

RISK MANAGEMENT MATURITY OF CONSTRUCTION PROJECTS IN THE NETHERLANDS

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Construction projects are bounded with uncertainties and therefore, the occurrence of risks in these projects is unavoidable. Literature confirms that risk management increases the possibility of project success. A Risk Maturity Model (RMM) is a tool, which can help projects measuring the maturity of risk management and plan for risk management improvements. This research implements a Generic Risk Maturity Model (GRMM) in one contractor and two public organizations in the Netherlands. By means of individual and group interviews, 19 experts in 11 construction projects are asked to assess the risk management in their projects. The results show that risk management is properly performed in these projects, however, the organizations seem better in identifying risks rather than mitigating risks. Experts assessed their organizations high in performing 'Risk Assessment'. The results show that the experts in the public organizations evaluate 'Policy and Strategy' of risk management and 'Management Commitment' towards risk management low. The contractor could improve its risk management by giving more attention to evaluation of the risk management process. Further research into the ambition level of risk management is suggested.

Keywords: evaluation of risk management, risk maturity model, risk

INTRODUCTION

The construction industry is faced with a variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors. Literature shows that risk management increases the possibility of project success (Flyvbjerg, Bruzelius, and Rothengatter, 2003; Ren and Yeo, 2004). A Risk Maturity Model (RMM) can help projects. According to Wendler (2012), the 'maturity' concept is increasingly utilized by organizations to measure the quality of their processes. The term 'maturity' for an organization is known as a measurement concept that demonstrates progress in development and carrying out processes that are documented, managed, measured, controlled and continuously improved (Loosemore, Raftery, Reilly, and Higgon, 2006; Öngel, 2009). Maturity in terms of risk management points out an evolution towards full development of the risk management process. A major benefit of RMMs is identifying the improvement's areas of applying risk management (Loosemore *et al.*, 2006; Wendler, 2012; Yeo and Ren, 2009; Zou, 2010). Risk maturity models help to organise the processes required for improving the management of a certain risk (Schiller and Prpich, 2014). Wendler (2012) maps 237 articles related to the maturity models in more than 20 domains. Results reveal

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that despite an increasing trend in developing maturity models, not many discuss the validation and application of maturity models, particularly risk maturity models. This research contributes to the existing literature by implementing a risk maturity model and discussing the areas of improvement in risk management of construction projects.

This paper discusses risk management maturity of construction projects in the Netherlands. The objective of this research is to help projects in the construction industry advance their risk management practices by investigating the improvement areas of risk management of construction projects in the Netherlands and hence advance the performance of their project management practices. The research discusses the implementation of a Generic Risk Maturity Model (GRMM), developed by the authors, in 11 construction projects in two public organizations and one contractor in the Netherlands. In the next section, literature is reviewed and the GRMM is introduced (Section 2). Next, Section 3 explains the methodology of the research. In Section 4, the results and analysis are presented and afterwards, the results are discussed. The paper ends with conclusions and recommendations for future research opportunities.

LITERATURE REVIEW

Background

The idea and the concept of ‘maturity’ goes back to the field of quality management (Wendler, 2012). During the last two decades, several maturity models are also developed in other domains (Yeo and Ren, 2009).

Specific to risk management maturity, several researches have been conducted by organizations and researchers (IACCM, 2003). There are few literatures, which discuss the application of risk maturity models in construction projects. For example, Öngel (2009) explains developing and implementing a risk maturity in construction projects in Turkey. He concludes that the level of risk management varies per project and between local and international projects. Besides, companies, which do not allocate a budget to risk management activities, encounter immature risk management process. A similar study by Mu, Cheng, Chohr, and Peng (2014) assesses the risk management capability of subway project contractors.

