Investigating Impact of Business Risk on Requirements Selection Decisions

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***Abstract*—In market-driven software product development, requirements that can potentially go into a product or a product release represent different kinds of investments. Requirements differ in the type of value that they provide and level of risk associated to investing in them.**

In this paper we investigate how business risk associated with different requirement types is considered by the decision makers and how it affects requirement selection decisions.

The results of the conducted case study indicate that due to lacking methods for handling the requirements business risk, requirements with low level of risk are preferred over other type of requirements such as innovations and architectural improvements.

Keywords-requirements selection; market driven software development; value; risk; case study

I. INTRODUCTION

In market-driven or packaged software product development (MDSPD), planning the contents of consequent product releases is one of the most crucial activities determining a company's success [1, 2]. The requirements evaluation and selection process (often associated with product planning and road-mapping) is a complex activity involving trade-offs between requirements from different origins and stakeholders, such as customer specific, market pull, technology push, and internal system requirements [3, 4].

A major property that distinguishes MDSPD from typical customer specific development is that in a market-driven context the software company takes all risk related to product development. Decisions regarding what requirements to include in a release can be seen as investment decisions since when selecting a requirement a software company decides to invest money and effort for its realization. The ultimate goal of the requirements selection decision is to find a collection of requirements which 1) will maximize the value delivered by the release, 2) is possible to deliver within the available resources and budget, and 3) is in line with the business strategy of the company [5]. These decision are often complex because product managers are usually faced with a large number of requirements to choose from, and it is not always possible to produce exact estimates of expected customer value or associated costs for a requirement at this initial stage. This ultimately places requirements selection decisions in a category together with other decisions involving a high level of uncertainty and risk [6].

In order to take an informed decision on requirements investments software companies have to properly evaluate both technical risk (related to the level of uncertainty in technical complexity and cost estimations) and business risk (related to the level of uncertainly of value estimations) associated with this investment [6, 7].

In the software engineering branch we have traditionally focused on evaluating and managing technical risks, whereas business risk-related issues have received little attention [8]. This is also reflected in existing methods and models of requirements selection and release planning in MDSPD where technical risks are explicitly addressed while practices for handling business related risks are not clear [2, 9-13].This lack of focus on evaluating business risk may also be reflected in the industry and could be contributing to the difficulties that companies experience when balancing commercial requirements against other type of requirements such as architectural improvements and technical innovation [14-16].

In this paper we present results of a case study investigating how business risks associated with different type of requirements are considered; and to what extent they affect requirements selection decisions. The research reported in this paper presents the first steps towards finding solutions for evaluating and managing business risk in software requirements selection decisions.

The outline of the paper is as follows: Section II presents MDSPD as a concept and introduces requirements investment categories. Section III gives an overview of applied research strategy and the research questions. Empirical results, analysis and discussion on validity threats are found in sections IV, V and VI respectively. Finally, discussion and conclusions are presented in Section VII.

II. BACKGROUND

In typical market-driven software development the development organization does not have one specific customer but rather develops products for a number of customers or markets. The success of the product depends on the customers and markets' perceived value of the product and the development cost, meaning that the ultimate goal is to develop a product that will generate revenues high enough to compensate for any risk taken [1, 17] .

The requirement types that are typically involved in the requirements selection process cover commercial requirements, requirements connected to innovation and system requirements (internal quality aspects, for example architecture improvements) [3, 4, 14, 18].

The decision to include any of the aforementioned requirements into software product can be considered an investment decision. Once a requirement is selected, the development company invests its recourses in the realization of the requirement and expects to receive a positive return on investment once the product is released to the market.

The risk of the investment in the financial world is associated with level of variability in the returns of the investment. This risk is related to the extent of variation in a) expected value provided by the asset; and b) target costs connected to the acquisition of the asset. Thus high level of variability gives high risk and vice versa [19].

The variability in expected value of the investment is normally associated with competitive risks and market risks (hereon referred to as business risks). The variability in target costs are associated with the unknowns involved in completing an investment, such as technical complexity, time and effort required to build the asset (hereon referred to as technical risk) [6, 7].

