RIGA TECHNICAL UNIVERSITY
Faculty of Engineering Economics and Management
Institute for Quality Engineering

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IMPROVEMENT METHODOLOGIES OF INTEGRATED MANAGEMENT SYSTEMS FOR PRODUCTION INDUSTRY ENTERPRISES IN LATVIA

Doctoral Dissertation Summary

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OFFICIAL REVIEWERS

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BA School of Business and Finance

CONFIRMATION

I hereby confirm that I have elaborated this Dissertation that has been submitted for review to Riga Technical University for the promotion to the degree of Doctor of Engineering (Dr.sc.ing.). This Dissertation has not been submitted to any other university in order to receive any scientific degree.

Iveta Mežinska .....

17 January 2011

The Doctoral Dissertation is written in Latvian and consists of Introduction, 5 parts, general conclusions, list of literature and 9 Annexes. There are 49 Figures, 22 Tables in the Dissertation. Volume is 180 pages (without Annexes) and 233 pages (with Annexes). There are references to 231 information sources in the list of literature.

TOPICALITY OF THE RESEARCH

Global financial and economical crisis between 2007 and 2009 radically influenced traditional understanding of enterprises' sustainability, which is achieved by interaction of internal and external conditions of business environment. Still concept of sustainable development remains more vital than ever before. The position of the European Union (EU) on sustainable development – competitiveness and sustainability are complementary, in order to implement them the EU is developing business environment, where enterprises in Europe could thrive, thus providing a contribution to sustainable development. Sustainable Development Strategy of Latvia „Latvia 2030" (approved by the Latvian Parliament (Saeima) on 10 June 2010) puts forward an objective to become EU leader in preserving, enlarging and sustainable utilization of nature capital. Wherewith issues related to quality management, environmental management and social responsibility will take more visible importance.

One of the prerequisites making possible enterprise's existence is necessity for it's products. Enterprise's quality management system structures its processes, ensures their transparency in effective way and aims to continuous fulfilment of clients' satisfaction. Quality management systems, developed following to requirements of general quality management system standard ISO 9001, industry specific quality management system standards, products' standards, conformity assessment standards promote fulfilment of clients' and legal requirements. Environmental management system, occupational health and safety management system, based on standards ISO 14001:2004 and OHSAS 18001:2007, creates framework for purposeful reduction of the impact of enterprises' products and processes on environment and appropriate management of occupational health and safety risks.

Integrated management system, developed according to requirements of several standards harmonizes enterprise's processes and allows to adopt decisions simultaneously assessing them in three dimensions of sustainable development: economical, environmental and social. Integrated management system is a tool for enterprises' products, processes and systems quality, effectiveness, efficiency assurance and improvement, and it is a prerequisite of enterprises' operation in sustainable way.

OBJECTIVE AND TASKS

The objective of research, performed within the framework of Doctoral Dissertation, is elaboration of production industry enterprise's integrated management systems improvement methodologies, application of which allows to evaluate integration degrees of several management systems and characterizes further improvement possibilities.

For achieving of the objective, the following **tasks** have been identified**:**

- To study quality management, environmental management, occupational health and safety management systems importance in context of sustainable development concept implementation.
- To review and evaluate application experience of quality management systems' and related standards, industry specific quality management systems standards, product standards, conformity assessment standards, standards of different scopes.
- To review theoretical and empirical researches about integrated management systems (IMS) and integrated quality management systems (IQMS), to elucidate IMS implementation and improvement critical aspects, to formulate less investigated issues.

- To characterize IMS and IQMS, illustrating IQMS application in manufacturing industries and justify IQMS implementation necessity in enterprises, which products are in the scope of New Approach Directives.
- To elaborate IMS integration degree identification methodologies, to evaluate their applicability.
- Empirically clarify processes' improvement impact on production industry enterprises' IMS.
- To develop IMS model, depicting several management systems integration options and IMS development sequence.
- To review traditional quality management system, environmental management system audit methodology, to draft proposals for traditional audit improvements.

OBJECT AND SUBJECT OF RESEARCHES

The **object** of the research – production industry enterprises in Latvia (NACE red. 2, divisions C, D, F).

The **subject** – integrated quality management systems (IQMS), integrated management systems (IMS) and their improvement methodologies.

Limitations of theoretical researches: quality, environmental, occupational health and safety management systems (IMS), based on standards ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007 have been studied; IQMS, based on standard ISO 9001:2008, laboratory's competence standard ISO/IEC 17025:2005, products' standards, conformity assessment standards. Limitations of empirical researches: enterprises in Latvia participate in the research, empirical research participants have been selected using publicly available data, researches of certified enterprises IMS have been done, using data from one management system certification body.

HYPOTHESES TO BE DEFENDED

- Integrated quality management system (IQMS) is a form of integrated management system (IMS).
- Management systems integration degree can be evaluated, using self - assessment methodologies.
- Management system integration options and integrated management system implementation sequence is described in PDSA („Plan-Do-Study-Act") cycle and process' model logics.
- Management system audit methodology are to be improved for value-added auditing.

RESEARCH METHODOLOGY

Overall approach to research is structured in DMAIC methodology. Qualitative and quantitative methods have been applied for studies:

- Qualitative analysis of Latvian and foreign documents - legal acts, standards, publications.
- Management system certification body's *„Det Norske Veritas Latvia"* Ltd. unpublished information of restricted availability (interviews' summaries, third

party audit findings and conclusions, descriptions of corrective and preventive actions, certified IMS documentation analysis) qualitative and quantitative analysis.
- Survey method for enterprises' IMS in Latvia (Survey with questionnaires, statistical analysis).
- Case study of processes' improvements, using self-assessment, audit, quality improvement methodologies, impact to IMS of production industry enterprise.

Triangulation strategy has been applied in planning and performing researches and results interpretation. Action research elements have been used in the Case study.

NOVELTY

- Identified integrated management system (IMS) form - integrated quality management system (IQMS). Justified IQMS necessity in enterprises, which products are in the scope of New Approach Directives.
- Elaborated IMS, IQMS initial self-assessment methodology and empirically identified connection, which characterizes possible IMS integration situations in relation to employees, processes and documents integrations: V=3n-2, where V is a number of possible IMS integration situations, n is a number of standards, applied for IMS development.
- Elaborated production industry enterprise's comprehensive IMS self-assessment methodology, applicable for IMS, based on standards ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007.
- Developed IMS model, grounded on PDSA cycle and process' model logics.
- Supplemented standard ISO 10014:2006 methodology for processes' improvement, confirmed processes' improvement impact on IMS of production industry enterprise.
- Improved audit methodology for IMS value added audit.

APPROBATION

PUBLICATIONS
PUBLICATIONS ON RESEARCH RESULTS

1. Mezinska I., Apine A. Application of Standard ISO 10014:2006 „Quality management – Guidelines for realizing financial and economic benefits" for processes improvements// Proceedings of 13th QMOD International Conference of Quality Service Sciences, LearnAbility, Innovability and SustainAbility, 30 August – 1 September, 2010, Cottbus, Germany.
2. Civcisa G., Janauska J., Mezinska I., Mazais J., Saleniece I., Salenieks N. ImproveAbility Training on Education and Research// Proceedings of 13th QMOD International Conference of Quality Service Sciences, LearnAbility, Innovability and SustainAbility, 30 August - 1 September, 2010, Cottbus, Germany.
3. Mežinska I., Mazais J. Quality management systems in metal processing, hardware and machinery manufacturing industries in Latvia// RTU zinātniskie raksti. 6. sēr., Mašīnzinātne un transports. - 31. sēj., 2009. ISSN 1407-8015, 84.-88. lpp.

4.Mezinska I. Integrated management systems in Latvian companies. Situation today and look in tomorrow//Baltic Business and Socio-Economic development 2008, Berliner Wissenchafts-Verlag, Berlin, 2009., ISBN 978-3-8305-1743-6, 488.-501.lpp.
5.Mežinska I., Mežinskis G. Designing of integrated quality management system in building materials production companies// International Journal „Total Quality Management&Excellence", No.3, Vol.37, 2009., ISSN 1452-0680, 2009.
6.*Mežinska I. Uzņēmumu kvalitātes vadības sistēmas 2009.gadā. // RTU zinātniskie raksti. 6. sēr., Mašīnzinātne un transports. - 29. sēj. 2008., ISSN 1407-8015, 73.-78. lpp.*
7.Mežinska I., Mežinskis G. Integration of product and management system standards requirements for developing quality management system in building materials production companies // Advanced Construction. Proceedings of International Conference., Advanced Construction, Kaunas University of Technology, Kaunas, Lithuania, 13-14 November, 2008. ISSN 2029-1213, pp. 22.-26.
8.*Mežinska I. Integrētas vadības sistēmas un to vadītājs.// Latvijas kvalitātes asociācija, žurnāls „Kvalitāte", Nr.1, 2008., 4.-7. lpp.*
9.*Mežinska I. Kvalitātes vadība. Metodoloģijas finansiālu un ekonomisku ieguvumu apzināšanai.// Latvijas kvalitātes asociācija, žurnāls „Kvalitāte", Nr.3, 2007., 7.-9. lpp.*
10.*Mežinska I. Kvalitātes sistēmas iekšējo auditoru mācības. Pasniedzēja pārdomas.// Latvijas kvalitātes asociācija, žurnāls „Kvalitāte", Nr.2, 2005., 8.-10. lpp.*
11.Mezinska I. Efficiency of Quality Management Systems Internal Audit in Small and Medium Sized Companies// Materials of 48th Congress of European Organisation for Quality, Moscow, Russia, 7 - 9 September, 2004., p. 7
12.*Caune I. Kiberaudita metodes kvalitātes sistēmas auditā.//RTU zinātniskie raksti, 6.sēr., Mašīnzinātne un transports, 6.sēj., 2001., 89.-94.lpp.*

OTHER PUBLICATIONS

1.Čivčiša G., Janauska J., Mazais J., Mezinska I., Mikelsons J., Salenieks N. Harmonized Quality Assurance and Assessment methodology for Engineering Education// Proceedings of International Conference on Engineering Education ICEE-2010, July 18-22, Gliwice, Poland, CD.
2.Čivčiša G., Janauska J., Mezinska I., Mazais J., Mikelsons J., Rudnevs J., Salenieks N. Engineering Education – New Approach and New Style// Proceedings of 9th International Conference on Engineering for Rural Development, May 27-28, 2010, Jelgava, Latvia . - Vol.9, ISSN 1691-3043, pp.7.-12.
3.*Čivčiša G., Janauska J., Mežinska I., Bērziņš J., Mazais J., Priednieks V., Salenieks N. Doktora studijas lietderīgās pētniecības prasmei.// 12.starptautiskās konferences „Ūdens transports un infrastruktūra" 2010.gada 29.-30.aprīlis, Rīga, tēžu krājums, ISSN 1691-3817, 29.-31. lpp.*
4. Janauska J., Mežinska I., Salenieks N. Quality Education in Latvia. Proceedings of KTU conference. Approximation on quality promotion and legal regulation in Lithuania and European Union// Kaunas "Technologija", (2003), p.155.-159.
5.*Caune I. Kvalitātes sistēmas iekšējais audits – dažas problēmas un ieteikumi.// Latvijas kvalitātes asociācija, žurnāls „Kvalitāte", Nr.3, 2001., 8.-9.lpp.*

PRESENTATIONS OF RESEARCH RESULTS

1.Seminar, presentation „Integrated management systems in Latvian industry" Chalmers University of Technology, Department of Technology Management and Economics, Division of Quality Sciences, 27 January, 2011, Gotheburg, Sweden *(planned).*
2. Presentation and seminar in RTU Institute for Quality Engineering 13 January, 2011, Riga.

