Risk as a Subjective Construct: Implications for Project Management Practice

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***Abstract* - The management of risk is a key element of all mainstream project management methodologies. It has implications for the effectiveness of the project management process itself, and for the management and communication of knowledge that is an inherent part of that process. There are two main schools of thought regarding project risk management – 'risk as an objective fact' and 'risk as a subjective construct'. The former considers risk as epistemologically probabilistic, whilst risk in the subjective construct perspective allows multiple epistemological dimensions of risk. Here we review how 'risk as a subjective construct' features in existing risk management literature, and how these contributions can be classified or grouped together. The role of risk registers is then reviewed to determine whether this has any relationship with the 'risk as a subjective construct' concept. The paper then reflects upon the authors' future research programme and the possible implications for project management practice.**

Keywords - risk; risk analysis; subjective construct; project management; knowledge management; perception; stakeholders

I. INTRODUCTION

Project management is an established discipline in traditional industries such as engineering and construction, and other industry sectors such as education, IT, health, pharmacy and surgery have adopted project management in their organizations in recent years [1]. Project management has also grown from a tactical to a strategic discipline, with project managers playing an increasingly significant role in the execution of senior management business strategy [2]. Strategic project management, project performance tracking and systematic assessment of lessons learned may underpin strategy revisions and adjustments [3].

Despite the recognized criticality of project success for organizations, a considerable proportion of projects continue to either not meet their due dates, exceed budget, do not deliver the specifications, miss quality, underestimate risk or do not meet customer satisfaction. That is why project management failure remains an area of considerable interest in contemporary project management literature [4].

Formal risk management is a relevant part of project management. In fact, risk management has been identified as one of the major criteria for project success [4]. Hence, risk management has become a central component of some of the most deployed industry standard methodologies such as Project Management Body of Knowledge, PRINCE2, Systems Development Life Cycle, Capability Maturity Model Integrated, and Information Technology Infrastructure Library.

Comprehensive risk management implementation increases the probability of project success [5]. It is considered as the tool that limits the effect of unexpected events or prevents such events from happening. Therefore it is assumed, that risk management as part of project management contributes to overall project success [6]. Contemporary risk management literature can be assigned to two distinct schools of thought, risk as an objective fact and risk as a subjective construction. Both schools provide different definitions of risk, both are based on different ontological and epistemological principles, and both handle risk in a different manner [11].

Risk management is one of nine project management knowledge areas defined in the Project Management Body of Knowledge. Among project management practitioners it is one of the most critical activities for project success together with communication, resource planning and scheduling. Project management should always include risk management [7]. The Association of Project Management identifies and separates out a series of hard and soft benefits (see Table I) from deploying risk project management [8]. Bartlett [9] stresses individual benefits, and concludes that the major impact on deploying risk management resides in focusing the way the team members think, behave and work together. One further conclusion of the author is the contribution of project risk management to the organization as a means of identification of threats to the organization.

However, it is generally accepted that organizations tend to lack application of this knowledge. Bannerman [10] suggests the existence of a gap between the development of risk and risk management in the literature and the needs of the phenomenon in practice. Not only does there appear to be a disconnect between risk focused management research and the needs of project risk management in industry, but also the converse - the adoption of risk concepts and risk management methods in practice lags behind the new concepts and understandings found in the literature. Researchers and practitioners still have to learn from each other to reduce the level of project failure.

Different schools of risk analysis provide different risk definitions which may have significant implications and impact on the management of risk in the context of project management. Generally speaking two schools of thought

 ISBN: 978-1-61208-254-7

have crystallized on project risk management, 'risk as an objective fact' and 'risk as a subjective construct'. Risk as an objective fact considers risk as epistemologically probabilistic, while risk in the subjective construct perspective allows multiple epistemological dimensions of risk, encompassing experience, organization, culture and society which are to be taken into account to manage risk in the context of project management.

'Risk as a subjective construct' opens a new opportunity and approach to risk management, a new perspective on the creation and use of risk registers, and engenders a two-way communication process between stakeholders and project manager [11].

The research questions (RQs) addressed in this paper are:

RQ1: To what extent does 'risk as a subjective construct' feature in existing risk management literature, and how can these contributions be classified or grouped together?