Translating the above listed definitions in the context of requirements selection, investments in software requirements can be characterized by:

- *Requirements business risk:* level of variability in the expected value of the requirement.
- *Requirements technical risk:* level of variability in expected costs of implementing the requirement, usually associated with factors such as technical complexity and required effort.

In Table I, we present how investments in commercial, innovation and system requirements can be characterized in terms of business and technical risks.

Investment category 1 - Commercial requirements: These requirements are usually associated with market pull. They originate directly from customers or sales and marketing units of the development organization. Commercial requirements may be e.g. features wished by customers and external qualities of the product important for the customers such as performance, reliability or security. Because of the clear link to customers and their current needs, the value proposition of the requirements is clear and expected value of the requirement is reasonably certain. Thus the business risk is relatively low.

Investment category 2 - Innovation: Innovations can originate from key customers, however mostly these types of requirements are defined by the R&D unit of a development company and they are also the main stakeholder of a requirement. The value offering of an innovative feature can vary depending on aspects such as maturity of the markets, hype factor, and other factors. The value of innovative technology may be low or high depending on whether a technology will be acknowledged as a standard or not, or as a consequence of several other factors [16]. Therefore the value proposition of innovation requirements has relatively large variation and high business risk.

Investment category 3 - System requirements: System requirements mainly focus on system architecture and evolution aspects. They originate from company's R&D unit, which also is the main stakeholder of this type of requirements. System requirements do not have a direct link to the customer value and are often associated with internal needs of the company to maintain a clear system architecture, which in turn provides possibilities for faster and cheaper development and decreased maintenance costs. Architectural improvements also are associated with high risk since they require immediate and often long-term investment but it is not always clear what the gain will be or when the gain can be obtained [15].

Recent studies have shown that specifying system requirements value is considered challenging due to its distance from customer needs [12, 20]. Because of the above listed reasons the value proposition of system requirements is perceived as uncertain and/or highly variable.

TABLE I. REQUIREMENTS INVESTMENT CATEGORIES

Investment Category	Req. value	Business risk	Technical risk
1.Commercial requirements	Relatively Certain	Low	Varies depending on certainty in technical analysis & cost estimations.
2. Innovation	Highly variable	High	Same as above
3. System requirements (internal quality aspects)	Highly variable & hard to define	High	Same as above

The requirement investment categories presented in Table I, highlight the need for evaluating and managing both technical and business related risks when deciding which requirements are best to invest in. In the software engineering field there has traditionally been a strong focus on analyzing and managing technical risk connected with the costs and schedules of software projects and development [8, 21] and weak focus on business risk analysis.

Coming from a background with bespoke customer projects, there is naturally a high focus on analyzing and evaluating technical risk and development costs, since the business risk was taken mainly by the customer that contracted the development effort.

In the context of MDSPD the business risk lies with the developing organization. However, there is still very little research on how to handle this shift. In most of the existing methods and models of requirements selection and release planning in MDSPD practices for handling business related risks are not clear [2, 9-13] and the software engineering industry appears equally immature or unprepared to deal with business risk factors.

This lack of focus and practices for evaluating and managing business risk of requirements may be contributing to the reported misbalance between commercial and other types of requirements, where the results show a trend of avoiding investments in innovations and system requirements [15, 22, 23]. The situation is troubling since avoiding investment in system requirements may lead to system architecture deterioration and collapse which is connected to serious losses for the company [15]. Equally important, ignoring innovation related requirements may lead to losing a competitive edge for the company [16].

In this paper we provide a first step towards finding a solution for managing the business risk in requirement

selection decisions, by means of investigating how business risk is handled and to what extent the business risk associated with different requirement types affects requirements selection decisions in industry. The following sections offer details on the research strategy employed for answering these questions.

III. RESEARCH QUESTIONS AND STUDY DESIGN

In this study we want to investigate how well the imbalance between the different requirements types found in previous studies can be explained by the uncertainties in value definition of a requirement and associated business risks. The research questions are thus:

RQ1: How does business risk associated to the different requirement types impact the requirements selection decisions?

