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Stretching risk management standards: multi-organizational perspectives

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Abstract

Purpose – Standard frameworks for project risk management (RM) are currently mostly focussed on single-firm organizations, whereas in practice, construction project RM involves multiple organizations. The purpose of this paper is to identify and systematically maps practical processes that bridge the gap between single-organizational RM standards and multi-organizational RM (MORM) needs.

Design/methodology/approach – This case study covers three large construction management (CM) projects in Finland. The 35 interviews with project owners, project management consultants, design groups, and contractors identify the participants' positions on RM roles, integration within organizations, and further development requests.

Findings – Most (16 of 21) of the identified RM practices are multi-organizational; i.e. they involve two or more organizations. Compared to single-organizational standards, MORM practices involve less emphasis on detailed risk analysis processes but highlight both participant selection and managing collaborative performance.

Research limitations/implications – The research results are attached to Finnish CM projects but may be applicable to other types of collaboration-based construction projects, such as alliances and public-private partnerships. The efficiency of the MORM model requires further evaluation in future research.

Practical implications – A model for MORM is a systematic presentation of the research results. The model provides guidance for efficiently setting up MORM processes and for refining multi-organizational research.

Originality value – The multi-organizational interfaces of RM processes are mainly overlooked in the current literature, standards, and frameworks. This research provides a rare explication of parallel MORM processes.

Keywords Project management, Multi-disciplinary, Risk management, Complexity, Organization, Collaboration, Project teams, Multi-organization, Standard

Paper type Research paper

Introduction

Project risk management (RM) enables project owners and other participants to identify, assess, and respond to the threats and opportunities that may influence project goals throughout a project's lifecycle. The scope of standard RM frameworks is frequently focussed on a single organization. However, large-scale construction project delivery is frequently based on a multi-organization, i.e. an amalgam of fragmented, but interdependent, companies who share pre-defined goals and schedules throughout a project (Walker, 2007). Therefore, the adaptation of RM frameworks frequently requires stretching the standard RM framework to embrace a multi-organizational perspective.

Most project-specific risks, such as constructability, change orders, and conflicts in documents need to be managed by a joint effort of the project participants

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(Rahman and Kumaraswamy, 2002). Multi-organizational collaboration is critically needed to mitigate complex risks with significant lifecycle impacts, such as trade-offs between occupational health and safety risks in the construction phase versus the operation phase (Lingard *et al.*, 2013), because these risks are often not identifiable or manageable by a single organization.

The necessary pre-conditions for successful multi-organizational RM (MORM) approaches are prescribed in literature as equitable risk allocation in contracts (e.g. Jin, 2011; Bing *et al.*, 2005), flexible, and relational contracting conditions (e.g. Osipova and Eriksson, 2011; Rahman and Kumaraswamy, 2002), and pain/gain sharing (e.g. Rahman and Kumaraswamy, 2002; Love *et al.*, 2011). However, the actual multi-organizational adaptation of RM processes is not elaborated in standards, guiding frameworks, or research. The literature is especially thin regarding RM applications that cover both contractual and non-contractual relationships in the project delivery organization. In practice, the inadequacies of the single-organizational RM frameworks need to be addressed on a case-by-case basis. The lack of systematic presentation may hinder the adoption of systematic MORM processes in construction projects.

The purpose of this work is to identify and systematically map RM processes as they appear in three large, multi-organizational CM projects in Finland. It seeks to reply to the industry's expressed need for a systematic MORM model, which facilitates effectively and efficiently utilizing and supporting the collaborative work in multi-organizational project RM as the basis for project success.

Multi-organizational complexity

The construction industry is based on a growing number of companies with a narrowing focus of differentiation. The participant firms are interdependent with each other through the project but independent outside the project. Organizational (or social) complexity is identified as the dominant type of complexity in large construction projects (Hertogh and Westerveld, 2010; Lehtiranta, 2011; Pryke and Smyth, 2006).

The management challenges in multi-organizational projects are based on the lack of prior collaboration or a clear structure of hierarchical authority (Janowicz-Panjaitan *et al.*, 2009), differing or contradictory objectives and practices (Lehtiranta, 2011), and conflicts at the interface between the project organization and the participants' parent organizations (Kenis *et al.*, 2009). Each company has its own management policies, processes, and tools, which must be fitted together in a multi-organizational structure. RM in construction multi-organization depends on the alignment or conflicts within several individual, single-organizational, and multi-organizational interfaces, as illustrated in Figure 1. For example, an individual project participant's perception of risk and participation in RM is influenced by viewpoints of the single-disciplinary project team and in the project multi-organization, as well as in the line organization.

Multi-organizational project delivery may be managed by understanding the roles and complexities of project owners, actor networks, and end-users, including formal and informal structures of the multi-organization (Lehtiranta, 2011; Lizarralde *et al.*, 2011). To take this challenge, several researchers (Cicmil and Hodgson, 2006; Cooke-Davies *et al.*, 2007; Bredillet, 2010) have suggested to meet project complexity with complexity-based approaches to construction project management (PM) theory and practice. Primarily, the complexity-based approach guides the researcher (or practitioner) to address interfaces of integration, knowledge sharing,