RQ2: What is the nature of existing literature on risk registers and what relationship does it have with the 'risk as a subjective construct' concept?

RQ3: How could project risk management theory and practice be informed or improved by an assessment of the 'risk as a subjective construct' concept.

This introductory section is followed by a discussion of the research methodology, based on a detailed literature review. Findings and analysis are presented in section three and the final section draws together some conclusions from work completed to date and briefly outlines the authors' future research intentions.

II. METHODOLOGY

In the last two decades, qualitative research has found increasing recognition in the project management field [12]. A large number of empirical studies using qualitative data are available in academic literature and specialized journals. At the same time, management researchers and practitioners in particular rely on evidence-based policy [13]. In fact, most of the existing generally accepted standards in the field of project management are built around evidence-based policy and best practice.

The systematic review deployed in this research assumes that it is feasible and sensible to cumulate findings and generalize results to create new knowledge. The review attempts to identify, evaluate and interpret all available research relevant to the three research questions. The overarching aim is to synthesize existing evidence in a fair, rigorous, and open manner. This systematic approach is an aid to the grouping and structuring of findings, which will grow over time as new relevant materials are published, alerts collected and the search parameters or sources are adjusted.

An initial literature scoping exercise encompassed a range of disciplines that contribute to the discussion of the validity of the subjective construct of risk in the context of project management [11]. As a first step, evidence on 'risk as a subjective construct' was documented. The intention is to expand previous studies [11] by extending the period observed as well as the source of literature. Similar to other systematic researchers [14] who also accept the premise that

TABLE I. HARD AND SOFT BENEFITS OF PROJECT RISK MANAGEMENT [9]

	'HARD' BENEFITS		'SOFT' BENEFITS
H1	Enables better planning, scheduling and budgeting.	S1	Improves corporate experience and general communication.
H2	Increases the likelihood of a project adhering to its schedules and budgets.	S2	Leads to a common understanding and improved team spirit.
H3	Leads to the use of the most suitable type of contract.	S3	Helps distinguish between good and bad management (and good and bad luck!).
H4	Allows a more meaningful assessment of contingencies.	S4	Helps develop the ability of staff to assess risks.
H5	Discourages the acceptance of financially unsound projects.	S5	Focuses project management attention on the real and most important risks.
H6	Contributes to the build-up of statistical information for better decision- making.	S6	Facilitates greater risk-taking, thus increasing benefits gained.
H7	Enables a more objective comparison of alternatives.	S7	Demonstrates a responsible approach to clients.
H8	Identifies and allocates responsibility to the best Risk Owner.	S8	Provides a fresh view of the personnel issues on a project.

 ISBN: 978-1-61208-254-7

project management is under-represented in the leading management research journals, the current paper concentrates on the two flagship project management journals, Project Management Journal (PMJ) and International Journal of Project Management (IJPM), established in 1969 and 1983 respectively. The search which identified risk as subjective construct was broad, combining automated and manual searches. There were identified peer-reviewed articles published up to July 2012. Discovery service EBSCO search engines and indexing systems were used; in addition bibliographies of the initial papers were scanned for additional papers. The combined research strategies provided 90 articles for the RQ1 and 15 for RQ2.

Five areas were identified as interpretative contexts to understand 'risk as a subjective construct':

- Individual risk constructions
- Conflicts and contradictions
- Multiple rationalities
- Complexity - Size
- Perspective to project result / end product

For synthesizing the studies the technique chosen is 'lines of arguments'. The articles selected examine different aspect of the same phenomenon. The interest for one author may be more focused on the disaster feature; the next may be stressing the uncertainty aspect; both relate to complex, big sized projects with stakeholders of disparate backgrounds. The 'lines of arguments' uses categories surfacing from the data. In the next section, as part of the analysis, categories are linked with personal interpretation to offer a holistic version of the risk analysis by the selected authors.