The Generic Risk Maturity Model (GRMM)

To measure the maturity of construction projects in the Netherlands, the auteurs developed a Generic Risk Maturity model (GRMM) (own work). Figure 1 presents a schematic model for the GRMM. It consists of two categories: Organization and Application and Process. The Organization category contains those activities, which ensure that risk management can be performed in a project (e.g. training, culture, risk management policy and strategy and commitment towards risk management). As shown in Figure 1, the Organization category contains of four aspects: Policy and Strategy, Culture and Personnel Knowledge, and Management Commitment. The Application and Process category contains the steps of the risk management process. This category checks the application of risk management and contains three aspects: Risk Assessment, Risk Treatment, and Monitor and Review. The feedback loops between the two categories in the GRMM reflect the continuous improvements based on the results of the GRMM application.

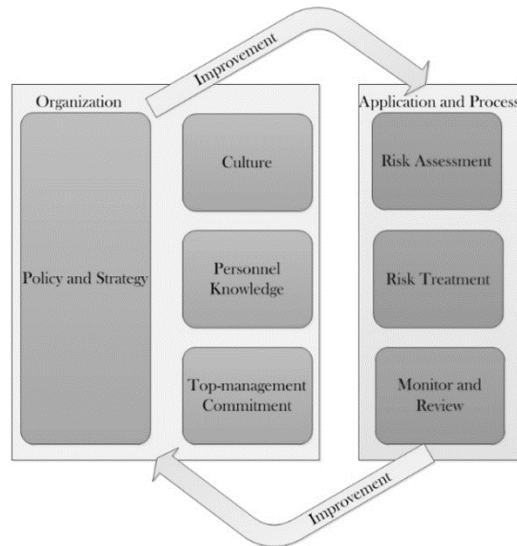


Figure 1 the GRMM model

METHODOLOGY

This research benefits from a mixed-methods approach, combining or mixing quantitative and qualitative research methods (Tashakkori and Teddlie, 1998). The goal of mixed-method research is not to replace either qualitative or quantitative approaches but rather to benefit from the strengths and minimize the weaknesses of these methodologies in a single research (Johnson and Onwuegbuzie, 2004). The research has followed a parallel 'design' (Tashakkori and Teddlie, 1998) meaning that the experts are asked to evaluate their project by implementing the GRMM (quantitative design). Afterwards, the experts were asked to elaborate on their answers by means of individual and group interviews (qualitative design).

To compare the risk management maturity of the contractor and public organization in the Netherlands, two public organizations and one contractor are selected based on their availability for participating in the research. In each of these organizations, a few ongoing projects are selected since gathering data from ongoing projects is easier, and the project members of these projects are easier to approach. The projects selected in the public organizations are among the projects that these organizations should regularly execute (e.g. improvement and reinforcement of the dikes, sluices and ways). The contractor's projects are selected among the pilot projects, which implemented a new framework to execute projects. Table 1 provides an overview of the number of projects and number of experts in each organization.

Participants in the public organizations (POs) are selected among the project team members who are actively involved in risk management: project managers, project controllers, risk managers or cost experts. At the contractor, two roles are considered relevant for this study: risk managers and design managers. After filling the GRMM by the participants, interviews are conducted and the participants are asked to elaborate (if possible) on statements with a low score. For the first public organization (PO1) and the contractor (CO), this step is held as an individual interview while in the second public organization (PO2) this step is conducted as a group interview because of restricted availability of the experts at PO2. Before the group interview, the experts had filled in the GRMM individually. Next, the

statements with a low score (1 or 4) were collected, and the experts were asked to elaborate on these in the group setting.

Table 1 overview of the number of participants and projects in each organization

Organization	First public organization (PO1)	Second public organization (PO2)	Contractor (CO)
Number of participants	7	7	5
Number of projects	4	4	3

RESULTS AND ANALYSIS

While there are many possibilities to analyse and present the results (i.e. analysis based on each project, analysis based on roles, comparing the current level and ambition level), this paper focuses only on the current level of maturity and presents the average results at company level. The results are analysed at two levels: ‘category’ and ‘statements’. The ‘category’ level discusses the results in ‘organization’ and ‘application and process’ categories of the GRMM. The ‘statements’ level discusses the result per aspect of the GRMM and elaborates on the statements in each aspect, particularly those that are evaluated low by the experts.