RQ2: How are the business risk related issues handled when selecting requirements for a future release?

In order to answer the research questions, we use a structured questionnaire targeting professionals involved in the software requirements selection decisions. RQ1 is answered in the first part of the questionnaire by using requirements selection scenarios as presented in Section III.A. RQ2 is answered in the second part of the questionnaire by means of comparing business risk-related issues with typical requirements selection criteria in an MDSPD context, as presented in Section III.B.

A. Requirements selection scenarios (RQ1)

The scenarios presented in Figure 1 are developed using Table I as a starting point.

Scenario 1
A (Key Customer): A requirement is requested by a key customer;

B (Many Customers): A requirements is requested by several customers;

C (Survey): A requirement originating from an independent survey of end-users that may be attractive to several customers.

Scenario 2
A (Key customer): A requirement is requested from one of the most influential customers.

B (R&D innovation): A requirement originating from R&D that may apply to the existing customers and attract new markets;

C (Competitor): A requirement originating from competitor analysis and that be attractive to existing and new markets.

Scenario 3
A (System improvement): Architectural product improvements originating from R&D, motivated by cost reductions and higher flexibility of the product architecture;

B (Key customer): A non-functional product improvement demanded by a key customer;

C (Competitor): A non-functional product improvement originating from competitor analysis that may be attractive to several customers.

Figure 1. Requirement selection scenarios

The scenarios are constructed with the purpose to reflect different levels of business risk related with different type of requirements and are based on the requirement investment categories from Table I.

For example, in Scenario 2 Requirement A represents category 1 - commercial requirement from a key customer, and Requirement B represents category 2 – Innovations from R&D. Finally, Requirement C represents a commercial requirement with an indirect connection to the customers. This requirement is expected to be more risky in comparison to a key customer requirement and less risky compared to innovation.

In order to investigate how business risk affects requirement selection decisions, the requirement selection scenarios are used in the interview with professionals. Each interviewee is asked to rank which of the requirements have the highest chance of being selected by means of prioritizing the requirements presented in each scenario. The most important requirement is ranked as 1, and least important is ranked as n [24].

B. Influence of business risk criteria (RQ2)

This part of the questionnaire aims to answer RQ2 by examining the relative influence of business risk compared to other commonly acknowledged requirements selection criteria in MDSPD. Table II presents a complete list of requirement selection criteria used in the questionnaire.

TABLE II. REQUIREMENT SELECTION CRITERIA

Selection Criteria	Definition
C1. Expected ROI of a requirement	ROI is expressed as a relationship between gain and cost, where: Gain is value presented by a requirement in term of potential sales or cost savings. Cost estimation is based on technical complexity, effort and required competence to implement a requirement.
C2. Time to ROI	Investment payback time, i, e. when and how fast the brake-even of the investment can be obtained?
C3. ROI Risk (business)	Level of uncertainty in the value offering of a requirement.
C4. Time-to-market	Can requirement be delivered by the targeted market window?
C5. Impact on the stability of the system	Does a requirement introduce disturbance in system architecture or hampers system evolution plans?
C6. A measure of missed opportunity	What is the cost of not implementing the requirement?
C7. Value dependencies	Does the requirement increase/decrease the value of other selected requirements?
C8. Technical dependencies	Functional and temporal dependencies between the requirements

C1, C4-C8 represent commonly acknowledged criteria derived from different requirement selection models in MDSPD [2, 10, 22].

C2 is adopted from corporate finance literature [25] and C3 represents business risk as defined in Section II of this paper.

In order to determine the relative importance of business risk-related criteria against the common criteria used in the requirements selection situations, the criteria presented in Table II are used in the interview with professionals involved in requirements selection decisions.

Each interviewee is asked to prioritize the criteria according to their impact on requirements selection decision, using the 100 dollar method [24]. This method asks participants to spend 100 points across all of the given criteria, to represent their relative influence. The criteria are prioritized twice: first according to current practices and second according to the ideal situation.