3. RTU 51st International Conference, section *"Ražošanas tehnoloģijas un transports",* subsection *"Drošums un kvalitāte",* presentation (1) „Integrētās vadības sistēmas vērtīga audita metodoloģija", presentation (2) „QFD metodes elementu lietojums zināšanu, prasmju, spēju vērtējumam", 15 October, 2010, Riga.
4. International Conference „13th QMOD International Conference of Quality Service Sciences „LearnAbility, Innovability and SustainAbility" presentation (1) I.Mezinska (presenting Author), A.Apine „Application of Standard ISO 10014:2006 „Quality management - Guidelines for realizing financial and economic benefits" for processes improvements", org. Lund University , Linkoping University, Brandenburg University of Technology Cottbus, 30 August - 1 September, 2010, Cottbus, Germany.
5. International Conference „13th QMOD International Conference of Quality Service Sciences „LearnAbility, Innovability and SustainAbility" presentation (2) G.Civcisa, J.Janauska, I.Mezinska (presenting Author), J. Mazais, I. Saleniece, N.Salenieks „ImproveAbility Training on Education and Research", org. Lund University, Linkoping University, Brandenburg University of Technology Cottbus, 30 August - 1 September, 2010, Cottbus, Germany.
6. Seminar, presentation „Quality management practices in Latvian organizations", Chalmers University of Technology, Department of Technology Management and Economics, Division of Quality Sciences, 28 April, 2010, Gotheburg, Sweden.
7. RTU 50th International Conference, section *"Ražošanas tehnoloģijas un transports",* subsection *"Drošums un kvalitāte"*, presentation (1) *„Vadības sistēmu sertifikācijas pakalpojumi Latvijā 1999.-2009.gads"*, presentation (2) *„Integrētas vadības sistēmas audita plānošanas nozīmīgie aspekti"*, 15 October, 2009, Riga.
8. International Conference „Total Quality Management – advanced and intelligent approaches", I.Mežinska (presenting Author), G.Mežinskis „Designing of integrated quality management system in building materials production companies", University of Belgrade, Mechanical Engineering Faculty, 31May - 4 June, 2009, Belgrade, Serbia.
9. International Conference „Advanced construction", I.Mežinska, G.Mežinskis (presenting Author) „Integration of product and management system standards requirements for developing quality management system in building materials production companies", Kaunas University of Technology, 13-14 November, 2008, Kaunas, Lithuania.
10. RTU 49th International Conference, section *"Ražošanas tehnoloģijas un transports",* subsection *"Drošums un kvalitāte", „Kvalitātes vadības sistēmas 2009"*, 13 October, 2008, Riga.
11. 4th International Conference „Baltic Business and socio-economic development", "Integrated management systems in Latvian companies. Situation today and look in tomorrow", Hochschule Wismar University of Technology, Business and design Wismar Business school, University of Latvia, Centre for European and transition studies, 30 September-1 October, 2008, Riga.
12. RTU 45th International Conference, section *"Ražošanas tehnoloģijas un transports",* subsection *"Drošums un kvalitāte", „Kvalitātes vadības sistēmu ārējais audits uzņēmuma un sertifikācijas institūcijas skatījumā"*, 11-14 October, 2004, Riga.
13. 48th Congress of European Organisation for Quality *"КАЧЕСТВО И ИННОВАЦИИ: ПУТЬ К ВЫСОКИМ СТАНДАРТАМ ЖИЗНИ"* , „Efficiency of Quality Management Systems Internal Audit in Small and Medium Sized Companies", 7-9 September, 2004, Moscow, Russia.
14. International Conference „Approximation on Quality promotion and legal regulation in Lithuania and European Union" J.Janauska, I. Mežinska (presenting Author), N.Salenieks „Quality Education in Latvia", Kaunas University of Technology, 28 October, 2003, Kaunas, Lithuania.

15. RTU 44th International Conference, "Pašvērtējumu metodoloģijas iezīmes standartā ISO 19011 - vadības sistēmas auditā", 10 October, 2003, Riga.
16. 6th annual International Conference in Total Quality Management *"Vadības sistēmu efektivitātes paaugstināšana - priekšnosacījums Latvijas uzņēmumu līdzvērtīgai konkurencei Eiropas tirgū", "Kāpēc iekšējais audits nesniedz gaidītos rezultātus?",* Latvian Association for Quality, Ministry of Economics, 28 November, 2002, Riga.
17. RTU 43rd International Conference, section *"Ražošanas tehnoloģijas un transports"*, subsection *"Drošums un kvalitāte", „Kāpēc kvalitātes sistēmas iekšējais audits nesniedz gaidītos rezultātus?"*, 10 October, 2002, Riga.
18. RTU 42nd International Conference, section *"Ražošanas tehnoloģijas un transports"*, subsection *"Drošums un kvalitāte"*, "*Kiberaudita metodes kvalitātes sistēmas auditā"*, 11-13 October, 2001, Riga.

OTHER PRESENTATIONS

1. International Conference „Baltic Dynamics 2010 – Knowledge flow in innovation system: from Idea to Action", J.Janauska, I.Mežinska (presenting Author), I.Saleniece, N.Salenieks „Education, Qualification and Research for Smart growth", section „Strategies and programmes to support innovation and knowledge transfer", 15-17 September, 2010, Riga.
2. International Conference „9th International Conference on Engineering for Rural Development", G. Čivčiša, J.Janauska, I.Mežinska (presenting Author), J.Mazais, J.Miķelsons, J.Rudņevs, N.Salenieks „Engineering Education – New Approach and New Style", 27-28 May, 2010, Jelgava.
3. Seminar „EEA Reglamentācija – standarti, norādes un norādījumi ražošanā/rūpniecībā" Latvijas Lauksaimniecības universitātes Tehniskajā fakultātē - 1 stundas semināra daļa (priekšlasījums) „Starptautiskās, reģionu un nacionālās standartu sistēmas, standartu veidi, standartu izstrādāšana/ pieņemšana, standartu uzturēšana, standartu lietojums reglamentētā jomā", 7 May, 2010, Jelgava.

PRACTICAL APPLICATION OF RESEARCH RESULTS

Practical application of elaborations in production industry enterprises in Latvia:

- Self-assessment methodologies application for integration degree identification.
- Model for IMS development, implementation and improvement in PDSA cycle and process model logics.
- Standard ISO 10014:2006 improved methodology for processes' improvement

PEDAGOGICAL WORK, RELATED TO DISSERTATION SUBJECT

Riga Technical university, Institute for Quality Engineering
(RTU Transport and Mechanical Engineering Faculty, from 1 November 2010 RTU Engineering Economics and Management Faculty)

Study courses:
„Integrated management systems" (RTU, MKI 510, 4KP)
„Quality assurance systems" (RTU, MKI 401, 2KP)
„Quality assurance systems" (RTU, MKI 477, 3KP)
„Effective management systems" (RTU, MKI 324, 2KP)

Riga Technical university, Faculty of Materials Science and Applied Chemistry

Study courses:
„Environmental management systems in materials' production industries" (RTU, ĶST 578, 3KP), from September 2010
„Quality and environmental management in materials' production industries" (RTU, ĶST412, 2KP), will be started in February 2011
„Materials' quality management " (RTU, ĶST577, 4KP), will be started in February 2011

Supervison of Masters' and Bachelors' thesis elaboration:
Supervison of Masters' and Bachelors' thesis elaboration in professionl studies programmes **„Total Quality Management"** - 26 Masters (2005 - 2011), 3 Bachelors (2010)
Supervison of Masters' thesis elaboration in study programme **„Manufacturing engineering and management" BALTECH Study centre, RTU** - 3 Masters (2005 -2006)
Supervison of Masters' thesis elaboration in study programme **„Innovation and entrepreneurship",** Engineering Economics and Management Faculty**, Department of International programmes, RTU** - 1 Master (2009)

STRUCTURE OF DISSERTATION, PUBLICATIONS AND PRESENTATIONS 2008-2010

DEFINE	*MEASURE*	*ANALYSE*	*IMPROVE*	*CONTROL*
INTRO-DUCTION, **CHAPTER 1**	**Presentation:** *Quality management practices in Latvian organizations* //Chalmers University of Technology , Department of Technology Management and Economics, Division of Quality Sciences, 28.aprīlis, 2010, Gothenburg, Sweden	**Publication**: *Designing of integrated quality management system in building materials production companies*// International Journal „Total Quality Management&Excellence", No.3, Vol.37, 2009, ISSN 1452-0680, 2009 **Presentation:** *Total Quality management –advanced and intelligent approaches*, 31 May – 4 June, 2009, Belgrade, Serbia	**Presentation:** *Integrated management systems in Latvian industry* //Chalmers University of Technology, Department of Technology Management and Economics, Division of Quality Sciences, 27.janvāris, 2011, Gothenburg, Sweden (PLANNED)	**Presentation:** Integrētās vadības sistēmas vērtīga audita metodoloģija // RTU 51.starptautiskā konference, apakšsekcija „Drošums un kvalitāte" 15 October, 2010, Riga
	Publication: *Quality management systems in metal processing, hardware and machinery manufacturing industries in Latvia*// RTU zinātniskie raksti. 6. sēr., Mašīnzinātne un transports. - 31. sēj. (2009)	**Publication**: *Integration of product and management system standarts requirements for developing quality management system in building materials production companies*// Proceedings of international conference „Advanced Construction" ISSN 2029-1213, 2008 **Presentation**: „Integration of product and management system standards requirements for developing quality management system in building materials production companies", Kaunas University of Technology, 13-14 November, 2008, Kaunas, Lithuania	**Publication:** *Application of standard ISO 10014:2006 for process improvements*// Proceedings of 13th QMOD Conference **Presentation:** 13th QMOD Conference, apakšsekcija *"Quality Management Systems",* 30 August – 1 September, 2010, Cottbus, Germany	**Presentation:** QFD metodes elementu lietojums zināšanu, prasmju, spēju vērtējumam// RTU 51.starptautiskā konference, apakšsekcija „Drošums un kvalitāte" 15 October, 2010, Riga
	Presentation: Vadības sistēmu serifikācijas pakalpojumi Latvijā 1999.-2009.gads //RTU 50.starptautiskā konference, apakšsekcija „Drošums un kvalitāte" 15 October, 2009, Riga			**Publication:** *ImproveAbility trainingin education and Research*// Proceedings of 13th QMOD Conference **Presentation:**13th QMOD Conference, apakšsekcija *"Quality Management in Education",* 30 August 1 September, 2010, Cottbus, Germany
	Publication: Uzņēmumu kvalitātes vadības sistēmas 2009.gadā.// RTU zinātniskie raksti. 6. sēr., Mašīnzinātne un transports. - 29. sēj. (2008), 73.-78. lpp. **Presentation**: Uzņēmumu kvalitātes vadības sistēmas 2009.gadā// RTU 49.starptautiskā konference, apakšsekcija "Drošums un kvalitāte", 13 October, 2008, Riga			**Presentation:** Integrētas vadības sistēmas audita plānošanas nozīmīgie aspekti// RTU 50.starptautiskā konference, apakšsekcija „Drošums un kvalitāte" 15.oktobris, 2009, Riga
	Publication: *Integrated management systems in Latvian companies. Situation today and look in tomorrow*//Baltic Business and Socio-Economic development 2008 (2009), Berliner Wissenchafts-Verlag, Berlin, ISBN 978-3-8305-1743-6 **Presentation:***Integrated management systems in Latvian companies. Situation today and look in tomorrow*//4.starptautiskā konference „Baltic Business and socio-economic development", 30 September -1 October, 2008, Riga	**CHAPTER 3**	**CHAPTER 4**	**CHAPTER 5**
	CHAPTER 2			

CONTENT

SUMMARY OF DISSERTATION

1. SUSTAINABLE DEVELOPMENT CONCEPT IN EUROPEAN UNION AND LATVIA'S ECONOMICAL POLICY AND ACTION PLANS

There are 5 pages and 1 figure in the Chapter

Western European countries, most belonging to European Union (EU), are implementing sustainable development strategies of their economies. EU strategy „Europe 2020. European strategy for smart, sustainable and inclusive growth" describes development priorities. Latvia participates in EU strategy implementation, simultaneously being intended to facilitate development of national economy. Governmental policies and strategies - „Latvia 2030" sustainable development strategy of Latvia, Latvian National development plan for 2007-2013, Programme for promotion of Business Competitiveness and Innovations for 2007-2013, describe vision of business development opportunities, indicating a number of issues to be considered. One among them - enterprises' quality, environmental, occupational health and safety management.

