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The Presence of the Customer and the Supplier Perspectives in Studies on Software Development Project Success

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***Abstract* – A systematic literature review on software development project success/failure from customer's or supplier's perspective is presented. The review covers studies published in peer-reviewed journals only. The results show that knowledge on software development project success/failure is multidisciplinary and fragmented. In addition, there are very few studies that consider software development project success from the supplier's perspective. One of the main contributions of this article is the table of articles in which articles have been classified by the perspective which they discuss. Another contribution is the list of journals in which the accepted articles have been published. Moreover, these results show a clear lack in our understanding of software development project success in outsourcing situations.**

***Keywords* – literature review, outsourcing, project, project management, software development, success.**

I. Introduction

Software development has its roots in the 1960's and is now an essential part of the modern society. Many tasks are enabled or helped by software, and it may play a crucial role in overall economy. However, during recent decades different ways of how to organize software development have been developed [1-4], and the terminology which is used to describe software development has also evolved.

One way to organize software development is outsourcing, i.e. where whole or a part of software development is given to another organization. However, the term 'outsourcing' is extremely confusing because in case of software development no common definition of 'outsourcing' denoting a sub-contracting relationship between a customer and a supplier exists [5]. Although the term itself is confusing, it is clear that in outsourcing relationships there are two parties: a customer and a supplier.

When software development is outsourced to an external organization, there is a sub-contracting relationship between a customer and a supplier, in which the customer is acquiring software and the supplier is developing software for the customer. For the supplier the project is a way to do business, and for the customer, the benefits gained with the help of the output of the project should be worth the price. Hence, at the same time the aim of the customer is to minimize the costs of the project and the aim of the supplier is to maximize the profit of the project [6, 7].

Since there are two parties from different organizations involved in software development project, it is important to find out how both parties perceive project success. However, in outsourcing/sub-contracting situations it is difficult to discern whether the project was a success or failure. One real example of the difficulty has been analyzed in [8]. In four cases out of five there was a sub-contracting relationship between a customer and a supplier, and one of these projects was a clear failure from the customer's perspective. However, from the supplier's perspective the case was different: the supplier finished the project practically on time, and the customer paid the invoice although did not take the system into use.

Although the concept 'project success' is inconsistent and complex [9-11], there are at least three reasons why research on project success is important in practice. The first one is related to individual performance where project managers are evaluated based on the success of the projects they have managed [11]. In addition to personal performance, projects have become more and more important to organizations whose organizational performance is dependent on the success of individual projects [10]. The third motivation is related to project itself. If the success criteria are agreed at the start of the project, project management adjustments will be made during the project execution [12], and therefore project objectives are presumably easier to reach [13].

In summary, since software development is often outsourced to an external supplier, there are two perspectives at present in software development projects, the customer's and the supplier's. Moreover, it is not straightforward to discern whether the project has been successful or not. Furthermore, research on software development project success is important at individual, organizational and at project level. In order to map the use of definitions and different perspectives on success we formulated three research questions:

RQ1: *Do studies that use the concept of software development project success/failure represent customer's or supplier's perspectives?*

In order to identify journals where software development projects and their success have been discussed we formulated the second research question:

RQ2: *In which journals the selected studies have been published?*

Since the importance of outsourcing has grown for decades, it would be expected that the perspective of the supplier would be more common in the recent studies than earlier. From that assumption we formulated our third question:

RQ3: *How often are both perspectives presented each year?*

In order to find answers to research questions we performed a systematic multidisciplinary literature review. The basic concepts which have to be understood are discussed in Section 2. Section 3 outlines the literature review protocol used and Section 4 provides the answers to the research questions. Section 5 is a brief evaluation of the validity of our review and Section 6 presents the conclusion.

II. Basic terms

During pilot searches we found that there is confusion and inaccuracy with terms. We aimed at construct validity, i.e. our study investigates what we claim to investigate, as proposed in [14]. Therefore there are some concepts which have to be clarified and understood before we could commence the study. The following paragraphs discuss these concepts.

