday) (Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 17:00~ 17:30)

## Welcome Reception + Preliminary Registration

Coffee and dessert will be provided

June 15 (Thursday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 321, Time: 17:30~ 18:30)

# The Expanded Editorial Board Meeting of JOItmC with Awards

- Welcoming Words
  - By JinHyo Joseph Yun, Editor-in-Chief Journal of Open Innovation: Technology, Market & Complexity (JOItmC)
- Introduction and Presentation about JOItmC Now and Future
  - By Samuel Beattie, Springer Editor Office

## Awards Ceremony

- We will award the following prizes to superior paper winners at JOItmC.
- 1. Most Accessed
- 2. Most Cited
- 3. Best Reviewers





June 15 (Thursday)

(Venue: Laivas(It is located in a beautiful place in Jurmala with the view to the river Lielupe.); Address: Vienibas prospekts 36, Jurmala, +371 26-680-373., Time: 18:30~ 20:30)

UNIVERSIT

## Invited VIP Dinner by the president of SOItmC Laivas(It is located in a beautiful place in Jurmala with the view to the river Lielupe.)

(X We will contact the participants separately between the Conference Schedule.)





June 16 (Friday)

(Venue: Lido Recreation Center, Time: 19:50~22:00)

# Gala Dinner

## Gala Dinner will be at Lido Recreation Center



## ■ Payment of registration: €40

\* Payment of registration fee is only possible through wire transfer in advance or cash on site. Credit card is not available.







June 17 (Saturday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, #321, Time: 17:20~18:20)

# General Meeting of SOItmC & Awards (Best Paper Award, Appreciation Plaque) Ceremony, Notice of SOItmC & University of Naples Federico II 2018 Conference with IFKAD

## Awards Ceremony

- We will award the superior presentation winner with "Best Paper Award".
- •Awarding the Appreciation Plaque.

## Notice of SOltmC & University of Naples Federico II 2018 Conference with IFKAD

- Hosted by University of Naples Federico II in Italy(Hosting Chair: Prof. Valentina Della Corte)
- Organized by Society of Open Innovation: Technology, Market, and Complexity (SOItmC)
- Dtae: June 26 (Tue.) June 29 (Fri.), 2018
- Venue: University of Naples Federico II, Italy







#### SOltmC & RTU 2017 June 15 (Thur.) – June 18 (Sun.), Riga Technical University (RTU), Riga, Latvia

#### June 18 (Sunday)

(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, 303 & 321, Time: 08:00~09:00)

## On-line Presentation (3 Sessions)





June 18 (Sunday) (Venue: Cultural Tour, Time: 09:00~16:00)

#### Cultural Tour - "House of the Blackheads"



■ (RTU → House of the Blackheads) The bus departure

- 09:00 at main gate of Rixwell Elefant Hotel
- 09:15 at main gate of RTU dormitory(Azenes street 6, Kipsala, Riga)
- (House of the Blackheads → Ethnographic Open-air Museum of Latvia)
  - 14:00~ Participants may act for themselves
  - The Baggage can be loaded in the bus and participants can go to another place (ex. Airport) whenever you would like to.
- Ethnographic Open-air Museum of Latvia  $\rightarrow$  RTU)
  - 15:00~16:00 (the arrival at RTU dormitory)
- How to apply: through email(openinnovationtmc@dgist.ac.kr)
  - First 50 applicants can only participate in the tour.
  - \* Lunch will be booked.