2. MANAGEMENT SYSTEMS OF ENTERPRISES

There are 46 pages, 6 tables and 19 figures in the Chapter

International Organization for Standardization (ISO) comprises 162 national standardization organizations and 18 083 international standards have been published since it's foundation [1]. Number of companies, having quality management systems certified to standard ISO 9001 requirements, reaches one million 2009 [2]. Number of industry specific quality management systems and systems developed conforming to different management systems standards requirements (ISO 22000, ISO/IEC 13485, ISO/TS 16949, ISO/IEC 20000-1, ISO 27001) is still growing.

Balanced Scorecard methodology authors R.Kaplan and D.Norton define management system as follows: "By management system, we are referring to the integrated set of processes and tools that a company uses to develop its strategy, translate it into operational; actions, and monitor and improve the effectiveness of both" [3]. Term of quality management system (QMS) is defined by different authors [7,6,5,4], and in the Dissertation term is used as it is defined in standard ISO 9000:2005: „quality management system is a system (set of interrelated or interacting elements) to establish policy and objective and to achieve those objectives" [8]. Term of integrated management system (IMS) also has been defined by several authors [9,10,11,12,13,14], in the Dissertation term is used according to European Accreditation cooperation definition: IMS results when an organization uses one single management system to manage multiple aspects of organizational performance, to meet the requirements of more than one management system standard [15].

QMS standard ISO 9001:2008 is based on eight quality management principles, defined in standard ISO 9000:2005, and ISO 9001:2008 requirements are laid out in the logics of PDSA (plan-do-study-act) cycle, in some information sources referred PDCA (plan-do-check-act) cycle, W. Shewhart or E.Deming cycle.

On 13 November 2008 new edition of standard ISO 9001 was launched. Standard ISO 9001:2008 contains few amendments, not widely discussed by other authors. The Author considers that explanation of term „product" is one of the most important amendments in the standard, because enterprises' final products, semi-finished products or supplier delivered products are mentioned in number of ISO 9001:2008 clauses. In standard ISO 9001:2000, term „product" has a more narrow meaning. Considering update of enterprises' QMS following adjustments shall be made:

- Planning and realisation of monitoring and measurement of semi-finished products, documenting results (ISO 9001:2008; 7.1, 8.2.4). Monitoring and measurement of products from outsourced processes have been required by ISO 9001:2000 (4.1, 7.4.3), therefore amendments should not be necessary.
- Documented procedure covering control of nonconforming semi-finished products, nonconforming products from outsourced processes, nonconforming products from suppliers, including records about the nature of nonconformities and any subsequent actions taken.

Standard ISO 9001:2008 contains few amendments which could lead to the revision and improvement of enterprise's QMS, however Author means that most important are related to term „product" and „statutory and regulatory requirements", requirement on appointment of management representative, who is a member of organization's management, reviewing of effectiveness of corrective actions and preventive actions, more requirements on outsourced processes.

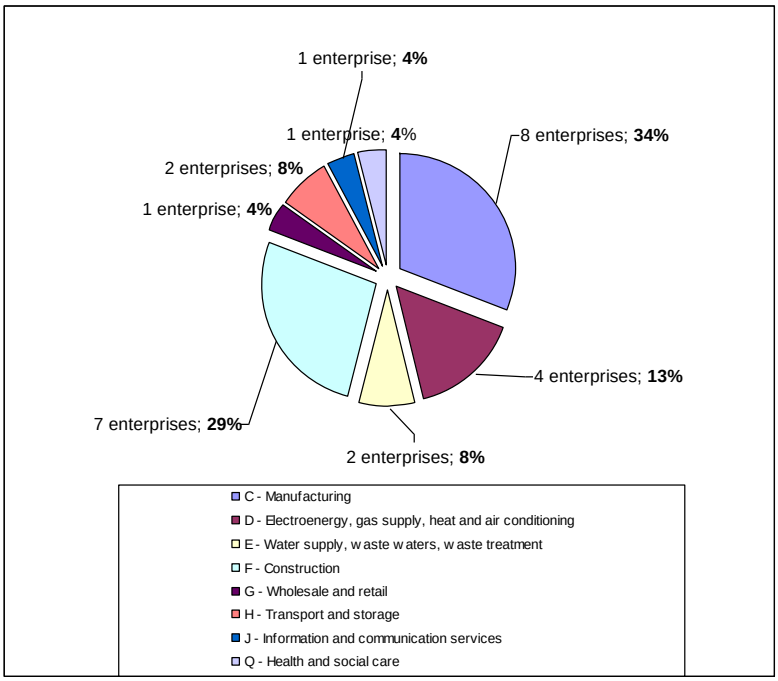
In November 2010 Author has elaborated and accomplished research about quality, environmental, occupational health and safety management systems in enterprises in Latvia. Enterprises, having management systems (integrated management system), which conforms to two or three standards - ISO 9001, ISO 14001, OHSAS 18001 - requirements, have been invited to participate. Totally 137 enterprises have been found in Latvia, and their management systems are established, certified or have been certified according to two or three standards requirements. It was expected rather low response rate, therefore triangulation strategy has been applied - data obtained in application of quantitative methods are confirmed and interpreted using data obtained in application of qualitative methods and vice versa [16]. In the Dissertation results of empirical research in enterprises are interpreted taking into account Author's experience in a role of QMS, EMS Auditor, Lead Auditor in management systems certification body *„Det Norske Veritas Latvia"*. Invitations to participate in the research and questionnaires have been sent to 119 enterprises. 26 enterprises sent back filled questionnaires, which results in 22% response rate. Comparing to response rates in IMS empirical researches in other countries this is a close to average rate. Tolerable error is 19,2% (at 95% confidence level).

General profiles of 26 enterprises, participating in the empirical research:

- Size of the enterprise (by number of employees) - 5 small (19%), 12 medium (46%), 9 big enterprises (35%).
- Enterprises (by economical activities areas), depicted in Figure 1. Production industry enterprises (NACE red.2 div. C, D, F) are represented by 19 enterprises (73%).
- Enterprises (by management systems) - 11 enterprises, having quality and environmental management systems; 13 enterprises, having quality, environmental, occupational health and safety management systems; 2 enterprises, having quality, occupational health and safety management systems.

Maturity of IMS - data of management system initial certification indicate that 37% of all enterprises had QMS initial certification between 2000 and 2002; 32% enterprises, having environmental management system (EMS), had EMS certification between 2003 and 2005, 31% enterprises, having occupational health and safety management systems (OHSAS) initial certification had between 2003 and 2005. It confirms that management systems of enterprises, participating in the research, are mature and they are operated at least 3 years.

In the research question about QMS results 23 of 26 research participants replied, that they do suggest to other enterprises QMS implementation, 3 respondents indicated uncertain answer „hard to say" Empirical research in 1996 about QMS certification in UK enterprises confirmed, that 57,2% certified organizations recommended to other enterprises QMS certification, 28,5% - neither recommend nor do not recommend, less than 15% do not recommend [17].



Source: Author's research

Figure 1. Enterprises, participated in research (by economical activity NACE red.2).

In the research question about effectiveness of QMS certification, nearly one third of respondents (8 enterprises out of 26) indicated answer „hard to say". Most of enterprises, participated in the research, have mature QMS, it means, that participants formulate their answers taking into account experience of several certification cycles, therefore their opinion reflect evaluation of QMS certification effectiveness in long term. Author considers, that for unequivocal confirmation of this presumption, more research is necessary. In question about QMS implementation and certification research participants marked from one to three statements, formulated in the way that allows to evaluate internal and external QMS implementation and certification motives. Enterprise's internal initiative is described in statements 1., 2., external motives in 3., 4., 5., 6. (Table 1).

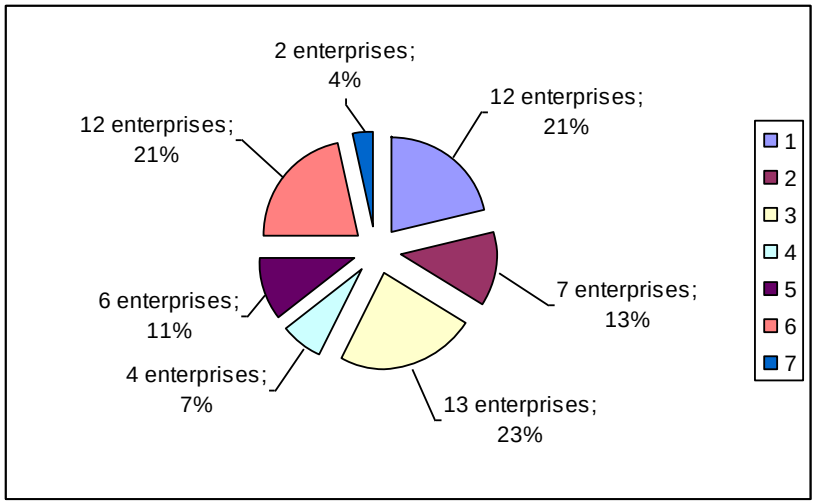
Table 1

QMS implementation and certification reasons

No. of statement in research question and Figure 2	Statement
1.	Identification of enterprises' processes, employees responsibilities review. QMS certification was not a QMS implementation goal.
2.	QMS was implemented for reducing amount of non-conforming products, thus decreasing a dissatisfaction of clients.
3.	QMS implementation in the enterprise was clients, collaboration partners initiative – requirement for starting (continuing) cooperation.
4.	Enterprise is a subsidiary enterprise in Latvia and QMS implementation and certification is requirement of parent enterprise.
5.	Decision of QMS implementation and certification was taken because competitors implemented and certified QMS.
6.	Enterprise's initiative - QMS implementation and certification necessity was determined by the assumption, that certified QMS will allow to attract new clients.
7.	Standard ISO 9001 was something new, we wanted to try ...

Source: Author's research

Research results confirm that 7 enterprises implemented and certified their QMS mostly internal initiative driven, external motivation factors were more important for 19 enterprises (Figure 2).



Source: Author's research

Figure 2. QMS implementation and certification reasons

Between 2000 and 2010 (including) 278 audit days Author participated in certification audit groups as an Auditor or Lead Auditor in enterprises, having QMS certified according to standard ISO 9001:2000 or ISO 9001:2008. Summary of audit interviews and audit findings affirms, that full value of QMS, based on standard ISO 9001, is affected by following factors: understanding of standard ISO 9001 application and standard's requirements interpretation, maturity of QMS, top management support and personal involvement in QMS implementation and improvement, team work in QMS implementation.

Standard ISO 9001 is applicable in any industry, therefore formulation of it's requirements is general and brief. Standard's application and requirements interpretation is critically important particularly in early QMS implementation stages. QMS improvement takes place later, when normally enterprise has an own experience and deep understanding about standard requirements interpretation, wherewith standard application does not cause difficulties. Understanding of standard's nature, requirements interpretation, stages of implementation are formed in trainings, seminars, consultations with professionals, discussions with colleagues, certification body's auditors and through independent self-studies. It has been confirmed also by Author's research results.