Analysis of the results at category level

Figure 2 presents the maturity of each organization per aspect. In the PO1, the aspects ‘Culture and Personnel knowledge’ and ‘Risk Assessment’ with the scores respectively, 8.14 and 7.84 are the most mature aspects. The aspect ‘Management Commitment’ has the lowest score. Results of the PO2 reveal that the aspects ‘Risk Assessment’ and ‘Risk Treatment’ are the most mature categories. The ‘Policy and Strategy’ category received the lowest maturity score. In the CO, the ‘Risk Assessment’ and ‘Policy and Strategy’ aspects are the most mature, with scores of 8.40 and 8.11 respectively.

In all of these organizations, the ‘Risk Assessment’ aspect is among the highest scores while the ‘Management Commitment’ aspect has the lowest maturity level.

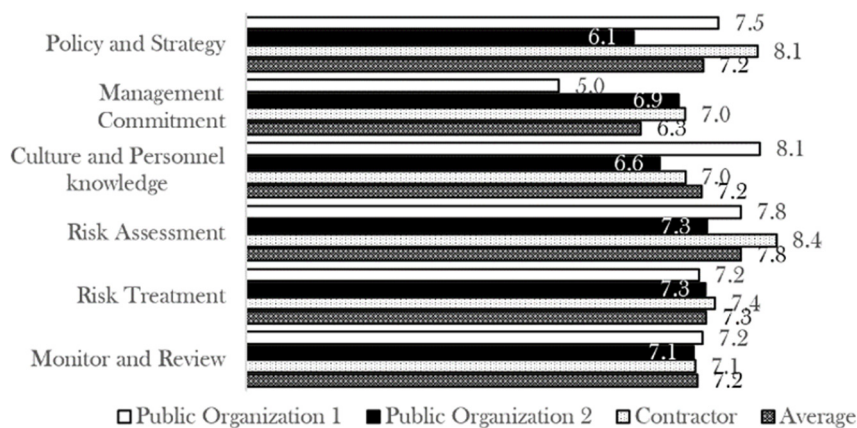


Figure 2 scores of all organizations per category of the GRMM

Figure 3 summarizes the GRMM scores and reveals that all three organizations are more risk management mature in the Application and Process category. Besides, the CO shows a more mature result than other two POs. The interviews revealed that the CO has a specific risk management process that each project should follow, hence explaining the higher scores in the CO.

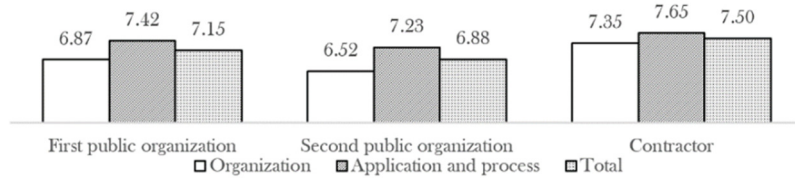


Figure 3 scores of risk management maturity of each organization per category

Analysis of the results at statement level

This section describes the statements that are evaluated low (i.e. the scores of 1 or 4 in the value column) by the experts in each organization, since the aim is to derive improvement opportunities.

Policy and Strategy

Figure 4 presents the results for the ‘Policy and Strategy’ category. For this category, the CO shows a better risk management maturity. The comments focus on the statements related to ‘risk appetite’. According to one of the respondents at the contractor: “There is no specific risk appetite document” or “Risk appetite is not completely integrated in the projects.” In addition, an expert in the PO1 mentioned, “we take all the risks for treatment...risk appetite is not something that we decide before-hand.” Likewise, stated by an expert in the PO2: “there is no risk appetite. The ambition is to define [risk appetite] high.”