Appendix 1. Journal of Open Innovation: Technology, Market, and Complexity

## Journal of Open Innovation

### Technology, Market & Complexity

Editor-in-Chief: JinHyo Joseph Yun



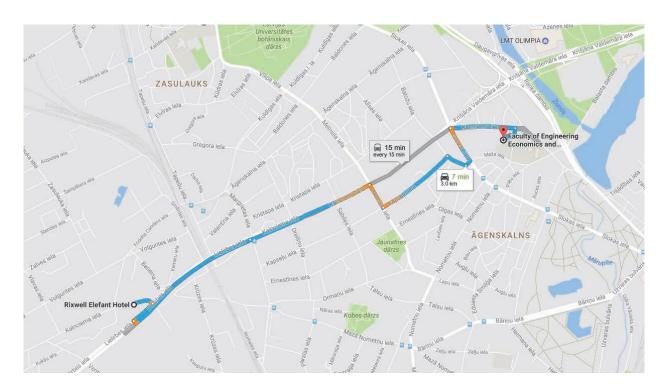


#### Appendix 2. Call for Paper of SOItmC & RTU 2017 Conference

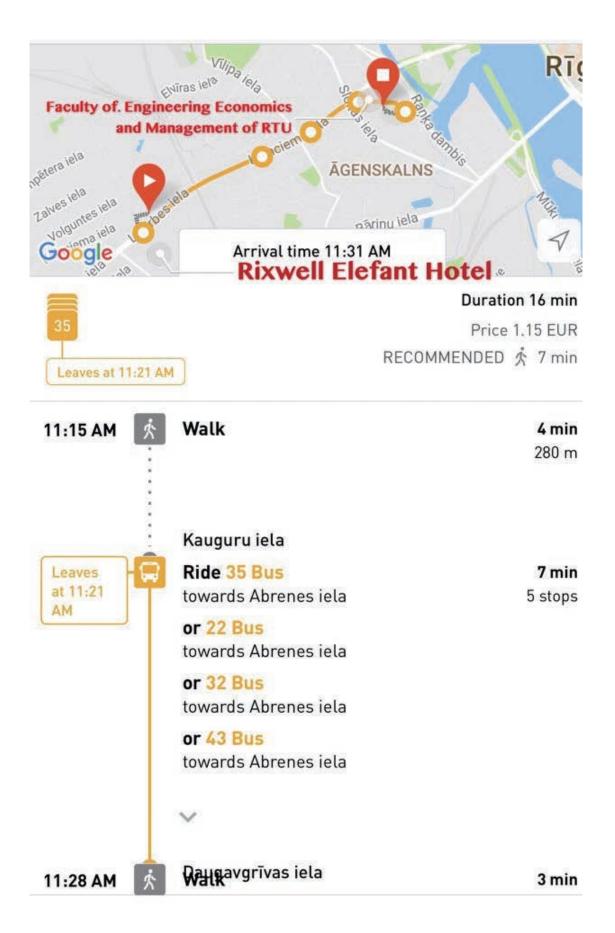
Right Technical UNIVERSITY	Technology, Market & Complexity	
SOltmC & Riga	<b>Technical Univ. 2</b>	2017 Conference
Let Us Conquer the Growth Limits of Capitalism - through New Combination between Technology, and Market or Society June 15 - June 18, 2017 Riga Technical University(Venue: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, 303, 309, 321), Riga, La (www.openinnovationtmc.org) Sponsored by COST COSTECH MPORTANT DEADLINES Early Bird Registration Deadline: April 30th Full Paper & BM Submission Deadline: May 31th		
	Regular Registration Deadline: June 10t Keynote Speakers	h
Deborah Dougherty (USA) • Former Potissor, Regres, Tile State University of New Jersey, USA • Premerikom Temer, "Taking Advantage of Emergence for Complex Involutions"	Circuanti Schiuma (Italy)     Professor al Lubershy of Basilicata and Vice Mayor of Matera City, Baly     Professor al Lubershy of Basilicata and Vice Mayor of Matera City, Baly     Christ-Sillior of the Journal 'Kowkedge Management Research and Practice     Christ-Sillior of the Journal Vice Massing Business Ecodemon'	Une Canther (Germany) - Polesco, liniveshy et Jens, Germany - Striffer of Journal of Celeficary Economics - Presentation Them: "Cluster Policy: Insights from the German Leading Edg Description Competition"
Philip Cooke (UK) - Protessor, Bergin University College, Norway - Stafford Flanopae Planning Studies(SSC) - Presentation Theme: "The Global Evolution of Cambridge's Crossover Model Immaritien"	Presentation Theme: "Krowkody-keed rule driver of company wide cradion in Xel century"     Professor at Griffith Business School, Griffith University/Asatralia)     Professor at Griffith Business School, Griffith University/School Res. 2006     Professor at Griffith Business School, Griffith University/School Res. 2006     Professor at Griffith Business School, Griffith University/School Res. 2006     Professor at Griffith Business School Res. 2006     Professor at Griffith Business School Res. 2006     Professor at Griffith Business     Professor at Business     Professor at Griffith     Professor at Griffith Business     Professor at Griffith     Profes	Jinflyo Joseph Yun (Korea) - Tenuro Principal Researcher, DSIT - Tenuro Principal Researcher, DSIT - Researcher, DSIT - Researcher, DSIT - Researcher, DSIT - Researcher, DSIT - Ethnic-Ro-tet of Jammid of Open Involution Technology. Minot, and ComplexityGillen - Ethnic-Ro-tet of Jammid of Open Involution Technology. Minot, and ComplexityGillen - Ethnic-Ro-tet of Jammid of Open Involution Technology. Minot, and ComplexityGillen - Ethnic-Ro-tet of Jammid of Open Involution Technology. Minot, and ComplexityGillen - Ethnic-Ro-tet of Jammid of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and ComplexityGillen - Ethnic Ro-tet of Open Involution Technology. Minot, and Complexi