C. Case study setting and execution

The case study was conducted during the autumn 2008 at Ericsson AB. Ericsson AB is a large enterprise operating mainly in the market-driven context, providing a wide range of software and hardware products and solutions to the market.

The study consisted of series of structured interviews using the questionnaire presented in sections A and B, and follow-up workshops where results obtained through the interviews were discussed with the study participants.

The study participants were requirements stakeholders for three separate products developed by the company. The participants were chosen in order to represent the roles that were either responsible and/or involved in the requirements selection decision by representing different stakeholders interested to push their requirements in the product. In total 14 interviews were conducted, where the following roles were interviewed: Product managers - 6, Technical Managers – 4, Sales & Marketing – 3, Customer support- 1.

All interviews were conducted in the form of face-to-face meetings between the researcher and the interviewee and lasted on average 60 min. In the beginning of each interview the researcher spent approximately 10 min to present the concepts in the questionnaire to the interviewee and to make sure that the terminology used in the questionnaire was clear and was interpreted in an adequate manner.

The follow-up workshops with the study participants had the format of an informal meeting where the researcher presented the findings from the conducted interviews and let the participants discuss the meaning and implications of these findings.

In total, two consequent workshops were conducted. Both workshops lasted for two hours. The following roles participated in the workshops: Product managers – 3, Technical managers 3, Sales & Marketing – 1, Customer support – 1.

IV. Case Study Results

In this section we present the data collected through the interviews and the follow-up workshops.

A. Requirements selection scenarios (RQ1)

Table III presents rankings of the requirements in each scenario. In the table, different requirements types in each scenario are depicted in the rows and information on their rating is presented in columns.

The table shows priority orderings of each requirement for an entire group of interviewed stakeholders. The group priority is found by identifying the most common rank given to a requirement by the individuals, i.e the mode. If a single mode can not be found (for example in case of multiple modes) the common value is identified by finding the median value of the individual rankings.

In order to determine the level of agreement between the group members we used the frequency of the common rank (Freq %), calculated by dividing the number of responses with common rank by the total number of responses. The agreement between the respondent answers is considered Weak if the frequency falls in the interval of 40-49%, Fair when it falls between 50-69%, Strong when between 70-89% and Excellent between 90-100%. The agreement can not be identified when a single mode is not found, or is less than 40%.

TABLE III. Requirements priority based on all results

	Common Rank		**Agreement**
	Rank	***Freq. (%)***	***Level***
	Scenario 1		
B (Many Customers)	1	0.62	Fair
A (Key Customer)	2	0.54	Fair
C (Survey)	3	0.92	Excellent
	Scenario 2		
A (Key Customer)	1	0.77	Strong
C (Competitor)	2	0.46	Weak
B (R&D Innovation)	3	0.61	Fair
	Scenario 3		
B (Key Customer)	1	0.69	Fair
A (System Improvement)	2	0.62	Fair
C (Competitor)	3	0.92	Excellent

The results presented in Table III show that the respondents were quite aligned when deciding priorities of the requirements in each scenario with the confidence level of responses varying from Fair to Excellent.

Rankings in Scenario 1 show that requirements demanded from one (key) or many customers are prioritized over requirements that do not have a direct link to the customer. Results in Scenario 2 and Scenario 3 also show the same outcome where requirements from key customers are confidently on the first place. These scenarios also show that requirements coming from R&D in general have lower priority compared to requirements initiated from competitor analysis. However as shown in Scenario 3 R&D architectural improvements that are motivated by cost reductions or improved architecture flexibility can be prioritized over the requirements coming from competitor analysis.

B. Influence of business risk criteria (RQ2)

The obtained results for this question are presented in Table IV. The table shows relative ordering of the criteria for an entire group of stakeholders, found by calculating the average of all points given to a specific selection criteria. The average points assigned to each criterion are later transferred to relative ranks in order to produce the priority list.

For each criterion the table shows average ranking, percentage of the answers (frequency) that assigned the same rank as the average, and percentage of the answers including average rank ±1. For example for the criteria "Time-to market" while only 27% of persons have assigned it rank 2, the total percentage of the people who assigned ranks 1, 2 and 3 to this criteria is 81%. This

allows us to study the agreement between the participants as to the general order of the criteria, even if the exact rank may be of less importance.