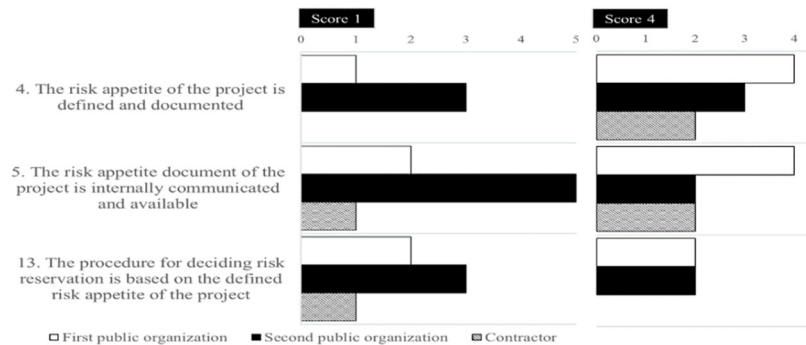


Figure 4 Statements with low scores (score 1 is shown left, score 4 is shown right) in the ‘Policy and Strategy’ aspect

Management commitment

The results of the second aspect, ‘Management Commitment’, are presented in Figure 5. The results in this figure (and Figure 2) show that this aspect has the lowest average score for all organizations. Statements 2 and 4 received the lowest scores. The experts in the PO1 stated that there is no direct steering or clear instruction on how to perform risk management within the projects. Also, there is no control whether risk management is performed. According to an expert in the PO1: “the management does not communicate about risk management and there is no clear way to deal with the risk management within the organization.” Furthermore, stated by another expert: “I don’t think that [the management] knows what [risk management] means.” One expert in the CO mentioned that: “[the management uses risk management reports] implicitly.” An expert in the PO2 gives a similar statement. In addition, several experts in the PO2 stated that the communication about risk management needed to be improved. Interviews with PO1 revealed that management does stimulate risk management by quarterly asking for the risk status in the projects via the progress reports that have to be filled in. However, this never leads to a real

conversation about risk management, especially with the average-size projects. The reason resides in the workload of the line manager, who not only guides several projects but also has a department to manage. This refrains him from paying equal attention to all projects.

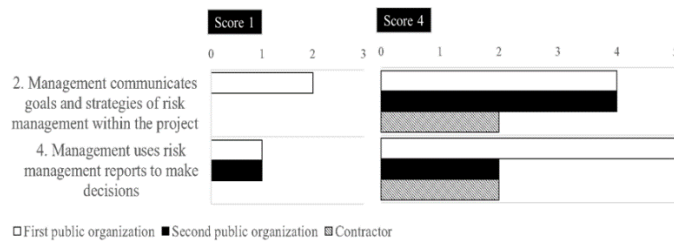


Figure 5 Statements with low scores (score 1 is shown left, score 4 is shown right) in the ‘Management Commitment’ aspect

Culture and personnel knowledge

Figure 6 presents the results of the third aspect, ‘Culture and Personnel knowledge’. The PO1 shows a higher maturity score in this aspect (Figure 2 and Figure 6). The statements 4 and 5 have received the lowest score. Regarding the statement 2 one expert in the PO2 mentioned that: “mistakes are not always accepted. [There are] often discussions about who could avoid this (a problem).” The experts in the PO2 and the CO confirmed the lack of training regarding risk management within their organizations. Stated by PO2: “There is no training to improve risk management skills.” Furthermore, stated by CO: “We do not train the people explicitly... This is also time dependent. No time is considered for that [for training].” Not mentioned among the low score statement, the group interview with the experts in the PO2 declared that experts expected more attention to risk management in their organization. For instance, it was mentioned: “not all the team members give risk management a high priority to their work” or “[it should be] more attention and time to risk management among the team members.” During the interview with the experts in the PO1, it was mentioned several times that some risks are explicitly not communicated to the management. As mentioned by an expert: “[we are told to] take some of the risks out because the management does not understand it and cannot influence the risks, and we get just questions... therefore, you create a culture of scare, and you bury your head in the sand.” Or “... we treat these risks in our team, and we do not need to bother the management.”