In the case of outsourcing there are always a customer and a supplier which are from separate organizations or firms. According to ISO/IEC 12207 'Systems and software engineering – Software life cycle processes', the customer is defined as "*organization or person that receives a product or service*" [15]. The same standard defines the supplier as "*an organization or individual that enters into an agreement with the acquirer for the supply of a product or service*". Since we found that it is difficult to extract from the articles whether customer and supplier are from different firms we included articles in which customer or supplier were mentioned. In the case of in-house projects the perspective is inherently the one of the customer.

Another concept is related to differentiating software development from other types of projects. We did not include projects which were information technology (IT) projects, e.g. purchasing new operating, database management, or communication systems. We excluded construction projects as well as organizational development projects. We included information systems development (ISD) projects and projects where software is designed or developed, or major customization is made to software products.

We found that there is confusion between the concepts 'project' and 'continuous services'. The former is defined in standard 'Systems and software engineering – Software life cycle processes' as "*endeavour with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements*" [15]. Hence, a project should have defined start and finish dates and specific resources should be allocated to do unique and complex work. After accomplishment project resources will be relieved to other projects or work. The latter concept relates to software maintenance work which is done on a continuous basis, i.e. without bundling changes or new features together and establishing a project for that. Because there is only a slight difference between software development project and software maintenance work, we included also software maintenance in our review. However, we excluded continuous services which are related to software but are not software development, e.g. database administrative support and network support.

There are two major forms to develop software, and these are 'bespoke software development'[1] and 'software product development'. Software products are produced for mass markets and bespoke software is developed only for one customer. Bespoke software may be developed from scratch and may contain different software components, but the final software is developed for a single customer. Differences between bespoke software development and software product development are discussed in e.g. [16, 17]. Bespoke software development is carried out in internal development departments of large companies (in-house software development) or carried out by external suppliers, i.e. a customer has outsourced software development to a supplier. In this review, we included all these software development forms, as it has been made in [18].

Because concept 'project success' is inconsistent and complex [9-11], we do not provide a definition or inclusion/exclusion criteria for it in this review. However, we refer to other studies which differentiate 'project success' from 'project management success' (e.g. [6, 7, 19-25]), and 'success criteria' and 'success factors' (e.g. [6, 10, 24, 26-29]). We included a study if the study provided a definition of software development project success/failure or a definition could be interpreted from the article.

III. Literature review protocol

Our preliminary queries by using the databases made it clear that relevant articles have been published in a variety of journals. We found that journals outside the disciplines of software engineering and information systems have published articles that might be relevant to RQ1. Hence, we decided not to concentrate on particular journals but to search all databases that were available to us. These databases were ACM Digital Library (portal.acm.org/dl.cfm), EBSCOhost (web.ebscohost.com), Elsevier Science Direct (www.sciencedirect.com), Emerald (www.emeraldinsight.com), IEEE Electronic Library (ieeexplore.ieee.org), SpringerLink (www.springerlink.com), and Wiley Interscience (www.interscience.wiley.com). The selection of the databases and journals was based on their availability to us.

After the analysis of the hits produced by the pilot searches, we used the following restrictions in our searches:

1. Only peer-reviewed journals were considered.

[1] Other terms meaning 'bespoke software development' are 'custom software development' or 'tailored software development'.

2. Disciplines relevant to our review were project management, computer science (including software engineering), information systems, engineering, management, and business research.

Additionally, we did not use manual search techniques, i.e we did not go through individual journals and their issues.

It seems to be the case that, although the terms 'customer' and 'supplier' are used in the standards ISO/IEC 12207 [15] and ISO/IEC 15288 [30], the terminology used in published studies does not follow the terminology used in the standards. When we conducted our systematic literature review, we used the following terms: supplier/ vendor/contractor/seller; customer/client/buyer/acquirer; project; software; success; failure. The search strings were formulated by using search expressions created from the terms. The total number of logically different expressions was 52.