TABLE IV. RELATIVE INFLUENCE OF REQUIREMENTS SELECTION CRITERIA

	Today		
	Average Rank	*Freq.%*	*Freq. ±1*
Expected ROI	1	0.55	0.73
Time-to- market	2	0.27	0.81
Impact on system	3	0.09	0.45
Tech. depend	4	0.00	0.54
Missed opportunity	5	0.09	0.27
Time to ROI	6	0.36	0.45
Value depend	7	0.18	0.60
ROI Risk	8	0.18	0.63
	Ideal		
Expected ROI	1	0.60	0.80
ROI Risk	2	0.20	0.50
Time to ROI	3	0.20	0.70
Time-to- market	4	0.10	0.40
Impact on system	5	0.20	0.60
Missed opportunity	6	0.20	0.50
Tech. depend	7	0.30	0.70
Value depend	8	0.40	0.90

The results show that the expected ROI of the requirement confidently appears on the first place on both current and ideal scenarios. For the current practice, the average rankings indicate that Expected ROI, Time-to-Market, System impact and technical dependencies have the most impact on the requirements selection decision, whereas the criteria Value Dependencies and Business Risk have least impact. The answers also show that in an ideal situation the practitioners wish to see ROI risk together with expected ROI and Time-to Market as the most influential criteria affecting requirements selection. In fact the ROI risk criteria have moved from the last to the second place in the ideal scenario.

C. *Results from the workshops*

The presentation of interview results caused lively discussions at the workshops, even though the practitioners felt that the outcome of the selection scenarios have accurately captured the current relation of business risk and its impact when selecting requirements.

The practitioners explained that requirements that did not have a direct connection to the customers, for example innovations, architecture and product improvements, were considered more risky compared to requirements originating from customers. The practitioners also felt that this risk adverse attitude was correct for the products in question while for other products the picture could be different.

The weak focus on ROI risk related issues identified in the questionnaire was explained by a strategy to focus on customer originated requirements.

V. RESULT ANALYSIS

The results of the conducted case study allow identification of the following findings:

RQ1: When it comes to the question of to what extent business risk associated to different requirements types affect requirements selection decisions, the outcomes of the requirements selection scenarios presented in Table III clearly show a dominance of commercial requirements.

Further, the results indicate that business risk associated with requirements is one of the main reasons for the dominance of commercial requirements. Initially by the requirements selection scenarios, and later through the workshops, participants confirm that the commercial requirements receive priority since they are considered less risky compared to architectural improvements and innovations. These are in generally associated with larger business risk since they do not have a direct link to the customer.

RQ2: The results from the second part of the study, as presented in Table IV, reveals that for the studied products improvements can be made when it comes to analyzing business risk related criteria compared to other criteria, for example time-to-market, system impact and technical dependencies of the requirements.

This is mainly explained by the fact that currently the requirements selection process is mostly focusing on satisfying commercial requirements which are by their very nature associated with low business risk. However there is a wish to use business risk related criteria more actively in the decision making process. The identified lack of focus on analyzing business risk related criteria in the studied case is well in line with the available literature of requirements selection techniques in market-driven software product development [2, 9-13], where we have found much focus on technical risk analysis and limited focus on business risk.

VI. VALIDITY THREATS

Any empirical study is associated with some types of validity threats. For this study the following threats are most important to consider: *1) Design of the questionnaire:* the requirements selection scenarios used in the conducted study provide a rather simplified model of requirements selection situations in an MDSPD context, both in terms of diversity of requirements types and the richness of requirements descriptions. For the purposes of this study and in order to control the participants' perceived business risk of requirements, the problems were reduced to reflect the most basic differences in business risk between the requirements. Thus, despite their simplicity the utilized scenarios can still provide a good-enough basis for answering the research questions. Another potential problem with the questionnaire is the respondent's interpretation of the question formulations and terminology used in the questionnaire. In order to minimize the risk of different interpretations the researcher has spent some time in the beginning of each interview to introduce and clarify terminology used in the questions. *2) Generalizability of the results:* The identified empirical results could be influenced by the business model and character of the studied products, and may thus potentially create problems to generalize the findings. On the other hand the study findings are well aligned with other studies

reporting dominance of commercial requirements [14, 15, 22, 23]. Hence the results from this case study may still be used to motivate a need to consider business risk-related issues more actively in software requirements selection situations in general.