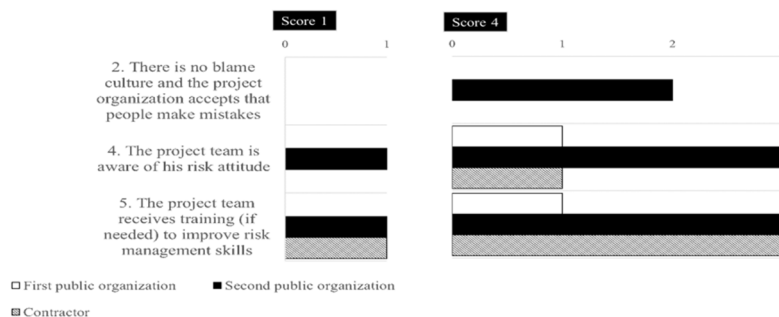


Figure 6 Statements with low scores (score 1 is shown left, score 4 is shown right) in the ‘Culture and Personnel Knowledge’ aspect

Risk assessment

The results of the ‘Risk Assessment’ aspect are presented in Figure 7. As shown, the statements 2 and 6 have the lowest score. Regarding the statement number 2, one

expert in the PO1 mentioned: “Key external stakeholders like municipals, companies and residents do not physically participate in the identification session, but the input from these externals is considered through the communication manager.” Likewise, mentioned by another expert: “The risks are identified by the project team and the people who work in the project...external people are not attending [the risk identification].” As mentioned by the experts in the PO2: “more external stakeholders can be invited to the risk identification sessions.” Some experts mentioned that the involvement of the external stakeholders could be improved.



Figure 7 Statements with low scores (score 1 is shown left, score 4 is shown right) in the ‘Risk Assessment’ aspect

Risk treatment

Figure 8 presents the scores for this aspect. Interviews revealed that all the three organizations determined control measures for treating the risks, however, the risk response strategies are not decided specifically. Risk response strategies are: avoid, transfer, reduce and accept (PMI, 2013). In reality, no other risk response strategy was used other than ‘reduce’. One expert at the contractor mentioned: “We do have control measures, but it is not explicitly based on strategies”. The interviews revealed that in the CO, less attention is given to the evaluation of control measures after implementation. The results from the POs show that the secondary risks are not considered in the project. Secondary risks are defined as risks that arise from implementation of an agreed response strategy to the basic risk (Hillson and Simon, 2007).



Figure 8 Statements with low scores (score 1 is shown left, score 4 is shown right) in the ‘Risk Treatment’ aspect

Monitor and review

The results of the last aspect, ‘Monitor and Review’, is presented in the Figure 9. The statement number 6 regarding the communication and documentation of this aspect has received the lowest score by the experts. Among the respondents, it was mentioned that: “[the results of monitor and review] is documented and shared limitedly” or “lessons learned are documented, but they are not further shared or used.” One expert in the CO stated: “We have organized several sessions with the client and contractors, but that is not enough.” Regarding the lessons learned, for

example, the CO mentioned that "... We don't do it due to time pressure." The experts in the PO1 came with the similar arguments. Besides, it was stated by the PO1 that capturing lessons learned, especially for internal projects, is not always performed.