Enterprise's QMS and quality culture maturity affect standard ISO 9001 application – QMS, based on standard ISO 9001, deliver more benefits if QMS is applied for facilitation of enterprise's objectives - it has been affirmed by several authors [18,19,20]. Author concludes that top management support for QMS, IMS implementation and improvement are forming, effected by internal and (or) external motives. Internal motivation factors promote elaboration of QMS, taking into account enterprise's true needs (identification of processes, establishment of effective process management actions, processes management, monitoring, taking of decisions, based on facts). Setting of internal motives can be facilitated by seminars, trainings, participation in conferences, informal conversations. If QMS implementation motivation is external - requirements of clients, cooperation partners, then QMS elaboration is following to minimum requirements of the standard. ISO 9001 interpretation depth and expanse differ from enterprise to enterprise. In case of external motivation top management support initially is more formal. However if QMS implementation, e.g. corrective, preventive actions, delivers tangible results, allowing to solve quality related problems formal attitude changes.

Colleagues involvement, team work in QMS elaboration have been emphasized by several authors [21, 22]. Management systems - QMS, EMS, IMS shall be elaborated in teams, involving participation of interested persons. This is especially important, developing IMS, which embraces different scopes – quality, environment, occupational health and safety.

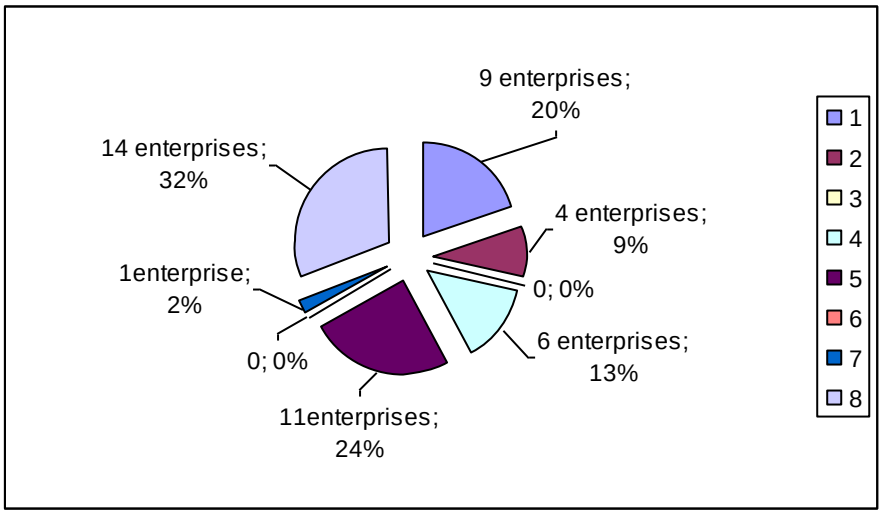
In Author's research question about obstacles, which burdened QMS implementation (Table 2, Figure 3), research participants most frequently marked statements are - perception of preparation of great amount documentation, negative attitude from colleagues' side, related to resistance to change.

Table 2

QMS elaboration and implementation burdening obstacles

No. of statement in research question and Figure 3	Statement
1.	Language, used in standard ISO 9001 is complicated, requirements can be interpreted differently.
2.	Standard ISO 9001 requirements are understandable, however it is not clear, how they should be applied within your enterprise.
3.	In the enterprise standard ISO 9001 text in Latvian is used, and translation makes standard requirements crabbed.
4.	Lack of top management support and personal involvement in QMS elaboration and implementation.
5.	Negative attitude from colleagues' side, related to resistance to change.
6.	Your enterprise is a subsidiary in Latvia and parent's enterprise QMS implementation principles, documentation is not suitable for QMS in your enterprise.
7.	Consultation and training costs for QMS elaboration and interpretation were rather high, therefore consultants' services were not used and trainings were not attended.
8.	QMS elaboration and implementation was impeded by perception of preparation of great amount documentation.

Source: Author's research



Source: Author's research

Figure 3. QMS elaboration and implementation burdening obstacles

Taking into account QMS maturity, answers of participants are influenced by experience between 2000 and 2005, when new version of ISO 9001, based on process approach was launched. Standard contained minimal requirements for documentation,

however traditional opinion of QMS as system with complicated documentation, based on standards ISO 9001:1994, ISO 9002:1994, ISO 9003:1994, still prevails. During third party (certification) body audit Author has observed that in enterprises, which QMS initial certification took a place later (after 2005) amount of QMS documentation is not considered as burdening obstacle.

In order to understand development of knowledge, skills and competence in QMS elaboration and improvement, Author invited research participants to give their opinion on training effectiveness evaluation. Competence is a result of effective and efficient training process. Answers of respondents were supplemented by number of comments, many of them referred to necessity more training time to devote for competence development. Skills enhancement in group works during trainings - case studies, elements of quality management system (flowcharts of processes, process' quality characteristics formulation, documentation of procedures) development will facilitate standard application.

Next edition of standard ISO 9001 shall be launched in 2014 and ISO/TC 176 working group is working on questions to be included in requirements of new standard [23]. Author's has an opinion that some of requirements should be enhanced and formulated more precisely – infrastructure and work environment (ISO 9001:2008; 6.3, 6.4), product realization process planning (ISO 9001:2008; 7.1), communication with client (ISO 9001:2008; 7.2.3), control of production and service provision (ISO 9001:2008, 7.5.1). New version of ISO 9001 would be more useful as a guidelines document, however if it will be used for QMS certification, minimum requirements to be fulfilled for becoming certified should be unequivocally formulated and interpreted.

Standard ISO 9001 is widely known quality management system standard, however more and more industry specific quality management systems standards are developed: ISO 22000:2005 for food industry, ISO/TS 16949:2010 for automotive industry suppliers, ISO 13485:2003 for medical devices manufacturing and servicing organizations. Standards, applicable to quality management in particular enterprise's processes like ISO/IEC 20000-1:2008 un ISO/IEC 27001 can also be considered as industry specific QMS standards. QMS requirements are included competence standards of conformity assessment bodies - ISO/IEC 17020:2005 for inspection bodies, ISO/IEC 17021:2007 for management systems certification bodies, ISO/IEC 17024:2005 personnel certification, ISO/IEC 17025:2005 testing and calibration laboratories, EN ISO 45011 for product certification bodies, ISO 15189:2008 for medical laboratories.

Number of QMS, industry specific QMS standards users are growing, and it confirms a need to consider IMS development.

Author's research question about EMS implementation motivation in enterprises in Latvia, almost half of respondents (10 out of 23) position on EMS implementation is uncertain („hard to say"), which imply, that EMS implementation has not lead to expected results. In the research question about EMS certification convincing majority of respondents marked uncertain („hard to say"). Research question about OHSAS implementation motivation 3 enterprises of 13 have neutral position, but in question about OHSAS certification - 7 enterprises have uncertain position.

Comparing respondents' opinion about EMS and OHSAS systems implementation and certification, respondents are confirming that OHSAS system is valued as more advisable to other companies. It should be noted that there are 23 enterprises with certified EMS and 14 enterprises with certified OHSAS participated in the research.

Standards with different scopes - quality, environment, occupational health and safety - are tools for sustainable development concept implementation in the enterprise. If there is QMS implemented, then EMS, OHSAS implementation is easier, because ISO 9001, ISO 14001, OHSAS 18001 is based on common principles, PDSA cycle and concept of continuous improvement.

Number of certificates of QMS conformance to standard ISO 9001 is growing. In some countries - France, Germany, UK, USA, Japan number of QMS certificates is decreasing – QMS certificates, issued in one year, became smaller than number of certificates which expired or have been cancelled [24]. Despite of the fact that number of certificates retains positive growth trend [25], managers of management system certification bodies admit decrease of certification services, intensified by financial crises and costs saving. Notable increase of EMS and industry specific QMS certification is observed. Data about enterprises, having integrated quality, environmental, occupational health and safety management systems, are not summarized. Author has not obtained data about OHSAS systems certification according to OHSAS 18001. ISO Survey contain data about number of certificates, however one enterprise could have more than one certificate.

In most of Latvian enterprises QMS based on standard ISO 9001:2008 is a base for IMS development. In October 2010, reviewing data of Latvian Association for Quality, publications in home pages of certification bodies and consulting companies, 137 enterprises, having management systems conforming to several management system standards were identified. Industry specific integrated quality management systems: quality, information technology services management (ISO 9001:2008, ISO/IEC 20000-1:2005) - 1 enterprise; quality, information security management system (ISO 9001:2008, ISO/IEC 27001:2005) - 2 enterprises; quality, information technology services, information security management system (ISO 9001:2008, ISO/IEC 20000-1:2005, ISO/IEC 27001:2005) - 1 enterprise; quality, food safety management systems (ISO 9001:2008, ISO 22000:2005) - 7 enterprises. Actual number of enterprises, having ISO management system standards based systems is not possible to estimate, because not all of them are certified and those which has been certified, probably are not recertified, but still followed in the enterprise.

Certification of management system correspondent to several management system standards (integrated management system) is more convenient and financially profitable if service is provided by one certification body. For example in concrete production and construction enterprise „ABC" (50 employees), QMS audit duration according to IAF MD 5:2009 guidance is 5 auditor days, EMS audit duration - 6 auditor days (environmental aspects of „medium complexity"). If QMS and EMS are not integrated, audit duration is 11 auditor days, according to European Accreditation cooperation Certification committee document EA 7/05 „EA guidelines for standard ISO/IEC 17021:2006 application for combined audits" (25 October 2008), total duration of certification audit may be reduced by 20%, comparing with duration which shall be applied in case of certification of separate management systems. If QMS and EMS in enterprise „ABC' is fully integrated, then total duration of audit is 8,8 auditor days. If QMS and EMS are not integrated, then certification audit costs are 4400 LVL, if system is operated as IMS certification audit costs are 3520 LVL, assuming, that cost of one auditor day is 400 LVL (without VAT).

ISO annual survey of certification confirms, that despite of decrease of number of certificates in several countries, total number of QMS, EMS, industry specific QMS certificates is still growing.

3. EVALUATION OF MANAGEMENT SYSTEMS INTEGRATION OPTIONS

There are 21 page, 5 tables and 2 figures in the Chapter

Term standardised management system for the first time has been used by Stanislav Karapetrovic in 2001, for identification of management systems, developed conforming to several management systems standards. Integrated management system (IMS) comprises several (all) enterprises' areas, processes, functions. IMS traditionally has been deemed as partly or totally integrated management system [26]. Objective is to develop a system, operating in „Plan-Do-Study-Act" cycle and embracing quality, environmental, occupational health and safety issues in all processes – realization processes, supporting and management

processes, including finance management, marketing, personnel management. Proper interpretation of standard requirements, integration of requirements wherever it is possible are prerequisites for integrated management system, integrated quality management system development. For accurate characterization of IMS, Author proposes to subdivide two forms of IMS: integrated managements systems, covering several scopes (quality, environment, occupational health and safety) and integrated quality management system.

Author's definition for integrated quality management system (IQMS) :

„One single management system to manage organization's products, processes, systems quality related aspects to meet requirements of more that one document requirements".

IQMS criteria:

- Product standards e.g. building materials products standards.
- Industry specific QMS standards – ISO/TS 16949:2010 (automotive industry), ISO 20000/IEC-1:2005 (information technology), ISO 22000:2005 (food industry), ISO 13485:2003 (design, manufacturing, servicing of medical devices).
- General requirements for testing and calibration laboratory competence ISO/IEC 17025.
- General quality management system standard ISO 9001.