III. FINDINGS AND ANALYSIS

As regards RQ1, the quality criteria applied to select the articles were:

1. A focus on project risk
2. Addresses real projects, case studies – not a theoretical discussion
3. Relates to risk, uncertainty or failure or risk analysis/risk register

The studies which clearly fulfill all of the three quality criteria were graded 'A' (Table II). An analysis of this literature suggests that one defining characteristic of 'risk as a subjective construct' is the way risks are identified. The identification of risk as a subjective phenomenon coincides with its creation – the risk exists only once the stakeholder has identified it. This is particularly noticeable for risks linked to an organization's own qualities and deficiencies. Such risks show a significant limitation compared with traditional risk analysis based on external threats and probabilistic consequences. One further characteristic seems to be that risks apparently not identified by the existing project management systems are the ones originated by the organizational pathogens or organizational latent conditions. These are causes of failure, are created by actors, and often occur after a prolonged period, becoming evident or problematic after an adverse event occurs. Such conditions are the result of the individual's subjective interpretation (example: ring-fencing of funds for particular task against other tasks, investment flexibility becomes limited, and is then followed by unforeseen calls for other tasks). One stakeholder's pathogen is another stakeholder's protection. These constructions may move from protection to pathogen in the project life cycle. Such different constructs engender discrepancies during project development. Failure may not affect all stakeholders. Organizational pathogens can be better treated as subjective interpretations [15].

Failure in complex systems provides evidence of competing and contradictory demands. The multi-nodality of complex systems shows conflicts and contradictions. These conflicts and contradictions are interpreted as deviations and misunderstandings by traditional project management. The practice of mixed top down/bottom-up, local empowerment and top down responsiveness does not easily fit with academic project management methodologies. Ivory and Alderman [16] suggest that predictive project management models cannot necessarily capture such complex models as evidenced with several case studies using qualitative data from three complex industrial projects. Projects are built as framed linear and non-linear interaction – the deconstruction of these interactions provides the opportunity to identify non-linear interactions, in which inputs lead to unexpected outputs and possible project failure. The analysis of NASA recurrent disasters shows the prevalence of different and opposing risk rationality within a project oriented organization, in which certain leaderships, with certain objectives, influence risk handling with fatal consequences [17]. This provides a paramount example of different perceptions and expectations (commercial vs. safety) with different risk constructions leading to collapse.

A knowledge based risk assessment template has been developed [18] to analyse the risks from both supply-side and demand-side perspectives. The author takes into account the fact that project participants may have perspectives that differ from those of the project manager. Both the definition and existence of risk phenomenon are considered as subjective in this model. Particularly interesting is Marrewijk et al's contribution [19] to the concept of multiple rationalities in megaprojects. The authors oppose the assumption of projects having a single or shared rationality. Megaprojects offer - through their documentation and contract - a great example of the opportunities for ambiguities and multiple interpretations. Project participants with diverse cultures and rationalities will have different perceptions of uncertainty, ambiguity and risk. All this makes it hard to make "rational" and "consistent" decisions in such projects [20].

An area related to the megaprojects example is the build-operate-transfer (BOT) concession model. Yeo and Tiong [21] try to answer the question of how to positively manage such differences to achieve convergence of results. Actors in such a constellation are typically the representative authorities of the host governments, entrepreneurial promoters and banks. They represent different constructions of risk with different perceptions and expectations, values and motives. To sort out some of the conflicts that arise because of these different constructions of risk, the authors recommend an approach based on the Soft Systems Methodology [22].

 ISBN: 978-1-61208-254-7

Risk analysis could be subject to the impact of interest. The interest of the project owner is likely to be distinct from that of the project manager or a project team member. These different interests can be categorized as operational and strategic, and can lead to a different handling of operational and strategic risks. Krane et al [23] identify three major groups of stakeholders who will have different project objectives. They are:

1. The project team with a 'project internal' perspective, focusing on the project's deliverables, costs, and schedule. This is typically seen in a very short time perspective.
2. The customer or user, focusing on the benefits of the project or the project's direct effects. The time perspective will necessarily be somewhat longer than the project's perspective. They are the ones who will live with the end-product once the project is finished.
3. The project owner with a longer-term strategic perspective on the project.

These authors also use the term 'risk management systems' associated with the various stakeholder groups and point out that these distinct systems must communicate. The risk management systems communication is more a collaboration process to address the holistic view of the project and less a 'risk register' for dissemination to project participants.