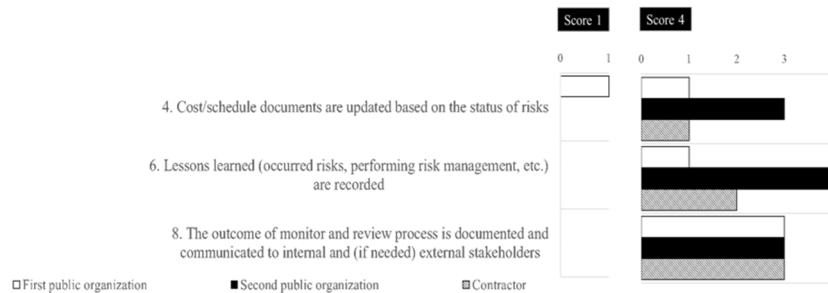


Figure 9 Statements with low scores (score 1 is shown left, score 4 is shown right) in the 'Monitor and Review' aspect

DISCUSSION

The paper examined the risk maturity of construction projects in the Netherlands in two public organizations and one contractor. The Generic Risk Maturity Model (GRMM) applied in these organizations examines the risk management application in two categories: Organization and Application and Process. These two categories consider both the essential requirements of apply risk management, ('Organization' category of the GRMM) and risk management steps ('Application and Process' category of the GRMM). Results reveal that most of the primary steps in risk management are performed in all three organizations. Hence, it can be concluded that all the examined organizations recognize value and benefit of risk management. Results show that the Application and Process category of risk management is more mature than the Organization category in all three organizations. There is a decreasing trend in the maturity scores of the aspects 'Risk Assessment', 'Risk Treatment' and 'Monitor and Review' (Figure 2). This indicates that the studied organizations are more advanced in identifying and quantifying risks, than in mitigating the risks and evaluating the whole risk management process.

Among the studied organizations, the CO shows, in general, a higher score on risk management maturity. The CO has developed its own risk management guideline, which has to be used from the start of each project. Besides, the CO actively used a project database to keep the project information up-to-date. This suggests that risk management is better established at the CO. In contrast, the POs, as exposed by the interviews, have either no defined risk management process or the risk management process is not actively used in their projects. The Experts in the POs mentioned that it was for a large part up to the project team to decide on how to set up risk management. According to one of the experts: "It would be helpful if there is a risk management framework for the organization... each project has its own kingdom" or "There is no instruction or guideline on how to deal with risk management. As a project team, you decide how you fill it [risk management] in, and because there is no control it can lead to not paying attention to it." This can clarify the difference between the CO and the POs in the aspect 'Policy and Strategy'.

One clear difference between the POs and the CO is the risks they decide to mitigate ('Risk Treatment' aspect). This has direct relation with the risk appetite of the organizations ('Policy and Strategy' aspect). We observed that most of the experts had difficulties in understanding the term 'risk appetite'. This can explain the low

scores for the statements number 4, 5 and 13 in the 'Policy and Strategy' aspect. The ISO (2009, 10) defines risk appetite as "the amount and type of risk that an organization is prepared to pursue, retain or take." The POs in this study are part of the government that is responsible for executing public projects. These public projects are fully subsidised by the government. Mistakes at these projects can lead to critics from society. Therefore, these projects are less willing to take risks and try to avoid any kinds of risks. The experts in POs confirmed this: "We, as a public organization, are not willing to take risks." Likewise, "we are in an organization that has a culture of 100% safety; therefore, all risks should be avoided." Therefore, all the identified risks in these projects are mitigated. This can be seen in the 'Risk Treatment' aspect where the project does not apply any other risk mitigation strategy rather than 'reduce'. Besides, this causes that the POs have larger risk reservation and, as a result, higher budget estimates. On the contrary, the contractor, due to the competitive market, has to come with a reasonable bid. Therefore, they decide only the important risks for treatment. In contrast with the POs, the CO has an implicit 'risk appetite'. The interviews with the experts at the contractor revealed that only the risks with consequences higher than a certain amount of money (in this case 100.000 euro) are selected for treatment. Besides, the contractor divides the risks in three categories and only the risks in the second and third category with higher priority are quantified. Results from Figure 7, Figure 8, and Figure 9, illustrate that experts from all three organizations expressed that the communication and documentation about risk management should be improved.