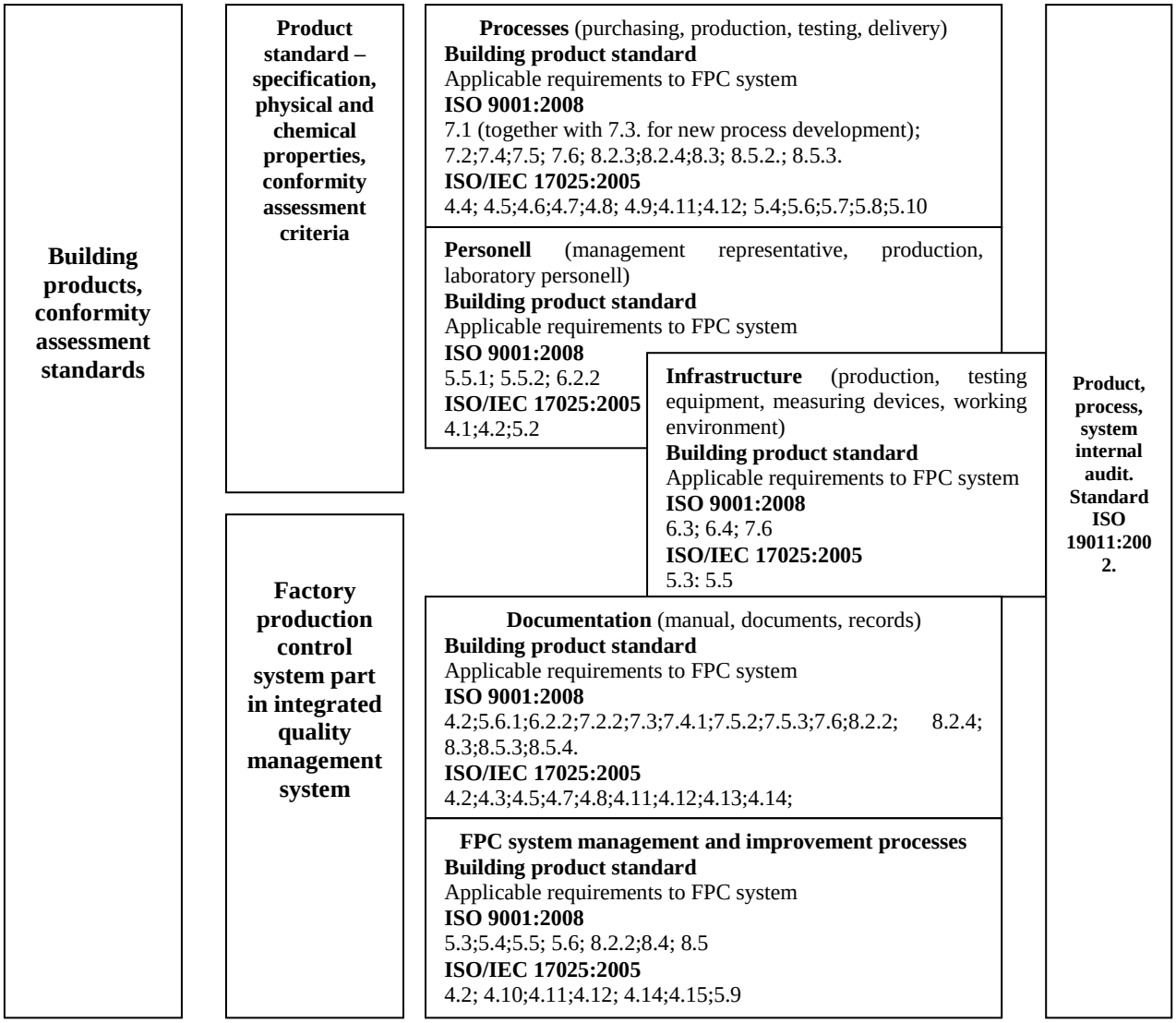
Criteria of IQMS development are dependent of enterprises' products, processes, systems and requirements, applicable to their quality aspects - legislation, clients' requirements, good practice in particular industry. For illustration of IQMS development Author has chosen building materials production industry because of personal experience in factory production control systems inspections in cement production enterprises (standards EN 197-1:2000, EN 197-2:200) and quality management systems audits in building materials production enterprises (standards ISO 9001:2000, ISO 9001:2008).

Number of harmonized European standards contain requirements for factory production control (FPC). FPCS objective is product quality assurance (Directive 89/106/EEC, Annex 3). Conformity assessment of cement harmonized standard EN 197-1:2000 is applied and it refers standard EN 197-2:2000 „Cement. Part 2: Conformity assessment". Requirements for FPC are set also in some building materials standardised which are not harmonized, for example, concrete standard LVS EN 206-1:2001 „Concrete Part 1.", chapter 9. FPC describe requirements for FPC system, however correct implementation of these requirements is possible if they are implemented as QMS. IQMS in building materials production enterprise is a system based on ISO 9001:2008, ISO/IEC 17025:2005 and product standards (Author's model in Figure 4).

Harmonized product, conformity assessment standards, containing FPC system requirements, number of elements like policy, objectives, internal audit, corrective actions, management review (building glass standards, cement standard EN 197-2:2000), are quality planning and quality improvement, which broader scope than quality assurance. Therefore following to the standard's content Author' presume that FPC systems are QMS. Most exhaustive FPC system is described in cement standard EN 197-2:2000. For development of effective building materials production enterprise's QMS, it is suggested to evaluate compatibility of particular building material standard requirements with requirements of standard ISO 9001. Following requirements of ISO 9001:2008 shall be considered – quality policy, objectives, management review, internal audit, non-conforming products control, corrective actions, documents and records control, adequately supplemented with particular product, conformity assessment standard requirements.

Report on Economic Development of Latvia (June 2010) states that especial notion shall be given to the fact that manufacturing industry is grown by 6,8% comparing first quarter of 2010 with first quarter of 2009. Most growing industries - wood processing, metal

working, machinery. Food industry IQMS develop following to standards ISO 9001:2000, ISO 22000:2005, ISO/IEC 17025:2005. IQMS in wood processing enterprises can be developed following to FSC, PEFC certification requirements, for wood products, used in building (Directive 89/106/EEC) following to product standards. Metal production and metal working, machinery industry enterprises industry specific QMS are developed following to standard ISO/TS 16949:2010.



Source: Author's elaborated model

Figure 4. Compatibility of several standard requirements for integrated quality management system development in building products manufacturing enterprise

Integrated quality, environmental, occupational health and safety management systems conforming to standards ISO 9001, ISO 14001, OHSAS 18001 can be implemented in enterprise of any industry. Standards ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007 are elaborated in the way that their requirements shall be compatible. Cross – reference tables in standards' annexes should facilitate use of several standards, however Author has noticed that in number of cases compatibility of requirements is indicated incompletely or even wrongly.

Author's review of 30 enterprises certified IMS documentation confirms, that 15 enterprises with IMS, corresponding to two or three standards requirements, documentation contain information about relationship between standards requirements and documentation. Standards' requirements compatibility cross-reference tables shall be used appropriately evaluated.

4. INTEGRATED MANAGEMENT SYSTEMS AND THEIR IMPROVEMENT

There are 39 pages, 4 tables and 20 figures in the Chapter

Between 1991 and 1999 articles about IMS development, case studies of IMS implementation were mostly published in professional periodicals. From 1999 publications about IMS are published in academical journals. Reviewing results of theoretical and empirical researches, Author concludes that one of the issues having crucial practical importance in IMS development and improvement is integration degree of management system, conforming to several management system standards requirements.

In the IMS empirical research in enterprises in Latvia, as most important IMS development reasons were marked following statements:

- IMS facilitate review processes, merging and combining them, where possible – for example, internal audit, management review, document control.
- IMS implementation leads to documents and records reduction comparing to the amount which could be if systems could be developed separately.
- IMS application save resources – personnel, time consumption.

Some authors – R.Salomone, M.Bernardo [27,9] in empirical IMS researches found out high integration in enterprises' policy, objectives, processes, documentation.

Necessity of policy, objectives integration is grounded on enterprises' understanding of sustainable development. Financial savings on policy, objectives integration are not inherent, rather conversely – under particular circumstances integration can require additional costs related to investments of infrastructure development for reducing environmental impact of enterprises products and processes. Records integration are restricted to great extend due to records' content. If processes are not integrated, for example production process un waste management in production process are two separately documented processes, then records related to both processes most likely will not be integrated. Records integration in producing industry enterprise allow to minimize documentation amount, thus simplifying their circulation, to facilitate decision taking because data about processes' results or results of one process are recorded in one record.

Author is elaborated IMS integration degree initial self-assessment methodology (Figure 5). Inspiration of different characterization comes from IMS for situations descriptions [26]. For IMS integration degree evaluation Author described six IMS integration degrees, used in enterprises, having management system conforming two management system standards and nine IMS integration degrees, having management system conforming to three management system standards.

Methodology can be applied by enterprises with high maturity of IMS and it can be used by enterprises, which plan to implement IMS. Different options of integration level can be used for IMS implementation and improvement. Author's observations indicate that it possible to estimate financial benefits (cost savings) associated with different integration degrees, however in different enterprises most suitable IMS integration degree can be different. Enterprises operating in chemical industry, hazardous waste management and treatment business have many significant and complex environmental aspects, management representative in environmental management, environmental manager most likely should be separated from quality management representative, quality manager tasks.

Management systems integration degree initial self-assessment (two standards)

☐ One employee responsible for both systems – QMS, EMS; processes (e.g. internal audit) and documents (procedures, instructions) are individual for each system.	☐ One employee responsible for both systems – QMS, EMS; processes (e.g. internal audit) and documents (procedures, instructions) are partly common.	☐ One employee responsible for both systems – QMS, EMS; processes (e.g. internal audit) and documents (procedures, instructions) are common.
☐ One employee responsible for QMS, one - for EMS, processes (e.g. internal audit) and documents (procedures, instructions) are individual for each system.	☐ One employee responsible for QMS, one - for EMS, processes (e.g. internal audit) and documents (procedures, instructions) are partly common.	☐ One employee responsible for QMS, one - for EMS, processes (e.g. internal audit) and documents (procedures, instructions) are common.

Management systems integration degree initial self-assessment (three standards)

☐ One employee responsible for all three systems – QMS, EMS, OHSAS; processes (e.g. internal audit) and documents (procedures, instructions) are individual for each system.	☐ One employee responsible for all three systems – QMS, EMS, OHSAS; processes (e.g. internal audit) and documents (procedures, instructions) are partly common.	☐ One employee responsible for all three systems – QMS, EMS, OHSAS; processes (e.g. internal audit) and documents (procedures, instructions) are common.
☐ Two employees are responsible for all three systems QMS, EMS, OHSAS (e.g. one for QMS, one for EMS and OHSAS), processes (e.g. internal audit) and documents (procedures, instructions) are individual for each system.	☐ Two employees are responsible for all three systems QMS, EMS, OHSAS (e.g. one for QMS, one for EMS and OHSAS), processes (e.g. internal audit) and documents (procedures, instructions) are partly common.	☐ Two employees are responsible for all three systems QMS, EMS, OHSAS (e.g. one for QMS, one for EMS and OHSAS), processes (e.g. internal audit) and documents (procedures, instructions) are common.
☐ One employee responsible for QMS, one - for EMS, one - for OHSAS; processes (e.g. internal audit) and documents (procedures, instructions) are individual for each system.	☐ One employee responsible for QMS, one - for EMS, one - for OHSAS, processes (e.g. internal audit) and documents (procedures, instructions) are partly common.	☐ One employee responsible for QMS, one - for EMS, one - for OHSAS, processes (e.g. internal audit) and documents (procedures, instructions) are common.

Source: Author's elaborated methodology

Figure 5. IMS integration degree self-assessment initial methodology

Each enterprise depending on industry, number of processes un complexity, amount and significance of environmental aspects, occupational health and safety risks, has it's own most appropriate IMS integration degree.

Number of different integration degrees can be expressed by formula: V=3n-2, where V is a number of possible IMS integration situations, n is a number of standards, applied for IMS development.