Anil K. Cupta (India) Protesor, India Institute of Management, India Protesoriar of Hongy Bee Network Presentiation Theme: "Corporation, Communities and Civil Society: Motioning Children and Youth for Open Inclusive Invovation"	Natalia Lace (Latvia) Professor, Raja Tochrical University, Latvia Professor, Raja Tochrical Productivity and the Features of Economic Growth: the Case of Lithuaria and Latvia*	Tan Yigitaanir (Austalia) • Associate Professor, Queensiani Uliveesity of Technology, Asstralia • Associate Professor, Queensiani Uliveesity of Technology, Asstralia • Associate Professor, Queensiani (Noveldge-Based University) • Presentation Theme: "Snart governance for sustainable and modelge-Based University and devicement"
Journal of Open Innovation: Technology, Market, and Complexity • All Kenode Speakers' Presenting Papers will be invited to the journal as Speak lissue (All publications will be supported and funded by DGIST & SDImC)	SOltmC & Riga Technical University 2017 Conference - Poter downlaad, click (Here) - Registration Invoice downlaad, click (Here)	Inviting Professor of Open Innovation Academy & Donator Building Open Innovation Off-Ine Campus - For more inviting requirements, cick (Fiere)
	Special Sessions	
Special Session 1. Schumpeterian Dynamics • Chair: Andreas Pyka(University of Hohenheim, Germany)	Special Session 11. Knowledge, Value, Ethics, and Business Ecosystem • Chairs: John C. Yl(Saint Joseph's University, USA), Jeong SukJae(KwangWoon University, Korea)	Special Session 21. Social Network and Technology Commercialization • Chair: Klaeok Kwon(Hanbat National University, Korea)
Special Session 2. Emerging Design Practices in Knowledge-Oriented Economies – The Creative Destruction of Design • Chair: Craig Anz(Southern I]Inois University, USA)	Special Session 12. Entrepreneurship, and Kowkedge and Action Straing Among Industries, Higher Educations & Research Institutions, and Science and Technology Parks • Chains: Jaehoon Rhee(Yeungnam University, Korea),	Special Session 22. Open Innovation of Service Sectors • Chair: DaeCheol Kim(Hanyang University, Korea)
Special Session 3. Evolutionary Economics, Economic Geography, Open Innovation and Business Networks • Chair: Tommi A. Inkinen(University of Turku, Finland)	Jurghyun Yoon[Dongguk University, Korea) Special Session 13. Creativity, Public Service Motivation, and Innovation Diffusion at Comparative Perspective Chairs: Kwangho Jung/Secul National University, Korea),	Special Session 23. Open Innovation and Business Model Competition Session • Chairs: Choonglae Im(Keimyung University, Korea)
Special Session 4. Japan's Rule of Business Innovation in Emerging Economies • Chair: Yuri Sadoi(Méljo University, Japan)	Seung-Hee Lee(Southern Ilinois University, USA) Special Session 14. Technology Commercialization & Management • Chairs: Taehoon Kwon/Korea Institute of Science and Technology Information, Korea),	Special Session 24. Uncertainty and Innovation Policy Making
Special Session 5. Open Innovation Focused on Renewing Aging	Eui-Seop Jeong(Korea Institute of Science and Technology Information, Korea)	