A recommendation for the POs is to develop a risk management framework for the organization and its projects. Basically, it means making clear appointments between the internal stakeholders of the project about the level of risk assessment, treatment and monitor and review; interval times and goal and set up of risk sessions and reviews, responsibilities, agreements on risk reservation, communication, etc. This can be in the form of a risk management plan or as part of the integral project plan. At the contractor, more attention should be given to train the project team and to evaluate the risk management processes. Furthermore, in all studied organizations, documentation and communication of risk management demand more attention.

CONCLUSION

This research contributes to the existing literature by implementing a risk maturity model and discussing the areas of improvement in risk management of construction projects in the Netherlands. A Generic Risk Maturity Model (GRMM) was applied in one contractor and two public organizations by means of individual and group interviews. The results show that risk management is performed in the projects in the studied organizations, and most of the risk management steps are properly implemented. However, some steps can still be improved. Results reveal that the 'risk assessment' and 'management commitment' aspects have respectively the highest and the lowest risk management maturity score. For the public organizations, a possible improvement could be developing a framework for risk management.

LIMITATION AND RECOMMENDATION FUTURE RESEARCH

The limitations in this study can be considered as opportunities for future research. First, one of the limitations of this study is the number of organizations, which has been investigated. A possibility for future research can be to investigate more organizations. The authors will perform this study in more projects in the future. In this research, only the current risk maturity (scores in the column value) of the

projects is examined, whereas as a second recommendation it would be interesting to investigate this over time. Third, future research can also consider the scores on the ambition level. Finally, fourth, defining and comparing the risk management maturity of projects based on different roles in the project is another possibility for future research.

REFERENCES

- Flyvbjerg, B, Bruzelius, N and Rothengatter, W (2003) *Megaprojects and Risk: An Anatomy of Ambition*. Cambridge: Cambridge University Press.
- Hillson, D and Simon, P (2007) *Practical Project Risk Management: the ATOM Methodology*. Tysons Corner: Management Concepts Press.
- IACCM (2003) Organisational maturity in business risk management: The IACCM business risk management maturity model (BRM3).
- ISO (2009) *ISO Guide 73: Risk management - Vocabulary*.
- Johnson, R B and Onwuegbuzie, A J (2004) Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.
- Loosemore, M, Raftery, J, Reilly, C and Higgon, D (2006) *Risk Management in Projects*. London: Taylor and Francis.
- Mu, S, Cheng, H, Chohr, M and Peng, W (2014) Assessing risk management capability of contractors in subway projects in mainland China. *International Journal of Project Management*, 32(3), 452-460.
- Öngel, B (2009) *Assessing Risk Management Maturity: A Framework for the Construction Companies*. MSc Thesis, Architecture Department, Middle East Technical University.
- PMI (2013) *A Guide to the Project Management Body of Knowledge (PMBOK Guide) 5th Edition*. Newtown Square, PA: Project Management Institute.
- Ren, Y and Yeo, K (2004) Risk management capability maturity model for complex product systems (CoPS) projects. In: *2004 Engineering Management Conference*, 18-21 October, Singapore.
- Schiller, F and Prpich, G (2014) Learning to organise risk management in organisations: what future for enterprise risk management? *Journal of Risk Research*, 17(8), 999-1017.
- Tashakkori, A and Teddlie, C (1998) *Mixed Methodology: Combining Qualitative and Quantitative Approaches Volume 46*. London: Sage.
- Wendler, R (2012) The maturity of maturity model research: A systematic mapping study. *Information and Software Technology*, 54(12), 1317-1339.
- Yeo, K and Ren, Y (2009) Risk management capability maturity model for complex product systems (CoPS) projects. *Systems Engineering*, 12(4), 275-294.
- Zou, P X, Zou, W, Chen, Y and Chan, T-Y (2010) Understanding and improving your risk management capability: Assessment model for construction organizations. *Journal of Construction Engineering and Management*, 136(8), 854-863.