In empirical research 26 enterprises used methodology for IMS integration degree self-assessment and results confirm that IMS in enterprises in Latvia are highly integrated. Initial self-assessment methodology can be used also for evaluation of IMS, developed to other than ISO 9001, ISO 14001, OHSAS 18001 standards, e.g. evaluation of IQMS.

For comprehensive IMS integration evaluation Author has elaborated detailed methodology, comprising questions in three areas – general IMS issues and top management responsibility, employees responsibilities, processes and documents. Author has not found any publication about self-assessment of IMS, based on ISO 9001, ISO 14001, OHSAS 18001 in any combination, integration degrees, applicable to any enterprise in producing industry. Self-assessment methodology contain a descriptions of IMS integration levels „integrated", „partly integrated",„not integrated", therefore application of methodology gives results which allow objectively compare IMS integration degree of different companies. Within the frameworks of empirical research 10 enterprises applied comprehensive self-assessment methodology. Profile of enterprises:

- IMS of 6 enterprises are mature, operated at least 5 years, IMS of 4 enterprises - less than 3 years.
- Management systems of 9 enterprises are certified, management systems of 1 enterprise are not certified.
- IMS of 4 enterprises are based on ISO 9001:2008 and ISO 14001:2004, 1 enterprise - ISO 9001:2008 and OHSAS 18001:2007, 5 enterprises - ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007.

IMS elements included in first part of self-assessment methodology (Figure 6) in empirical researches, done by R.Salomone, B.Bernardo et al. [27,9] are characterized by very high integration level. Policy, objectives integration in 10 enterprises self-assessments demonstrates necessity of more detailed research, because 5 enterprises indicate, that each scope – quality, environment, health and safety has own policy, objectives, 5 enterprises – policy, objectives, comprising all three scopes. Reviewing documented policies of 30 enterprises' certified management systems, Author concludes that policies of 6 enterprises (20%) are integrated, policies of 18 enterprises (60%) are formulated like „quality and environmental policy" or „quality, occupational health and safety policy"). The content of these policies are separated, title is conjunctive element. 3 enterprises has „quality and environmental policy", „occupational health and safety policy" separately or „quality, occupational health and safety policy", „environmental policy" separately. In empirical research in 50% policies are integrated, in review of certified management systems policies. Review of same 30 enterprises objectives conforms, that 3 enterprises (10%) have integrated objectives, 18 enterprises (60%) have „quality and environmental objectives" („quality, occupational health and safety objectives"), where each objective is formulated in one scope and title is conjunctive element; 9 enterprises' (30%) „quality objectives" and „environmental objectives" („quality objectives" and „occupational health and safety objectives") are formulated separately. Separation of programmes is natural - if objectives are separated, then programme also is separated.

Considering IMS improvement in this area, 5 enterprises could continue with further integration, however benefits of policy, objectives, programmes integration shall be considered in each enterprise individually.

Object of management system	**Evaluation of management systems integration degree**		
	Not integrated	**Partly integrated**	**Integrated**
	RESPONSIBILITY OF TOP MANAGEMENT		
Policy *ISO 9001 (5.3.); ISO 14001 (4.2.); OHSAS 18001 (4.2.)*	☐ separate policies	☐ policies of two scopes are formulated together, one separately (if IMS is based on 3 standards)	☐ one policy, embraces all scopes
IMS scope *ISO 9001 (4.2.2..); ISO 14001 (4.1.); OHSAS 18001 (4.1.)*	☐ management systems' scopes are separated, QMS is covering sales, EMS – production, OHSAS – delivery processes	☐ management systems' scopes partly overlap (if IMS based on 3 standards), e.g. QMS and OHSAS in production, EMS in delivery processes	☐ management systems' scope is the same for all systems, e.g. QMS, EMS and (or) OHSAS in sales, production and delivery
Objectives *ISO 9001 (5.4.1.); ISO 14001 (4.3.3.); OHSAS 18001 (4.3.3.)*	☐ separate objectives	☐ in some objectives two of three scopes are included	☐ in some objectives all three scopes are included
Resource planning and allocation *ISO 9001 (5.1., 6.); ISO 14001 (4.4.1); OHSAS 18001 (4.4.1)*	☐ resource planning is separated, takes place depending of necessity to allocate resources for each scope	☐ resource planning takes place simultaneously or separately for all three scopes, but allocating resources for e.g. infrastructure development (QMS) in some cases consideration is given to impact to environment (EMS) and/or OHSAS issues	☐ resource planning takes place simultaneously for all three scopes, and allocating resources for e.g. infrastructure development (QMS) consideration is given to impact to environment (EMS) and/or OHSAS issues
Programmes *ISO 9001- no requirement; ISO 14001 (4.3.3.); OHSAS 18001 (4.3.3.)*	☐ each scope has separate programme	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	☐ Environmental, occupational health and safety programme includes tasks for completing quality objectives

Source: Author's elaboration

Figure 6. IMS integration degrees description in top management responsibilities

The highest integration degree is observed in self-assessment methodology part of employees responsibilities and authorities integration (Figure 7), which generally is not correspondent to other empirical research results [27], which present 63% integration.

Object of management system	EMPLOYEES		
Management representative, management system manager *ISO 9001 (5.5.2); ISO 14001 (4.4.1); OHSAS 18001 (4.4.1)*	☐ each scope has separate management representative (system manager)	☐ two of three scopes have one responsible (e.g. EMS, OHSAS), one scope (e.g. QMS) other responsible	☐ one management representative is responsible for IMS (based on 2 or 3 standards)
Responsibilities and authorities of employees *ISO 9001 (5.5.1); ISO 14001 (4.4.1); OHSAS 18001 (4.4.1)*	☐ responsibilities and authorities in each scope are appointed and documented in different documents e.g. job description contains responsibilities related to quality, but procedures/process descriptions about environment and OHSAS	☐ job descriptions contain responsibilities and authorities in two scopes (e.g. QMS and EMS), but responsibilities related to OHSAS are documented in procedures (process descriptions)	☐ job descriptions, procedures (processes descriptions) contain responsibilities and authorities in all scopes)
Internal auditors *ISO 9001 (6.2.2.); ISO 14001 (4.4.2); OHSAS 18001 (4.4.2)*	☐ internal auditors' competence have been developed and maintained in one scope e.g. QMS or EMS or OHSAS	☐ all or some of internal auditors have competence in two of three scopes	☐ all or some of internal auditors have competence in all scopes

Source: Author's elaboration

Figure 7. IMS integration degrees description in personnel responsibilities and authorities

Responsibilities integration related employees' cost savings is one the demonstrative examples showing integration efficiency. If one employee is employed instead of three, costs are lower. However such a simplified approach to integration of employees responsibilities in producing industry, having complicated processes, number of significant environmental aspects, occupational health and safety risks could lead to opposite effect – loss of due control.

Self-assessment methodology part „Processes and documents" reflects general integration of documentation (documents and records), process integration, process related documentation integration (Figure 8). In 10 enterprises self-assessments high integration is manual integration, process descriptions integration. Processes descriptions „Documents control", „Records control" are evaluated as fully integrated. Documents, records integration reduce volume of documentation, which facilitates effectiveness of documents circulation. Documentation control process is not adding value to the product, however following to *Lean* principles, it is not possible to resign from documentation. Therefore each reduction of documentation volume, simplification of circulation leads to avoidance from activities, which do not added value to the product.

Object of management system	PROCESSES AND DOCUMENTS		
Manual (general) *ISO 9001 (4.2.2.); ISO 14001 (4.4.4.); OHSAS 18001 (4.4.4.)*	☐ each scope has separate manual	☐ two scopes of three are included in one manual, one scope has separate manual	☐ all scopes in one manual
Manual (manual) content	☐ there are two or three manuals, each manual contains the information about particular scope, there are no references to documents of other scopes (manuals, procedures, process descriptions)	☐ content of manuals partly integrated – in two or one manual reflected issues, common for two of three areas, e.g. EMS and OHSAS - „preparedness for emergency situations"	☐ one manual for all scopes
Processes, processes descriptions (general)	☐ each scope has separate processes descriptions - references to documentation of other scopes (manuals, procedures, processes descriptions) are not included	☐ some processes descriptions cover two, three scopes , e.g. process' description „management review", but some are separate - „preparedness for emergency situations" for EMS and OHSAS are separate	☐ where possible, processes descriptions, procedures cover all scopes, still some processes related to particular field are separated
Process and (or) process' description „Document control"	☐ documents' elaboration, circulation and maintaining order is established separately for each scope	☐ documents' elaboration, circulation and maintaining order is established partly integrated, e.g. EMS and OHSAS together, QMS separately	☐ documents' elaboration, circulation and maintaining order is established in the integrated way and documented in one document
Process and (or) process' description „Records control"	☐ records' elaboration, circulation and maintaining order is established separately for each scope	☐ records' elaboration, circulation and maintaining order is established partly integrated, e.g. EMS and OHSAS together, QMS separately	☐ records' elaboration, circulation and maintaining order is established in the integrated way and documented in one document
Content of records	☐ each scope has own records	☐ some records could be integrated unintentionally, e.g. monitoring records (EMS, OHSAS)	☐ Records intentionally are integrated, wherever possible – QMS, EMS, OHSAS internal audit results, management reviews

Source: Author's elaboration

Figure 8. IMS integration degrees description in documentation control

In self-assessment methodology part „Processes and documents" (Figure 9) Author' considers processes and documents together. Justification of such approach is based on viewing enterprises from process approach point of view. Documents contain general requirements and sequence of activities to be followed. Records reflect reached results of processes realization. Documentation (documents and

records) have supporting role and they should not be viewed separately from process to which they are related to.

Object of management system	**PROCESSES AND DOCUMENTS**		
Process and (or) process' description „Training" *(ISO 9001 (6.2.2.); ISO 14001 (4.4.2.); OHSAS 18001 (4.4.2.)*	☐ training planning is separated; training planning processes for three scopes are described in different documents and done by different responsible employees	☐ training planning partly is together, one or two (or three) process' descriptions, training planning process is implemented by one or two (or three) responsible employees	☐ training planning is integrated, one process' description, training planning process is implemented by one responsible
Process and (or) process' description „Subcontractors management" *(ISO 9001 (4.1, 7.4.); ISO 14001 (4.4.2); OHSAS 18001 (4.4.2)*	☐ subcontractors' control and informing about quality, environmental, OHSAS issues are separated, process is described in different documents and process is implemented by different responsible employees	☐ subcontractors' control and informing about quality, environmental, OHSAS issues is done together, process is described in one or two different documents and is implemented by one or two (or three) responsible employees	☐ subcontractors' control and informing about quality, environmental, OHSAS issues is done together, process is described in one document and is implemented by one responsible
Process and (or) process' description „Identification of legal requirements" *(ISO 9001 (7.2.1.); ISO 14001 (4.3.2.); OHSAS 18001 (4.3.2.)*	☐ laws, Regulations of Cabinet of Ministers and other requirements for each scope is documented in different process descriptions and is implemented by different responsible employees	☐ laws, Regulations of Cabinet of Ministers and other requirements for each scope is documented in one process' description, but is implemented by different responsible employees, or there are more than one process' description and process is implemented by one or two responsible employees	☐ laws, Regulations of Cabinet of Ministers and other requirements for each scope is document in one process' description and is implemented by one responsible
Process and (or) process' description „Monitoring and measurement" *(ISO 9001 (8.2.1., 8.2.3., 8.2.4.); ISO 14001 (4.5.1.); OHSAS 18001 (4.5.1.)*	☐ monitoring and measuring is established for each scope separately, documented in separate documents	☐ monitoring and measuring established partly together, e.g. EMS and OHSAS, but for QMS – separately	☐ monitoring and measuring established, where possible, together and documented in one document
Process and (or) process' description „Monitoring and measurement equipment" *(ISO 9001 (7.6.); ISO 14001 (4.5.1.); OHSAS 18001 (4.5.1.)*	☐ monitoring and measuring equipment control is established for each scope separately, documented in separate documents	☐ monitoring and measuring equipment control established partly together, e.g. EMS and OHSAS, but for QMS – separately	☐ monitoring and measuring equipment control established, where possible, together and documented in one document

Source: Author's elaboration

Figure 9. IMS integration degrees description in processes

The greatest difference in integration levels is observed in processes' realization, e.g. process „Monitoring and measurements" includes different monitoring activities - visual evaluation, measurements using measurement equipment and others, depending on significant environmental aspects.