TABLE II. GRADE 'A' ARTICLES USED IN LITERATURE ANALYSIS FOR RQ1

Author	Title of work	Region/Detail	Knowledge contribution	Practice implications
[15]	The pathogen construct in risk analysis	UK - Based on interviews to 22 project members	Risk origination in the way an organization sees the world. Pathogen link to practice and its subjective interpretation	Enhancement of risk identification by querying contradictory interpretations of the same entity.
[16]	Project Managements learns from complex systems failure	UK - Detailed examination 3 large size projects	Recognition of conflicts and contradictions as opposed to deviations and misunderstanding as consequence of diverse social positions, organizational responsibilities, values, and culture	Suggestion of mixed top-down/bottom-up approach to management.
[16]	Organizational behaviour and disaster: NASA	USA - Detailed examination of 2 large projects. Access to investigation board documentation and lessons learned.	Risk analysis impacted by interests, values and culture and objectives; risk phenomenon is subjective	Integrate devil's opinion, independent quality review, identification and elimination group behaviour; setup multiple groups under different leaderships to work on critical issues
[31]	Deviation, ambiguity , uncertainty project-organization	USA – The Millcorp case study	Knowledge sharing through interaction and communication between teams and contexts to enhance risk understanding	Interactive risk identification and analysis processes
[30]	Fall of firefly	USA – case study	Different risk constructions	Provides lessons learned / check list to identify different risk constructions for practitioners
[23]	Project Manager–Project Owner Interaction influences risk management	Norway - Analysis of 7 big complex projects	Project Owner – Project Managers' interaction results in lack of strategic risk attention, strong focus on operational risk	Recommendation to emphasize the identification of more short- and long-term strategic risks at all stages of projects
[18]	A knowledge-based risk assessment framework for evaluating web-enabled application outsourcing projects	Global	Practical tool to assess specific stakeholder risks	Template available
[19]	Managing public–private megaprojects: paradoxes, complexity, and project design	Netherlands and Australia	Multiple rationalities	Adequate project design to accommodate partners' culture to enable cooperation to achieve project objectives
[21]	Positive management of differences for risk reduction in BOT projects	Turkey, Thailand, Indonesia, Australia, Bangladesh, Malaysia, Canada and Hong Kong	Analysis of different constructions of risk	Proposed soft systems methodology to achieve convergence

The risk register review (RQ2) does not require an integrative synthesizing analysis, but Table III details the grade 'A' articles that were reviewed (using the same quality criteria as noted above). Risk registers are widely used as a tool or template. Integration and simplicity are common requirements. All of the selected studies described tools or analysis that could be adapted to incorporate and integrate several constructions. Project management applications supporting stakeholders' collaboration are primarily built according to specifications based on a project manager centric risk viewpoint. Although it may be too early to provide a definitive answer, it appears feasible to adapt the current systems and templates structure to incorporate several risk constructions. It is possibly not that much of a

technical challenge to incorporate different risk constructs, but more of a challenge to the people involved to adopt and deploy the required processes.

Krane et al [23] [24] address the issue of how risks, once identified, are then distributed amongst different risk categories. This analysis provides a comprehensive general overview of how to deal with different risk items using a risk register. This comprehensive study proposes a basic categorization based on the levels of hierarchy of management objectives. They define the three categories as follows:

1. Operational Risks—risks related to operational objectives of the project. This means risks related to the direct results from the project: its products.
2. Short-Term Strategic Risks—risks related to short-term strategic objectives of the project. The project owner will have a set of objectives related to his/her use of the project results. The short-term strategic risks are the risks related to those objectives, or the risks concerning first-order effects of the project— that is, risks pertaining to the effects that should be achieved for the target group or end users of the project.
3. Long-Term Strategic Risks—risks related to the long-term strategic objectives of the project. This means those risks related to the project purpose—the long-term objective that the project is meant to contribute to.