VII. Discussion and conclusions

In this paper we investigate whether the dominance of commercial requirements over system improvement and innovation related requirements can be explained by the business risks associated to the investment in these requirements.

The results of the conducted case study show a risk adverse attitude in requirement selection decisions, where commercial software requirements are prioritized over system improvements and innovations. This happens since commercial requirements are associated with less business risk compared to the other requirement types.

This outcome provides confirmation for the classification of the requirements' investment categories presented in Table I. It also offers an insight that the dominance of commercial requirements in the requirements selection decisions found by other researchers [14, 15, 22, 23] can be explained by identified improvement potential found in the practices for dealing with requirements investments that are associated with high business risk. This indicates that the problem of balancing commercial and other types of requirements can be resolved by introducing strategies for managing business risk associated with requirements.

The study findings also show a limited focus on managing business risk related criteria as opposed to aspects related to technical issues connected with the requirement and time-to-market.

In a situation where a company is pressured with time-to-market deadlines, and tough demands to show positive results on quarterly basis, the focus on commercial requirements becomes natural. In fact existing research in decision theory suggests that by default most decision makers will choose defined and sure benefits over unclear or uncertain benefits [14].

Considering a by default risk-adverse attitude of decision makers when it comes to benefits, the results of this study provide an important message:

Unless software companies are equipped with strategies and methods that help in estimating, managing and balancing different levels of business risk associated with different types of requirements, system improvements and innovations will not survive the competition against commercial requirements which are associated with guaranteed and direct benefits.

The implication of the research presented in this paper is that in order to enable software companies to invest in requirements that do not have a guaranteed value (and thus an increased business risk, see Table I), software companies need better methods for specifying value attached to requirements and strategies for handling investments associated with high business risk.

Both of these areas are currently not emphasized in MDSPD literature (for example mechanisms for evaluating requirements value are mostly still not defined and most of the requirements selection and product planning literature lack support for handling business risks) and thus provide an arena for future research and possibility to provide better solutions for the practitioners.

The research presented in this paper contributes both industry and academia in the following way: 1) to the best of our knowledge this paper is one of the first attempts to investigate how business risks associated with requirements investment situation are handled in industry and thus it provides novel results and insights. 2) The results of the study provide a potential explanation to the misbalance between commercial and other types of requirements identified by other researchers. 3) The reported research results identify lack of support for managing business risks associated with requirements selection decisions, thereby defining a future area of research.

References

[1] B. Regnell and S. Brinkkemper, "Market-Driven Requirements Engineering for Software Products," in Engineering and Managing Software Requirements, 1st ed, C. Wohlin and A. Aurum, Eds. Berlin Heidelberg: Springer, 2005, pp. 287-308.

[2] A. Ngo-The and G. Ruhe, "A systematic approach for solving the wicked problem of software release planning," Soft Computing - A Fusion of Foundations, Methodologies and Applications, vol. 12, pp. 95-108, 2008.

[3] L. Karlsson, Å. Dahlstedt, J. Natt och Dag, B. Regnell, and A. Persson, "Challenges in Market-Driven Requirements Engineering - an Industrial Interview Study," in Proceedings of the Eighth International Workshop on Requirements Engineering: Foundation for Software Quality (REFSQ'02), Essen, Germany, 2003, pp. 101-112.

[4] B. Boehm and A. Jain, "An initial Theory of Value-Based Software Engineering," S. Biffl, Aurum, A., Boehm, B., Erdogmus, H., Grünbacher, P., Ed.: Springer, 2005.