The logical structure of each search was written for each database. Fine-tuned database-specific queries ensured as reliable and repeatable searches as possible. In order to include articles only from the specified disciplines we wrote each string and the inclusion of disciplines individually according to the syntax used by the search engines of the databases. We used common search terms because earlier studies have shown that many articles use unclear and nonstandard terminology [31]. If a search produced more than 1500 hits, we looked at the first 500 hits, relying on the relevance ordering produced by the publisher's database.

We added one term later to the search terms. We realized that some studies used term 'performance' to denote all variations between a failure and a success, e.g. studies [32-35]. Both the terms 'failure' and 'success' were replaced by the term 'performance', and the set of searches was re-run with those changes. The first year to be searched was the earliest one provided by the database, and the last year was 2009. The searches were completed before the end of April 2010. The studies published on-line after the end of 2009 which are included in the review were selected after performing searches for '2010 only' during June 2010 (the article [36] got its final publication data for the year 2011).

The articles were selected for further analysis mainly on the basis of the title and the abstract. However, the abstract did not always provide enough information to decide whether the article included relevant information or not. Several articles were excluded later on because they did not fulfill the inclusion criteria. The criteria were

1. article discusses software development projects; and
2. article provided a definition of project success/failure or a definition could be interpreted from the article.

Many articles were excluded because it was not clear whether the projects were software development projects, or it was not possible to find or interpret a definition for success or failure.

Due to our selection to search for articles from journals only made us to leave conference articles like [37] and [38] out of the results. In addition, some well-known papers have been left out because we had no access to them through the databases listed earlier.

IV. Answers to Research Questions

The articles which fulfilled inclusion criteria were classified according to their perspectives. The perspectives used were

– only the customer's perspective on success/failure has been used;

– only the supplier's perspective on success/failure has been used; and

– both the customer's and supplier's perspectives on success/failure have been used.

If it was not possible to deduce the perspective from the article, the article was classified discussing the customer's perspective. The classification is shown in Table I. The articles and the classification form the answer to RQ1.

It can be noticed that the number of articles that cover only the supplier's perspective is very small compared to the number of articles that cover only the customer's perspective. This is partly based on our verdict on the perspectives, but largely on discovery that most of the articles discussed in-house software development projects.

Another observation was that a large number of articles do not define how success is perceived in that article or which success criteria are used to evaluate project success. Moreover, most of the articles which we accepted in our review do not study project success factors which are considered elements which contribute to project success.

We accepted one literature review in our review [39] although it covers a large variety of articles which were not accepted in our review. Moreover, we did not check if actual projects were software development projects. The reason to accept literature review made by de Bakker is that it discusses project success, and emphasizes similar 'fundamental facts' on software development as in [40].

The answer to RQ2 is provided in Table II. The journals which have published most of the articles accepted in our review are *Information & Management*, *International Journal of Project Management*, and *Journal of Systems and Software*. Noticeable is that the journals which have published articles which discuss software development from the supplier's perspective are almost the same. The articles which consider the customer's perspectives are scattered among various journals. Those articles that cover both have been published in five journals.

The only software engineering journal that has published an article that includes the supplier's perspective is *Journal of Systems and Software*. It seems that information systems discipline has paid more attention to the supplier's perspective which is surprising because the inherent focus of information system discipline is on exploitable information systems from the customer's and end-users' perspective.

IEEE Software has published numerous articles which discuss software development project success or failure. However, we accepted only four articles because we had difficulties to interpret any type of definition for success/failure from most of the articles published in that journal.