Chair: Pedro D. Almaguer Prado((sinapsys, Mexico)	Special Session 15. Open Innovation, New Combination, and Schumpeter • Chair: JinHyo Joseph Yun(Daegu Gyeongbuk Institute of Science & Technology, Korea)	Special Session 25. Innovation in Supply Chain Management • Chair: Anna Svirina(Kazan National Research Technical University, Russia)
Chair: Pedro D. Almaguer Pradoljsnapsys, Mexico)     Special Session 6. Social Innovation for Sustainable Development     Chair: Karine OganisijamaRiga Technical University, Lativia)	Special Session 15. Open Innovation, New Combination, and Schumpeter Ohair: JinHya Joseph YunyDaegu Synengback Institute of Sonrea & Chenhology, Korea) Special Session 16. Open Innovation for Rockmapping Father Technology & Society Ohair: Josephana Jacof(Specinganga Tablicoal University), Korea)	Chair: Anna Sviriinal/Kazan National Research Technical University, Russia)
Special Session 6. Social Innovation for Sustainable Development	Ohan: Jimlya Joseph Yun(Daegu Gyeonghuk Institute of Science & Technology, Korea)     Special Session 16: Open Innovation for Rootinepping Faiture Technology & Society     • Ohan: Jeonghuma Jeonglycongamig National University, Korea)     Special Session 17: Dynamics of Open Innovation, Business and Society     • Ohan: Kunging ParkSprail University, Korea)	Chair: Anna Svirinal/Kazan National Research Technical University, Russia)     Special Session 26. Towards Circular Economy: Innovations, Clusters and Entrepreneur
Special Session 6: Social Innovation for Sustainable Development • Chair: Keine Opinitipana/Pilpa Technical University, Lelivia) Special Session 7: Management of Innovation and Technicopy Transfer	Otair: Jimlya Joseph Yun(Daggi Gyeongbuk Institute of Science & Technology, Korea)     Special Session 16: Open Investion for Roothrapping Future Technology & Scienty     • Otair: Joseph Investion Accellance of Open Investion Linkershy, Korea)     Serial Session 17: Openinis of Open Investion Barliess and Society     • Otair: Symphone Functional University, Korea)     Sangdh Stimpfrantist Autional University, Korea)     Special Session 18: The Enzymetrin of Open Investion and Operatorian Investion     Otairs: Charless Leptone University, Korea)     Special Session 18: The Enzymetrin of Open Investion and Operatorian Investion     Otairs: Charless Leptone University University Education, Taivani,     Otairs: Charless Leptone University	Chair: Kenia Svirinejškaan National Research Technical University, Russa)     Special Session 26. Towards Circular Economy: Innovatione, Clasters and Entrepreneur     Otair: Manuda TvaoroavicientyReise Gedminas Technical University, Uthuania)     Special Session 27. Gimate Change and Environmental Resilience     • Chair: Sing-Don Lee(Enha Wonana University, Korea),     Special Session 28. Invosation & Technicky: Entrepreneurly     Special Session 28. Invosation & Technicky: Enterpreneurly     Special Session 28. Invosation & Technicky: Enterpreneurly     Special Session 28. Invosation & Technicky: Enterpreneurly
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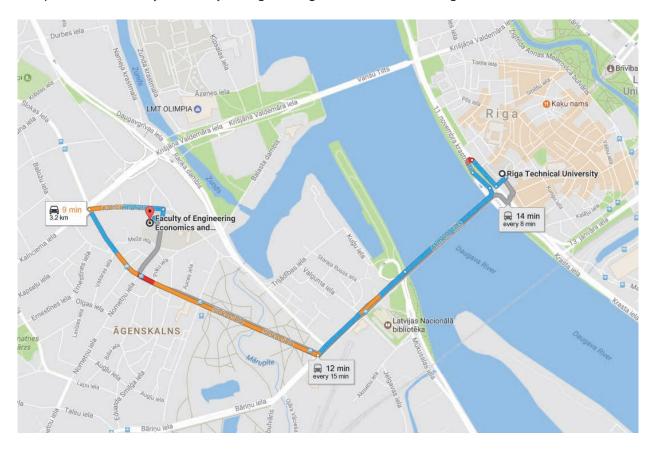
#### Appendix 3. Main Venues Map