As regards RQ3, Macgill and Siu [25] stress the importance of a single architecture of risk knowledge as its epistemology. Their proposal is the establishment of a risk knowledge database for the promotion of knowledge dissemination. Macgill and Siu [26] also recognize the importance of risk analysis not as a philosophical or intellectual exercise, but as an applied discipline. The novelty of this proposal resides in the observation of the risk phenomena not only as a physical but also a social issue. People's perception of risk results in acceptability of risk that

TABLE III. GRADE 'A' ARTICLES USED IN LITERATURE ANALYSIS FOR RQ2

Author	Title of work	Knowledge contribution	Practice implications
[32]	Categorizing risks in seven large projects	Analysis of 7 big complex projects – Categorization of 1450 risk elements as operational, short- term or long-term strategic.	Questions of identification and assessment of operational short-term strategic and long-term strategic guidelines
[8]	Knowledge based proactive risk management	Detailed description of mature interactive software application	Recommendations for adapting stakeholders interaction and collaboration
[33]	Integrated Methodology for Project Risk Management	Comprehensive practice example of risk management with risk register development including Delphi Analysis for final validation	Framework available for project owner - external consultant- collaboration that offers opportunity to adapt to other particular projects
[34]	Risk avoidance in bidding for software projects based on life cycle management theory	Integration of 'bidding risk' with project-life-cycle and risk response measures	Model suggested method for forecast, prevent, discover and reduce related risk completely and in a timely fashion, thus enhancing the probability of a successful bid.
[29]	Intervening conditions on the management of project risk: Dealing with uncertainty in information technology projects	Provides approaches to ensure risk is assessed; and to overcome practitioners risk management ineffectiveness perception	Application to improve risk management techniques when conflicting risk perceptions as opposed to deal with issue
[35]	Development of a Model for Risk Management at Corporate, Strategic Business, and Project Levels	Methodology to ensure risk management integration with internal and external stakeholders, in line with McGill risk knowledge database	Mainly theoretical, ensures consistency of risk register usage with corporate strategy
[36]	Comparing project management practices in new product development: a study in the automotive, aerospace and rail transport industry	Comparative approach, identification of best practices and suggestion for best practices transfer	Recommendations for best practice solutions exchange at inter-industry and intra-industry level
[37]	A Risk Register Database System to aid the management of project risk	Presentation of project risk assessment and project risk register in an automotive company through a project lifespan	Information about design and construction of risk registers in the automotive manufacturing industry
[38]	Project risk management practice: The case of a South African utility company	Risk management in practice involving stakeholders, adherence to very simple risk management processes	Insight, information for practitioners on how to integrate stakeholders using very simple risk management process. Ensures risk management is as part of mainstream business activities.
[39]	Risk management practices of leading UK cost consultants	Insight of usage of risk assessment techniques and risk registers	Outline of options for risk management approaches

 ISBN: 978-1-61208-254-7

does not necessarily correspond with the consensual body of peer group scientific knowledge. In this construct, risk based on people knowledge and the constructed social reality is not univocal. Risk appears to be contextual and the social actions adopted by individuals when facing a risk are related to their knowledge.

With this relatively new approach to risk, a new school of thought has been identified in the area of project risk management. Zhang [11] provides a systematic review of the position of 171 articles published between 1999 and 2009 regarding project risk in the two leading project management journals, Project Management Journal and the International Journal of Project Management. Only 12 out of the 171 articles belong to the 'risk as a subjective construct' category. The same author also suggests future exploration on identifying the epistemological dimensions of subjective risk for developing methods and tools to assess and evaluate subjective risk in the context of project management.

A significant blocker to developing and applying new risk management theory is its low uptake as a concept in industry [27]. A fuller understanding of the implications of risk as a subjective construct has the potential to significantly enhance the management of risk in projects and thus overall project outcomes. Some studies have already explored how mainstream project methodologies can be adapted to different company contexts [28], and recognition of the different origins and dimensions of risk can be seen in this context. The perceived effectiveness of different project risk management assessments has been analyzed to identify the root causes for manager's reluctance to deploy risk management processes and its consequences. This study [29] is a valuable input that could underpin an enhanced application of risk assessment in project management.

IV. Conclusion and Future Work

Of the authors that address 'risk as a subjective construct', no one presents a complete solution and none of them proposes a risk management system that could integrate several risk constructs. At the same time, literature on risk registers and current risk management is available but no relationship could be found between any of the existing proposals and the 'risk as a subjective construct' concept. This poses the question of how to adjust current approaches in order to integrate more than one risk construct.