TABLE I

THE CLASSIFICATION OF ARTICLES ACCORDING TO THE PERSPECTIVE INCLUDED

Articles that include the customer's perspective only
[13], [32], [34], [36], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58], [59], [60], [61], [62], [63], [64], [65], [66], [67], [68], [69], [70], [71], [72], [73], [74], [75], [76], [77], [78], [79], [80], [81], [82], [83], [84], [85], [86], [87], [88], [89], [90], [91], [92], [93], [94], [95], [96], [97], [98], [99]
Articles that include the supplier's perspective only
[100], [101], [102], [103]
Articles that include both perspectives
[39], [104], [105], [42], [106], [107]

TABLE II

TYPES OF PERSPECTIVE PUBLISHED IN JOURNALS

Journal	Customer	Supplier	Both	Total
Business Process Management	1			1
British Journal of Management	1			1
Communication of the ACM	2			2
Decision Support Systems	1			1
Empirical Software Engineering	1			1
Government Information Quarterly	1			1
IEEE Software	4			4
IEEE Transactions on Engineering Management	1			1
IEEE Transactions on Software Engineering	1			1
Industrial Management and Data Systems	2			2
Industrial and Commercial Training	1			1
Information & Management	7	1		8
Information and Software Technology	3			3
Information Systems Management	1			1
Information Systems Research	1			1
Information Technology and People	1			1
International Journal of Information Management	2			2
International Journal of Production Economics	1			1
International Journal of Project Management	7	1	2	10
Journal of Computer Information Systems	1			1
Journal of Global Information Management		1		1
Journal of Information Systems	1			1
Journal of Management Information Systems	3			3
Journal of Strategic Information Systems	1		1	2
Journal of Systems and Software	9	1		10
Long Range Planning	1			1
MIS Quarterly	1		1	2
Political Quarterly	1			1
Project Management Journal			1	1
Scandinavian Journal of Information Systems	1			1
SIGMIS Database	1			1
Software Quality Journal	1			1
Technology Analysis and Strategic Management			1	1
Transforming Government: People, Process and Policy	1			1
Total	**61**	**4**	**6**	**71**

The yearly distribution of articles, which is shown is Figure 1, is the answer to RQ3. The number of studies that consider the supplier's perspective has been growing over the years, and especially after the year 2005. This growth may be at least partially a result of the literature review [41], in which it is said that [42] is the only study that considers the supplier and that more research is needed. It is, however, possible that the timing of the new studies concentrating on the supplier is a coincidence, although we assume that the changing business environment and literature reviews that call for more research on supplier firms have made researchers more aware of the importance of the supplier firms.

V. THE VALIDITY OF THE LITERATURE REVIEW

Our review is based on three main constructs that are: 1) the concept of a software development project; 2) the distinction between the supplier and the customer; and 3) the concepts of success and failure.

The concept of a software development project is discussed already in Section 2. It has to be noted that we needed interpretation while deciding whether projects were on software development or they were other types of project. An example of difficulties is that we excluded article by Aundhe and Mathew [108] but included article by Haried and Ramamurthy [104]. Projects were unclearly described in the first article but clearly expressed in the latter article (four projects out of eight projects were on software development).

Customer and supplier have also been discussed already in Section 2.We rely on standards, e.g. ISO/IEC 12207 [15].

The concepts of success and failure are complex. We did not define either concept but looked for definitions or criteria which are used to define either success or failure. It was not possible to define definite inclusion/exclusion criteria for existence of success/failure definition, we rather included articles than excluded them.

We assumed that the terminology used in articles follows the most common usage of the corresponding terms. With that assumption there is no threat to the construct validity of our review.