- 4 main rooms for the conference: Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, 303, 309 & 321
- Map 1: Rixwell Elefant Hotel → Faculty of Engineering Economics and Management, 6 Kalnciema Street



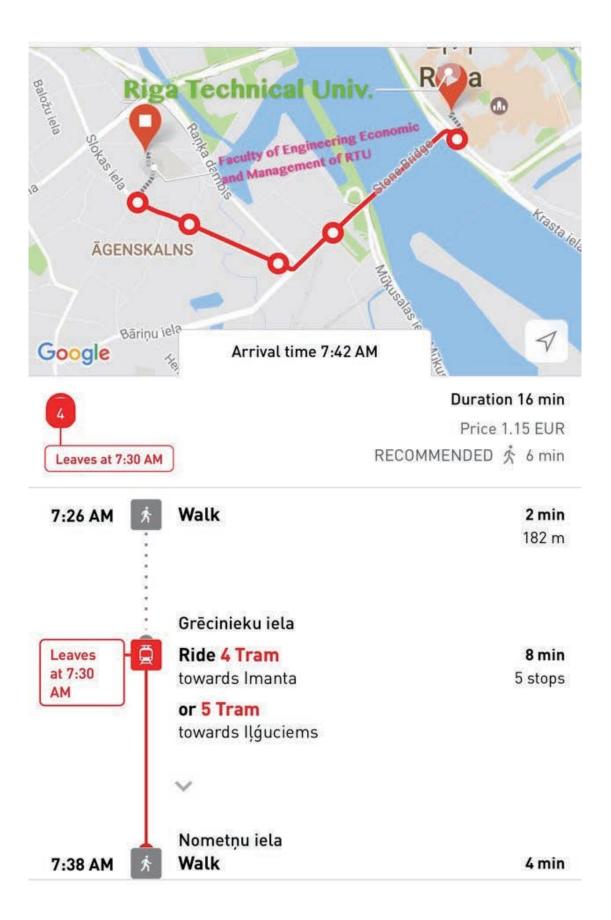




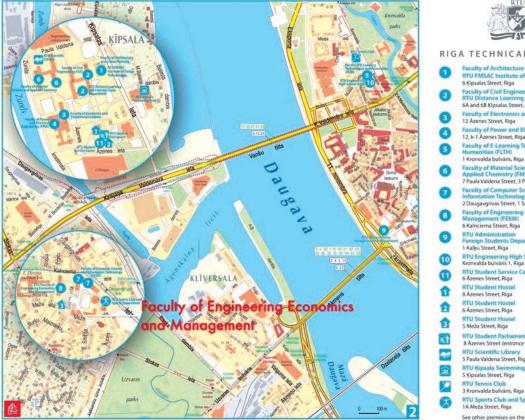


#### • Map 2: RTU Dormitory → Faculty of Engineering Economics and Management, 6 Kalnciema Street





• Map 3: RTU Campus & Faculty of Engineering Economics and Management, 6 Kalnciema Street **RTU** Campus