What is clear is that different stakeholders see different realities - as Peter Drucker has put it, 'when intelligent, moral, and rational people make decisions that appear inexplicable, it's because they see a reality different to the one seen by others' [30]. This phenomenon, in the case of risk, has no unique or universally accepted interpretation and it thus requires further research and enhancement, which the authors are pursuing with regard to project management practice in the German automotive sector. In order to develop further knowledge in this field, interaction and communication between project teams and their contexts will be required. This knowledge - context dependent, situational, shared - will be created collectively [31]. If it can be successfully harnessed within project management methodologies and disciplines, it has the potential to significantly enhance eventual project outcomes.

References

[1] D. E. Hodgson, "Disciplining the professional: The case of project management," *Journal of management studies*, 39(6), . 2002, pp. 803-821.

[2] A. Brown, "Getting your projects to meet strategic goals," Paper presented at the PMI Global Congress Proceedings, Sydney, Australia and Denver, CO, USA, 2008.

[3] J. Tharp, "Align project management to organizational Strategy," Paper presented at the PMI Global Congress Proceedings, Hong Kong., 2007.

[4] D. McClure, *From the CIO trenches: Why some projects fail and others succeed*, Gartner Industry Research, 2007.

[5] R. Jen, Visual Ishikawa Risk Techique (VIRT) - An approach to risk management, *PMI Virtual Library*, 2009. Available: http://www.pmi.org/en/Knowledge-Center/Knowledge-Shelf/~/media/Members/Knowledge%20Shelf/Jen_2009.ashx. Retrieved: January, 2013.

[6] K. de Bakker, "Risk management affecting IS/IT project success through communicative action," *Project Management Journal*, 42(3), 2011, pp. 75-90.

[7] PMI., *A guide to the project management body of knowledge* (PMBOK®) (Fourth ed.) Project management institute, Inc., 2008.

[8] J. Arrow, "Knowledge-Based proactive project risk management," *AACE International Transactions*, June 2008, pp. 1-9. Available: http://ehis.ebscohost.com/eds/pdfviewer/pdfviewer?sid=7d282fa8-4eb3-4756-86ad-5f2d4aa0d29d%40sessionmgr15&vid=2&hid=1. Retrieved: January, 2013.

[9] J. Bartlett, *Project risk analysis and management guide*, Buckinghamshire: APM Publishing Limited., 2004, pp. 5-13.

[10] P. L. Bannerman, "Risk and risk management in software projects: A reassessment," *The journal of systems and software*, 81(12), 2008, pp. 2118-2133.

[11] H. Zhang, "Two schools of risk analysis: A review of past research on project risk," *Project Management Journal*, 42(4), 2011, pp. 5-18.

[12] T. Biedenbach and R. Müller, "Paradigms in project management research: examples from 15 years of IRNOP conferences," *International journal of managing projects in business*, 4(1), 2011, pp. 82-104.

[13] A. Bryman and E. Bell, *Business research methods*, Oxford : Oxford University Press, 2007, 2nd ed.

[14] B. Hanisch. and A. Wald, " A Bibliometric View on the Use of Contingency Theory in Project Management Research," *Project Management Journal*, 43(3), 2012, pp. 4-23.

[15] J. S. Busby and H. Zhang, "The pathogen construct in risk analysis," *Project Management Journal*, 39(3), 2008, pp. 86-96.

[16] C. Ivory and N. Alderman, "Can project management learn anything from studies of failure in complex systems?" *Project Management Journal*, 36(3), 2005, pp. 5-16.

[17] R. D. Dimitroff, L. A. Schmidt, and T. D. Bond, "Organisational behavior and disaster: a stydy of conflict at NASA," *Project Management Journal*, 36(2), 2005, pp. 28-38.

[18] W. L. Currie, "A knowledge-based risk assessment framework for evaluating web-enabled application

outsourcing projects," *International Journal of Project Management*, 21(3), 2003, pp. 207-217.