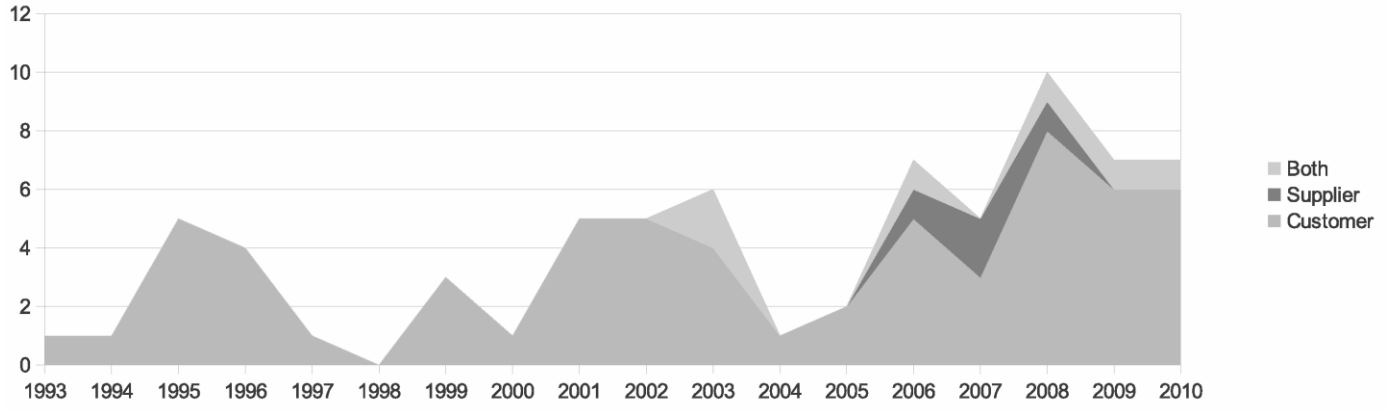

Fig. 1. The publication years of the selected articles

The internal validity of the review is guaranteed by the documented procedure used for the search, selection, and analysis of the articles. The main threat to the validity comes from the subjective evaluation of the contents of the articles. The internal validity of the review has been ensured by the documentation of the review procedure and random checking of the analysis by the other author.

The most obvious problem with our literature review is that the review is based on the results provided by the search engines incorporated into the publishers' databases. Although our search for the articles has been performed systematically and it can be easily repeated, the results of repeated searches may not be the same. The changing nature of search results has been noted in e.g. [31, 109, 110].

In general the impact of the biased perception in both the article selection and the analysis of the articles is possible, although it is not likely that the impact has been severe. Due to the size of the set of the articles and the type of the analysis we consider the impact of biased perception relevant but not critical to the results.

VI. Conclusion

In this article we have described a systematic literature review which we conducted in order to map the use of definitions and different perspectives on software development success. We got answers to our three research questions, and the answers are presented in Section 4.

One of the contributions of this article is the table of articles in which the articles have been classified by the perspective which they discuss. Another contribution is the list of journals in which the accepted articles have been published. The list of journals shows that our knowledge of software development projects and their success/failure from different perspectives is fragmented, and moreover, distributed among several disciplines. Our results have two implications which have to be considered while enhancing our knowledge of the subject.

Firstly, in situations when software development is outsourced to en external supplier there are two parties which have different perspectives with diverged goals. Since both parties have different perspectives with diverged goals, they may have different project success criteria. Therefore such research on software development project success/ failure are needed which make a distinction between these perspectives, and furthermore, based on our review, we need more research which considers supplier's perspective. The lack of studies that cover the supplier is noted by [103] and [41], and the prevailing situation is a serious obstacle considering our understanding of the actual goals of the parties in an outsourcing situation.

Secondly, our literature review shows that articles on software development project success/failure from different perspectives are distributed among many journals under several disciplines, and therefore knowledge of the topic is fragmented. Consequently, this impedes the growth of knowledge on this subject.

In order to enhance our knowledge of software development project success/failure from different perspectives, we propose more studies on this topic, clearly stating their perspectives, the type of projects, and defining success criteria for studied projects, and to concentrate publishing studies mostly in journals *Information & Management*, *International Journal of Project Management*, and *Journal of Systems and Software*.

Our proposal ensures that we will go towards uniform concepts, usefulness of database search engines will increase, and knowledge of software development project success/failure from different perspectives will enhance. Before that future reviews require manual searches in order to be more comprehensive, but presumably focused on the journals we have listed.

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