Figure 10 reflects non-conformities, potential non-conformities control, improvement activities, internal audit, and generally it reflects high integration degree, conforming to results of R.Salomone, M.Bernardo et al. [27,9] - 93% integration in improvement activities, 87% - internal audit. Products, processes, systems quality nonconformities control integration with environmental, occupational health and safety nonconformities control is under discussion. This is one the examples with limited integration options (like records integration) - actions in case of non-conforming product delivery to client, overdue delivery are not comparable with actions to be taken if emission limits are exceeded.

Object of management system	**PROCESSES AND DOCUMENTS**		
Process and (or) process' description „Preparedness for emergency situations" *ISO 9001 –no requirement ; ISO 14001 (4.4.7.); OHSAS 18001 (4.4.7)*	☐ actions in case of emergency are established separately	xxxxxxxxxxxx	☐ actions in case of emergency are established together, if periodical testing of preparedness is done, it is organized at the same time
Process and (or) process' description „Non-conformance control" *(ISO 9001 (8.3.); ISO 14001 (4.5.3.); OHSAS 18001 (4.5.3.)*	☐ system, process, product nonconformities are established in separate documents	☐ system, process, product nonconformities are established partly together, e.g. EMS and OHSAS non-conformance control	☐ system, process, product nonconformities are established in one document
Process and (or) process' description „Corrective and preventive actions" *(ISO 9001 (8.5.2., 8.5.3.); ISO 14001 (4.5.3.); OHSAS 18001 (4.5.3.)*	☐ corrective and preventive actions implementation is established for each scope in separate documents	☐ corrective and preventive actions implementation is established partly together	☐ corrective and preventive actions implementation is established in one document
Process and (or) process' description „Internal audit" *ISO 9001(8.2.2.); ISO 14001 (4.5.5.); OHSAS 18001 (4.5.5.)*	☐ internal audit process (planning, methodology, implementation, auditors) is established separately for each scope, all three scopes are audited separately	☐ internal audit process is established partly together, e.g. OHSAS and EMS together, QMS separately and (or) all scopes are not audited at the same time	☐ internal audit process (planning, methodology, implementation, auditors) is established together and all three scopes are audited together

Source: Author's elaboration

Figure 10. IMS integration degrees description in improvement processes integration

Summarizing it shall be concluded that 10 enterprises management systems' integration degree self-assessments during empirical research generates results conformable with two other empirical researches, done in Italy and Spain [9,27]. Substantial advantage of Author's elaboration is detailed description for common understanding of integration degrees meaning. Application of comprehensive self-assessment methodology in different enterprises of production industry allow objectively compare IMS in terms of integration degrees. Self-assessment results give the information for enterprises for further integration.

Review of theoretical and empirical research results other authors and experience got in managements systems empirical research in Latvian enterprises, lead to elaboration of IMS model. It depicts IMS development sequence in logics of PDSA cycle and process model (process concept). IMS model begins with planning, which corresponds to PDSA cycle stage „plan". Policy project elaboration, review, improvement of existing policy materialize in certain processes (model part „Process"), using personnel, information and other resources (part „Resources"). Different level of integration is possible in both parts - quality and environmental policy project can be elaborated by one responsible employee, one task group (integrated approach) or two and more employees, two or three task groups (not integrated approach), policy development can take place in the same task group, department employees meeting (integrated approach) or different task' groups meetings (not integrated approach). Part „Results" shows expected results of process - it can be documented process' description or established common understanding about process realization (not documented, but agreed and followed between employees, executing the process). Process' result can be integrated - one policy, covering quality and environmental scopes, or not integrated - quality policy and environmental policy.

PLAN

	RESOURCES	**PROCESS**	**RESULTS**
Policy **ISO 9001:** 5.3 **ISO 14001:** 4.2 **Products and processes planning** **ISO 9001:** 7.1, 5.2, 7.2., 7.3, 7.4, 7.5, 7.6, 8.3, 6.3, 6.4, 6.2, 5.5.1, 5.5.3 **ISO 14001:** 4.3.1, 4.3.2, 4.4.6, 4.4.7, 4.5.3, 4.4.2, 4.4.1, 4.4.3 **Integrated management system planning** **ISO 9001:** 4.2.2(a), 5.4.2, 5.5.2, 5.5.3, 8.2.1, 8.2.2, 4.2.2, 4.2.3, 4.2.4 **ISO 14001:** 4.1, 4.4.1, 4.4.3, 4.5.5, 4.4.5, 4.5.4 **Objectives planning** **ISO 9001:** 5.4.1 **ISO 14001:** 4.3.3	personell resources information resources infrastructure resources finance resources	individual work task groups meetings departments' meetings management review meetings	documented policy identified processes, their sequence and interaction products specifications established and documented (if necessary) production process established and documented (if necessary) sales process raw materials, auxiliary materials specifications established and documented (if necessary) raw materials, auxiliary materials purchasing process specifications for outsourced processes established and documented (if necessary) outsourced processes' purchasing identified infrastructure necessary for procesess realization established and documented (if necessary) infrastructure maintenance processes

Source: Author's model

Figure 11. Planning stage in IMS model

Typically integrated approach to planning from resource integration point of view does not lead to integrated process or integrated result. Integrated result can be also if there is no integration in resources or in processes.

Products and processes' planning is a next stage, in which planning realization processes, which add value to the product. Standards ISO 9001:2008 and ISO 14001:2004 requirements sequence in planning and doing stages (Figures 11,12) is important, because demonstrates Author's view on sequence to be followed during development of IMS.

DO

	RESOURCES	**PROCESS**	**RESULTS**
Products and processes realization **ISO 9001:** 7. **ISO 14001:** 4.4.6, 4.5.3. **Personell resource management** **ISO 9001:** 6.2. **ISO 14001:** 4. **Infrastructure resource management** **ISO 9001:** 6.3, 6.4 **ISO 14001:** 4.4.1, 4.4.6 **Products and processes monitoring and measurements** **ISO 9001:** 8.2.3., 8.2.4 **ISO 14001:** 4.5	personell resources information resources infrastructure resources finance resources	personell management process infrastructure maintenance process purchasing process production process sales process products and process monitoring and measurement nonconforming products control process	raw materials, auxiliary materials processed products, semi-finished products products for delivery to clients

Source: Author's model

Figure 12. Process realization stage in IMS model

In products' realization stage integration options are depicted using similar approach as in planning stage. Sequence of listing processes „Personnel management", „Infrastructure resource management" is not important because they equally conjugated with other processes. PDSA cycle stages „study" and „act" contain requirements for clients satisfaction measurements, internal auditing and management review.

IMS model is simplified depiction of actions sequence to be taken implementing and improving management system, which conforms to several management system standards. Practical application – model demonstrates what shall be considered for integration (process model) and in which sequence it shall be done (PDSA cycle).

For illustration of processes improvements impact on IMS, case study of process improvements project in solid wood furniture enterprise „ABC" is used. Initial objective of the project was to find, how to improve processes in terms of effectiveness and efficiency, using existing knowledge within the frameworks of IMS. Metrics of processes efficiency measurement was formulated as a "saving" – optimised used of resources, reduced production time, reduced down-times, reduced waste amount etc. Standard ISO 10014 was chosen because of use of PDCA (PDSA)

and eight quality management principles, which are deployed in "ABC" and accepted as effective.

Completing self-assessment phase following two essential conclusions emerged:

- One quality management principle is deployed in very many processes and activities. Coming to one principle with a lowest score – process approach – it was recognized that continue this investigation in all company's ABC processes is an extensive task, therefore, reviewing background information, it was decided to focus on one process – manufacturing.
- Background information review could be necessary. Comprehensive self-assessment about process approach principle results in seven numbers of maturity level assessment and project team members can add comments and examples for illustration (justification) their answers. However it could lead to particular problems occasionally, not in the determined way. Seven questions about process approach (for other quality management principles as well) are general and fit for any organization.

In case of "ABC" collection of background information has been realised in two steps – first lead to the fact that manufacturing process is process to be worked with and second - continue with "PLAN" phase is possible if there are clearly formulated problems which shall be addressed. In case of company ABC for this phase 3 methods have been used – FMEA, Pareto analysis and internal (processes) audit.

Lean principles, Theory of constraints elements application lead to very good results and also enterprises' management systems was improved. Because standard ISO 10014:2006 is based on PDSA cycle, it can be applied for improvement of environmental management systems. At the end of improvement project Author concludes, that standard ISO 10014 methodology with adjustments can be applied for enterprises IMS improvement.

5. VALUE ADDED AUDIT OF INTEGRATED MANAGEMENT SYSTEM

There are 25 pages, 7 tables and 7 figures in the Chapter

IMS value of production industry enterprise is characterized by level of interested parties requirements' implementation and reaching of strategical goals. IMS, created with a great number of procedures and instructions, in many cases does not reflect the real way how enterprise is operating.

Management system audit and self assessment are tools for evaluation of management system conformity to certain criteria and assessment of it's suitability for supporting efforts in reaching strategical goals. Application of self-assessment methodologies have been depicted in previous chapters.

Audit is systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled [28]. Terms „audit with added value", „value added audit" can be translated in Latvian differently, however Author propose to use translation *„vērtīgs audits"*. Author's formulation of value added audit (based on and extending audit term definition in standard ISO 19011:2002):

„Value added audit is effective, efficient, systematic, independent and documented process for identifying improvement areas and obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled."

Terms and principles related to audit characterized in standard ISO 19011:2002. Management system audit traditionally are applied for evaluation of conformity and effectiveness [29,30,31]. However more and more different authors

propose to extend audit objectives, including assessment of management system efficiency [32,33], Lean and Six Sigma project effectiveness and efficiency [34]. Effective and efficient conformity assessment and improvement areas identification audit is value added audit.

Formulation of effectiveness indicators for improvement areas identification audit is quite general, in contradistinction to conformity assessment audit. Effectiveness of conformity assessment audit can be measured, estimating how much systems' conformity to certain criteria is evaluated. In improvement areas identification audit important part of audit findings is related to improvement areas, processes and systems to be improved and audit findings themselves are suggestions for improvements. Management system internal audit shall be effective and systems' conformity shall be evaluated, however conclusion shall include conclusions about management system suitability, effectiveness and efficiency.

Internal audit efficiency can be characterized by resources used, utilized for audit process and reached results. Audit efficiency calculation can be made using quality costs theory. Internal audit effectiveness can be estimated in management system certification (third party) audit. If internal audits is done by properly trained internal auditors, however third party auditors find out a lot of nonconformities, it indicates ineffectiveness of internal audit.

QMS, EMS, IMS internal audit is related resource consumption. Audit costs to be regarded as appraisal costs (following to quality costs classification [35]). Production industry enterprise QMS, EMS, OHSAS (IMS) internal audit costs are related to auditors' training, professional competence improvement, working time (e.g.auditees), infrastructure resources.

Value of audit findings is more complicated for evaluation, still it is possible. For example, valuable audit findings allow to avoid from costs of internal and external failures. Examples of IMS audit situations in production industry enterprise are depicted in Table 3. Costs of internal and external failures under different circumstances can be related (could lead to) appraisal costs.