[19] A. van Marrewijk, S. R. Clegg, T. S. Pitsis, and M. Veenswijk, "Managing public–private megaprojects: Paradoxes, complexity, and project design," *International Journal of Project Management*, 26(6), 2008, pp. 591-600.

[20] M. Olzmann and M. Wynn, "How to Switch IT Service Providers: Recommendations for a successful transition," *International Journal On Advances in Intelligent Systems*, vol 5, no 1&2, 2012, pp. 209-219, IARIA journals.

[21] K. T. Yeo and R. L. K. Tiong, "Positive management of differences for risk reduction in BOT projects," *International Journal of Project Management*, 18(4), 2000, pp. 257-265.

[22] P. Checkland and J. Scholes, *Softt Systems Methodology in Practice*, J Wiley, Chichester, 1990.

[23] H. P. Krane, N.O.E. Olsson, and A. Rolstadas, "How project manager-project owner interaction can work within and influence project risk management," *Project Management Journal*, 43(2), 2012, pp. 54-67.

[24] H. P. Krane, A. Rolstadas, and N.O.E. Olsson, "Categorizing risks in seven large projects—Which risks do the projects focus on?" *Project Management Journal*, 41(1), 2010, pp. 81-86.

[25] S. M. Macgill and Y. L. Siu, "A new paradigm for risk analysis," *Futures*, 37, 2005, pp. 1105-1131.

[26] S. M. Macgill and Y. L. Siu, "The nature of risk," *Journal of Risk Research*, 7(3), 2004, pp. 315-352.

[27] R. Hynuk Sanchez, M. Bourgault Benoit, and R. Pellerin, "Risk management applied to projects, programs, and portfolios," *International journal of managing projects in business*, 2(1), 2009, pp. 14-35.

[28] M. Wynn. P. Turner, H. Abas, and R. Shen, "Employing knowledge transfer to support IS implementation in SMEs," *Journal of Industry and Higher Education*, Volume 23, No 2, April, 2009, pp. 111-125.

[29] E. Kutsch and M. Hall, "Intervening conditions on the management of project risk: Dealing with uncertainty in information technology projects," *International Journal of Project Management*, 23(8), 2005, pp. 591-599.

[30] Bud Baker, "The fall of the firefly: An assessment of a failed project strategy," *Project Management Journal*, 33(3), 2002, pp. 53-57.

[31] M. Hällgren and E .V. A. Maaninen-Olsson, "Deviations, ambiguity and uncertainty in a project-intensive organisation," *Project Management Journal*, 36(3), 2005, pp. 17-26.

[32] H. P. Krane, A. Rolstadas, and N.O.E. Olsson, "Categorizing risks in seven large projects—Which risks do the projects focus on?" *Project Management Journal*, 41(1), 2010, pp. 81-86.

[33] A. del Caño and M. P. de la Cruz, "Integrated methodology for project risk management," *Journal of Construction Engineering & Management*, 128(6), 2002 pp. 473-485.

[34] G. Xie, J. Zhang, and K. K. Lai,. "Risk avoidance in bidding for software projects based on life cycle management theory," *International Journal of Project Management*, 24(6), 2006, pp. 516-521.

[35] A. Merna and T. Merna, "Development of a model for risk management at corporate, strategic business, and project levels," *Journal of Structured & Project Finance*, 10(1), 2004 pp. 79-85.

[36] A. K. Müller, A. Wald, and A. Görner, "Comparing project management practices in new product development: a study in the automotive, aerospace and rail transport industry," *International Journal of Project Organisation and Management*, 4(3), 2012, pp. 203-217.

[37] F. D. Patterson and K. Neailey, "A risk register database system to aid the management of project risk," *International Journal of Project Management*, 20(5), 2002, pp. 365–374.

[38] R. van Wyk, P. Bowen, and A. Akintoye, "Project risk management practice: The case of a South African utility company," *International Journal of Project Management*, 26(2), 2008, pp. 149-163.

[39] G. D. Wood and R. C. T. Ellis, "Risk management practices of leading UK cost consultants," *Engineering Construction & Architectural Management*, 10(4), 2003, pp. 254-262.

 ISBN: 978-1-61208-254-7

 ISBN: 978-1-61208-254-7