RIGA TECHNICAL UNIVERSITY Faculty of Architecture and Urban Plannin RTU FMSAC Institute of Design Technolog 6 Kipsalas Street, Riga no (FAUP) Faculty of Civil Engineering (FCE) ATU Distance Learning and Eveni 6A and 6B Kipsalas Street, Riga g Study Depa And GR Kipsalas Street, Riga Faculty of Electronics and Telecommunication 12 Azenes Street, Riga Faculty of Power and Electrical Engineering (F 12 Art Azenes Street, Riga Faculty of Learning Technologies and Humanities (FLTH) 1 Krowalds bulváris, Riga Faculty of Material Science and Applied Chemistry (FRSAC) 7 Paula Valdena Street, 3 Paula Valdena Street, Riga Faculty of Computer Science and Information Technology (FCSIT) 2 Daugargivas Street, 1 Seas Street, Riga Faculty of Computer Science and Management (FEEM) 6 Kalnciena Street, Riga FTU Administration ns (FET) PEE 4 Foreign Students 1 Kaļķu Street, Riga RTU Engineering High Kronvalda bulvāris 1, Rīga RTU Student Servic 6 Azenes Street, Riga RTU Student Hoste 8 Azenes Street, Riga RTU Student Hostel 6 Azenes Street, Riga RTU Student Hostel 5 Meža Street, Riga RTU Student Parliamen 8 Azenes Street (entrance RTU Scientific Library 5 Paula Valdena Street, Riga RTU Kipsalas Svinetr, ng RTU Kipsalas Svinetr, ng Kipsalas Street, Riga RTU Tennis Club 3 Kronvalda bulváris, Riga RTU Sports Club and Sj 1A Meža Street, Riga





Faculty of Engineering Economics and Management, 6 Kalnciema Street, Room 301, 303, 309, 321





#### Appendix 4. Transportations to Main Venues(From Riga International Airport)

#### Riga International Airport $\rightarrow$ RTU

Taxi: ①/② Teparture: Ziemelu iela (Kārļa Ulmaņa gatve/A10 via)/Kārļa Ulmaņa gatve via Distance: 9.9/13.2km; Travel time: about 23/26 minutes;

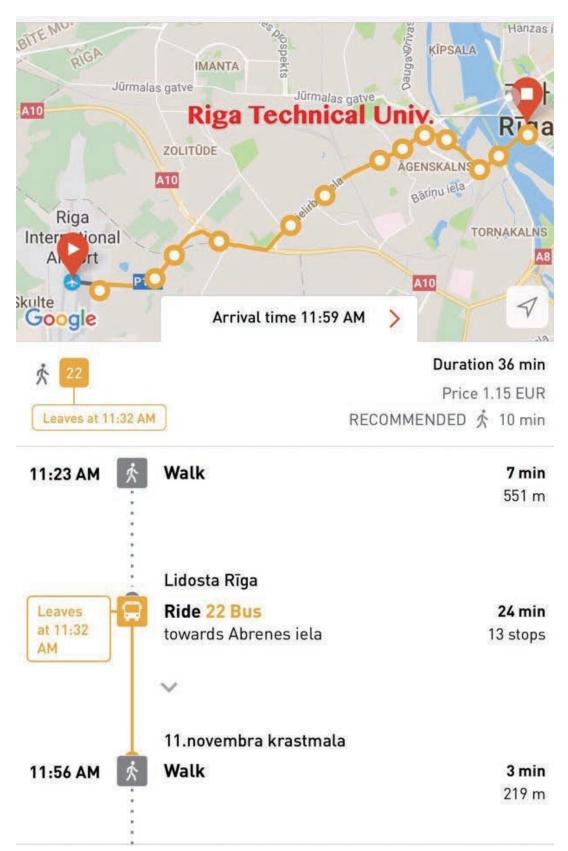
Train:

Departure: Lidonsta Riga; Interval: every 15 minutes; Travel time: about 35 minutes;

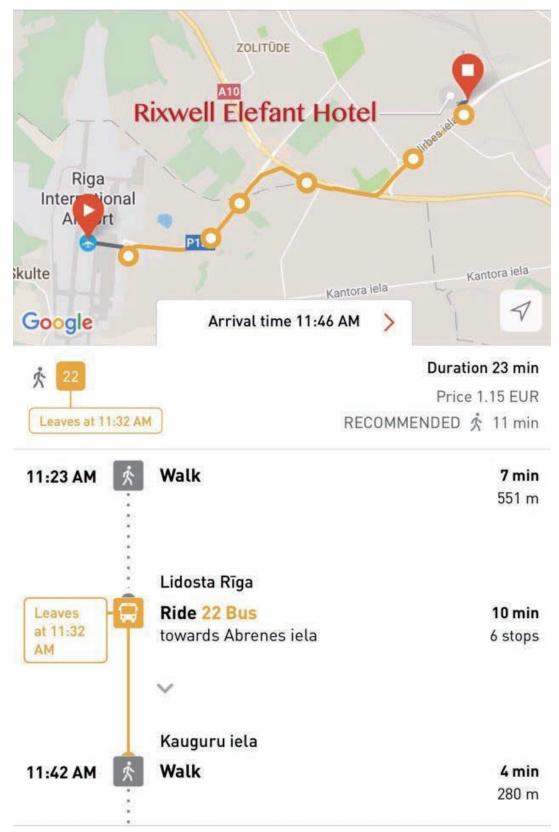




Bus:

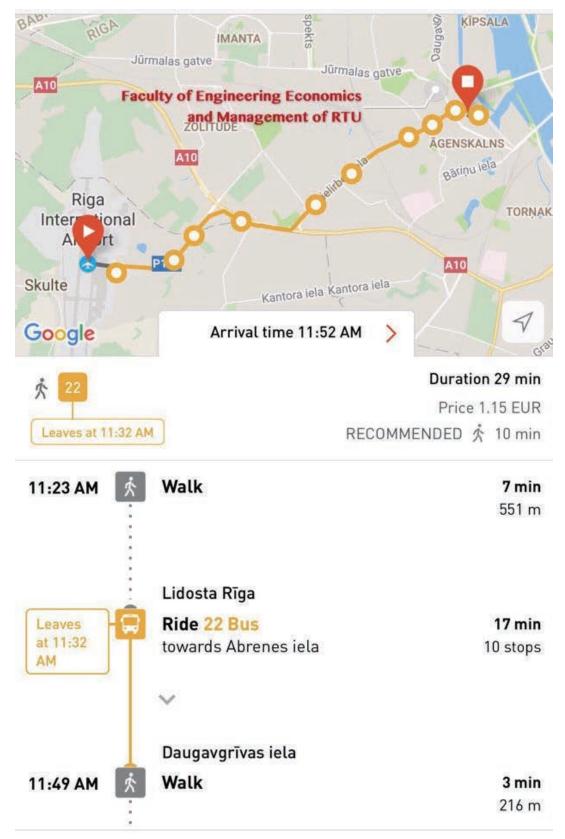


Riga International Airport  $\rightarrow$  Rixwell Elefant Hotel





Riga International Airport  $\rightarrow$  Faculty of Engineering Economics and Management of RTU



Memo





RIGA TECHNICAL UNIVERSITY

Memo

For more information, please contact: • Prof. Dr. JinHyo Joseph Yun (Organizing Chair of SOltmC & Riga Technical University 2017, President of SOltmC and Editor-in-Chief of JOltmC) Contact: jhyun@dgist.ac.kr +82-53-785-4410, (mobile) +82-10-6697-8355

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# Journal of Open Innovation

## Technology, Market & Complexity

Editor-in-Chief: JinHyo Joseph Yun