Table 3

External failures and appraisal quality costs examples

External failures	2.1. In the audit interview auditor finds, that in 2010 there was an exceeding of emissions limits, set in Authorities' issued Permit. According to Administrative Regulations codex of Latvia *(Administratīvo pārkāpumu kodekss),* Clause 9 penalty is **from 100 to 1000 Ls**; the same breach, if done repeatedly in one following year, is leading to penalty **from 500 to 5000 Ls** [33]. 2.2 Reviewing results of emissions' monitoring auditor finds, that amount of emissions are increasing, close to limits in the Permit. Auditor informs management representative. Director takes decision to review the situation in 1 hour meeting with 5 employees (costs, in working hours and Ls): **5 employees , 1 hour, together or 24,81 Ls* .** **Based on decision taken in the meeting, additional costs:** - **appraisal costs related to employees' working time, devoted to investigation of emission increase** - **appraisal costs related to environmental engineering service enterprise for investigation and consultation** **Depending on the cause of emission increase, additional costs arise for service of technological equipment or purchasing of new equipment (spare parts).** **It is assumed 4 employees hourly wage is 3,5 Ls (before Employees taxes) i.e. 4,34 Ls (including Employers social tax 24,09%), 1 employee hourly wage is 6 Ls (before Employees taxes) i.e. 7,45 Ls (including Employers social tax 24,09%). Costs of infrastructure is not added.*

Source: Author's elaboration

Interviews with quality professionals, management representatives (QMS, EMS, OHSAS, IMS) and audit interviews summaries indicate that understanding of valuable internal audit is different:

- Audit findings give valuable information for top management, process' owners and employee's.
- Auditor can evaluate process, system and to see their importance in interconnection with enterprises' strategical goals.
- Management representative is truly interested in coming audit, admitting that audit results are important for enterprises' development and delivers good value for money.
- Audit findings and questions discussed in audit interviews allow to improve QMS, EMS, IMS processes, products, documentation. If there are no findings, no new ideas – audit is not value added audit.
- Audit is succeeded information can be used for further perfection of enterprise.
- Internal audit is valuable if in the following external audit nonconformities are not found.

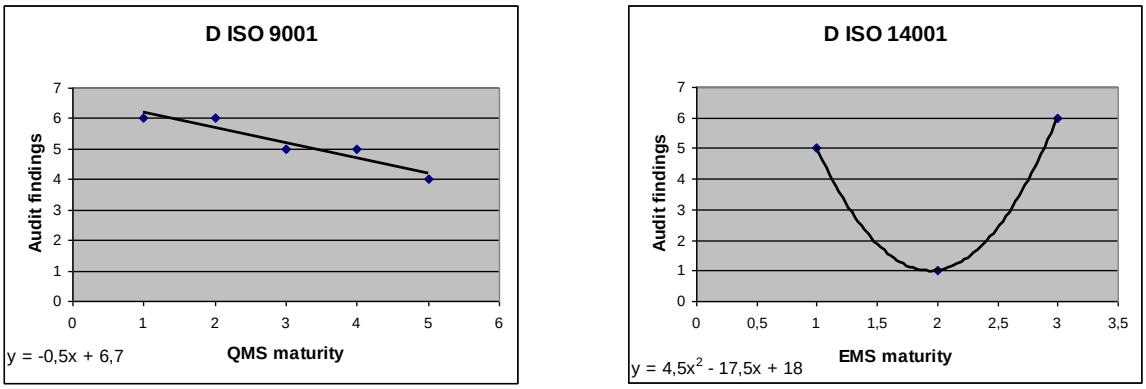
In empirical research question about most important information sources for management system internal and external evaluation most of respondents - 19 respondents indicate that important information comes from interviews with process owners (process managers). As a next important source indicated interviews with employees, directly involved in process and process' realization observations. Information sources, which gives less information are contracts with clients and employees' training records.

Traditional (conformity assessment) audit methodology shall be reviewed for value added auditing. Dynamics of audit findings amount with correlation to QMS, EMS, IMS maturity has been analyzed. Author assumption was with growth of management system' maturity, number of audit findings (nonconformities and observations) decreases. Preliminary review of audit findings correlation with QMS maturity in unintentionally selected certified enterprises confirms this assumption. Audit findings and management system maturity correlation can be calculated only for conformity assessment audits and not for improvement areas identification audit. Criteria and focus areas in improvement areas identification audit change from audit to audit, but in conformity assessment audit they remain the same.

Author formulated criteria for selection of certified production industry enterprises:

- Enterprise should have management system conforming to at least two management systems standards (e.g. ISO 9001:2008, ISO 14001:2004).
- QMS, EMS are mature.

Two factors correlation was applied (number of auditor days is equal for all periodical audits). Number of audit findings is a sum of nonconformities and observations numbers. Other findings – improvement areas, note - worthy efforts are not taken into the account, because they are related to improvement areas identification audit. 3 production industry enterprises (called as B, C, D) out of 30 certified were appropriate for calculation of correlations. One example of calculations (enterprise D) is presented in Figure 13. Number of audit findings related to QMS decreases, but EMS – decreases and then sharply increases.



Source: management system certification body information

Figure 13. Audit findings dynamic in relation to QMS and EMS maturity in enterprise D

Negative correlation between number of audit findings and management system maturity in certified production industry enterprises is observed only in one case (QMS of enterprise D), therefore it can not be confirmed that QMS, EMS maturity leads to decrease of conformity assessment audit findings. Two significant factors influences number of conformity assessment audit findings:

- Periodical audits take place once in 9-12 months, in meantime changes in enterprise can influence management system' conformity to standard requirements.
- Audit group staff can change from audit to audit and it could influence number of audit findings as well, particularly in relation to number of audit observations.

Author suggests to consider change traditional conformity assessment audit to improvement areas identification audit in case of continuous decrease of audit findings in relation to management system maturity (like in example of enterprise D).

Effective audit can not be performed without competent auditors. After training courses knowledge, skills and competence can be evaluated using Quality function deployment elements, which allow to evaluate, how much knowledge have been acquired, skills and competence have been improved. It gives a comprehensive overview about most appropriate learning forms.

Necessity of value added audit is grounded in production industry enterprise's QMS, EMS, OHSAS, IMS improvement needs. If properly performed management system audit is a tool, giving valuable information for continuous improvement of enterprise.

Integrated quality management system, integrated management system, comprising quality, environment, occupational health and safety issues, are tools for products, processes, systems quality, effectiveness, efficiency assurance and improvement. This is a prerequisite of enterprises sustainable operation. In future more and more attention will be devoted to ways, how to decrease business impact to environment and operate in socially responsible way. Sustained success will last in enterprises, which will be able to fulfil requirements of clients, as much as possible less impact to environment and following to occupational health and safety requirements.

MAIN RESULTS AND CONCLUSIONS

As result of theoretical and empirical researches the following conclusions emerged:

- Application of standards ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007 as one of the possible ways of sustainable development concept implementation in the enterprise has been reasoned.
- QMS implementation experience in enterprises of Latvia is positive. In the empirical research on management systems (IMS) in Latvia participated 26 enterprises, 19 of them belonging to the group of production industries (NACE red.2, div. C,D,F). Responding to the research question on QMS operations results 23 out of 26 research participants approved that they would suggest QMS implementation to other enterprises, 3 participants replied „hard to say", to the question on QMS certification 8 of 26 enterprises replied „hard to say". Majority of enterprises have mature QMS and this confirms, that answers have been formed in context of several certification cycles and indirectly indicates the advisability of certification services in a long term prospective. However, surely to confirm this assumption, more comprehensive research is necessary.
- In their responses to survey questions on EMS, OHSAS implementation and certification the research participants more value the OHSAS system. However, taking into account the profile of research participants - 23 enterprises having certified EMS and 14 enterprises having certified OHSAS system, these data should be treated deliberately.
- The integrated quality management system (IQMS) as separate form of IMS is identified and defined. Justified necessity to introduce IQMS in enterprises, which products are within the scope of New Approach Directives, where conformity assessment modules D, E, H contain requirements for quality system, factory production control system.
- Building materials harmonized product, conformity assessment standards, containing requirements for factory production control system include several requirements – policy, objectives, internal audit, corrective actions, management review, which are quality planning and quality improvement activities. In order to develop effective QMS (IQMS) for building materials production enterprise, whose products, conformity assessment standards contain requirements for factory production control system, it is recommended to evaluate the compatibility of the requirements of product standard with the requirements of the standard ISO 9001:2008.
- A general model, showing compatibility of requirements of several standards for implementation of IQMS in building materials production enterprise is elaborated.
- It has been identified that the theoretical and empirical research results on IMS have been published mostly between 1999 and 2010, comparatively many publications are published in 2010, which confirms topicality and significance of the research subject.
- Cognizance of IMS integration degrees and integration options are the less investigated issues, having direct practical impact on IMS development and improvement.
- Empirically confirmed - typical reasons for development of IMS in Latvian enterprises: IMS provides opportunity for structuring or reengineering of enterprise's processes, merging them where possible. When implementing

IMS, the amount of documents and records decreases, IMS application saves personnel resources and less time is necessary for taking decisions.

- The initial self-assessment methodology for identification of the integration degree of IQMS and IMS, based on two and three management system standards is elaborated. Established relationship, which characterizes possible IMS integration situations in relation to employees, processes and documents integration: V=3n-2, where V is a number of possible IMS integration situations, n - a number of standards, applied for IMS development.
- In Author's research about management systems (IMS), based on ISO 9001, ISO 14001, OHSAS 18001, 26 enterprises approbated methodology for initial self-assessment of their IMS. Management systems, developed conforming to two or three standards, in enterprises in Latvia are characterized with high integration degree.
- For more deepened IMS integration degree identification, detailed and comprehensive self-assessment methodology is elaborated. In Author's research about management systems (IMS), based on ISO 9001, ISO 14001, OHSAS 18001, 10 enterprises approbated methodology for self-assessment of their IMS. Descriptions of integration degrees have been divided in following parts: management responsibilities, personnel responsibilities and authorities, processes and documents. There are detailed descriptions of IMS integration degrees: „integrated", „partly integrated", „not integrated", therefore application of self-assessment methodology in different enterprises delivers comparable results.
- Benefits of IMS application in production industry enterprise: in quality, environment, occupational health and safety aspects balanced and simultaneous decision taking, functional and organizational integration of responsibilities, less amount of documentation.
- Integration of management systems conforming to several management systems' standards are limited due to different areas of application (environmental aspects identification, occupational health and safety risks identification related to particular working places, quality, environmental, occupational health and safety nonconformities control). There is a need for enterprises' policy, objectives integration in context of sustainable development. Results of empirical research confirm, that actual integration level in the question under discussion is different.
- As a result of empirical and theoretical research, the integrated management system model has been developed which according to the logics of improvement cycle PDSA and process' model reflects integrated management system development sequence and possibilities for integration.
- Standard ISO 10014:2006 methodology has been applied for processes' improvements in production industry enterprise, impact of processes' improvement to IMS has been observed. For improvement of standard's methodology practical use, proposals for additions to methodology have been elaborated.
- Value added audit has been characterized, using effectiveness and efficiency indicators. It has been concluded that quality costs theory can be applied to evaluate value of audit findings.
- In order to increase effectiveness and efficiency of IMS audits, the proposals for audit methodology improvement are drafted. Calculations regarding correlation between the audit findings and QMS, EMS, IMS maturity are

done, however in conformity assessment audits correlation between QMS, EMS, IMS maturity and decrease of audit findings can be observed in very few cases. Factors, influencing audit findings (nonconformities and observations) fluctuations, are identified.

- For auditors' knowledge, skills, competence evaluation Author suggests to use *Quality function deployment* (QFD) elements, which allows to indicate, at which degree during professional trainings, knowledge are enlarged and deepened, skills are improved, competence is developed and also to identify training forms which provide more contribution to knowledge, skills, competence improvement.

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