[5] L. Lehtola, M. Kauppinen, and S. Kujala, "Linking the business view to requirements engineering: long-term product planning by roadmapping," in 13th IEEE International Conference on Requirements Engineering (RE'05), 2005, pp. 439 - 443

[6] A. Dixit and R. Pindyck, Investment Under Uncetrainly: Princeton Univercity Press, 1994.

[7] M. Benaroch, "Managing information technology investment risk: A real options perspective," Journal of management information systems, vol. 19, 2002.

[8] B. Boehm, "Software risk management: principles and practices," IEEE Software, vol. 8, pp. 426-435, 1991.

[9] G. Ruhe and D. Greer, "Quantitative Studies in Software Release Planning Under Risk and Resource Constraints," in Proceedings of the International Symposium on Empirical Software Engineering (ISESE), Los Alamitos CA, 2003, pp. 262-271.

[10] P. Carlshamre, "Release Planning in Market-Driven Software Product Development: Provoking an Understanding," Requirements Engineering, vol. 7, pp. 139-151, 2002.

[11] D. Greer and G. Ruhe, "Software release planning: an evolutionary and iterative approach," Information and Software Technology, vol. 46, pp. 243-253, 2004.

[12] L. Lehtola and M. Kauppinen, "Suitability of requirements prioritization methods for market-driven software product development," Software Process: Improvement and Practice, vol. 11, pp. 7-19, 2006.

[13] J. Karlsson and K. Ryan, "A cost-value approach for prioritizing requirements," IEEE Software, vol. 14, pp. 67-74, 1997.

[14] N. Dzamashvili Fogelström, S. Barney, A. Aurum, and A. Hederstierna, "When Product Managers Gamble with Requirements: Attitudes to Value and Risk," in International Working Conference on Requirements Engineering: Foundation for Software Quality (REFSQ'09), Amsterdam, The Netherlands, 2009, pp. 1-15.

[15] M. Lindgren, A. Wall, R. Land, and C. Norström, "A Method for Balancing Short- and Long-term Investments: Quality vs. Features," in 34-th Euromicro Conference on Software Engineering and Advanced Applications (SEAA), 2008.

[16] T. Gorschek, S. Fricker, and K. Palm, "Star Search – Developing a Scalable Innovation Process," (in print) IEEE Software 2009.

[17] I. van de Weerd, S. Brinkkemper, R. Nieuwenhuis, J. Versendaal, and L. Bijlsma, "Towards a Reference Framework for Software Product Management," in Proceedings of the 14th IEEE International Requirements Engineering Conference (RE'06), Minneapolis, MN, 2006, pp. 319 - 322.

[18] T. Gorschek and A. Davis, "Requirements Engineering: In Search of the Dependent Variables," Information and Software Technology, vol. 50, pp. 67-75 2008.

[19] H. Markowitz, "Foundations of portfolio theory," The Journal of finance, vol. 46, 1991.

[20] N. Dzamashvili Fogelström, T. Gorschek, M. Svahnberg, and P. Olsson, "The Impact of Agile Principles on Market Driven Software Product Development," Software Process Improvement and Practice (in print, available from: www.interscience.wiley.com; DOI: 10.1002/spip.420), 2009.

[21] I. Sommerville, Software Engineering, 6 ed. Essex: Addison-Wesley, 2001.

[22] C. Wohlin and A. Aurum, "Criteria for selecting software requirements to create product value: An industrial empirical study," in Value Based Software Engineering, S. Biffl, Aurum, A., Boehm, B., Erdogmus, H., Grünbacher, P., Ed. Germany Springer, 2006, pp. 183-206.

[23] S. Barney, A. Aurum, and C. Wohlin, "A product management challenge: Creating software product value through requirements selection," Journal of Systems Architecture, vol. 54, pp. 576-593, 2008.

[24] P. Berander and A. Andrews, "Requirements Prioritization," in Engineering and managing software requirements, 1st ed, C. Wohlin and A. Aurum, Eds. New York NY: Springer, 2005, pp. 69-94.

[25] J. Berk and P. DeMarzo, Corporate Finance: Pearson Addison Wesley, 2007 .