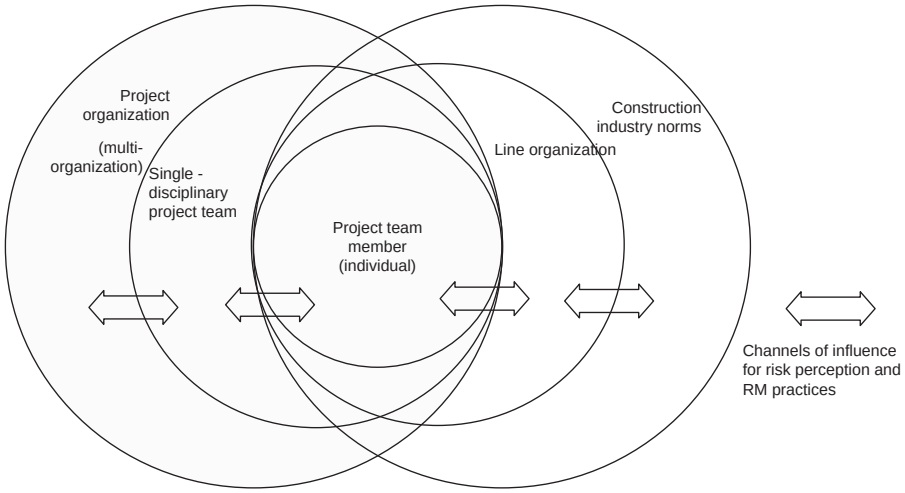

Figure 1.
The structure of RM related-interactions and influences in a construction multi-organization structure

Source: Adapted and amended from Lehtiranta (2011). With permission from ASCE

and communication. The productivity of multi-organizational project delivery can only be increased through improved collaboration (Latham, 1994). These views are adopted in this study.

Construction management (CM) projects

CM is a delivery method where a professional, consultant-like construction manager leads the project in close collaboration with the owner (Kiiras *et al.*, 2002). Three forms of CM co-exist in Finland, and these may be known by different names internationally. CM consultancy refers to delivery where a professional CM manages the trade contracts on behalf of the owner. In CM service, the CM also assumes the responsibilities of the main contractor, but all trade contracts remain signed by the owner. In the CM contracting variant, the CM takes on financial risk and manages the trade contracts.

CM projects are more organizationally complex and risky than the traditional Design-Bid-Build delivery. Special risk sources in CM projects stem from the broad collaboration between the participants, incomplete designs when contracts are made, splitting the construction works into several (sometimes numbering in the hundreds) trade contract, and concurrent implementation of design and construction works (Keinänen, 2009). CM projects embed various requirements for collaboration and management between multi-organizational participants who do not share a contract. Therefore, CM projects require an extensive amount of interdisciplinary coordination and flexibly complementing traditional PM approaches by bridging the gaps of contractual borders with advanced interdisciplinary management structures. The interfaces for authority, influence, and knowledge sharing are not adequately described by contractual relationships and traditional responsibilities, as illustrated in Figure 2.

Project RM

Project RM is a process of "conducting risk management planning, identification, analysis, responses, and monitoring and control on a project" (Project Management Institute, 2009).

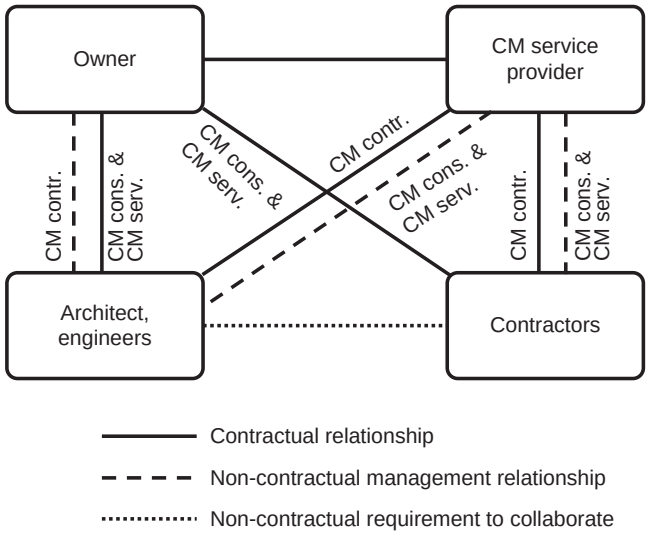

Figure 2.
Contractual and non-contractual collaborative relationships in CM projects

RM principles may be presented on a general level to fit any form of risk within any scope or context (ISO 31000:2009 – Risk management: Principles and guidelines, 2009). RM is not only a process or methodology but also connected to the organization's preparedness of responding to risks as they arise (Bannerman, 2008).

In large construction projects, the traditional, structured, and systematic RM frameworks have become common. Project RM applications are guided by standards, such as the PMBOK practice standards for project RM (Project Management Institute, 2009) and the APM body of knowledge (Association for Project Management, 2006). Practical applications are further supported by the standard-like RM frameworks, such as the construction project RM process by Flanagan and Norman (1993) and the risk analysis and management for project processes by the Institution of Civil Engineers (2005).

RM should be "aligned with the organization's external and internal context and risk profile" (ISO 31000:2009 – Risk Management: Principles and Guidelines, 2009). In a multi-organizational context, it is clear that no individual party can exclusively run effective RM. The key for managing construction projects successfully is in the way in which the contributors are organized so that their skills are used at the right time and right way (Walker, 2007). Also RM frameworks may be founded in collaboration to support information sharing and response coordination (Rahman and Kumaraswamy, 2002).

Yet, a handful of researchers have described RM practices explicitly in multi-organizational contexts. Lichtenberg (2000) recommends involving a multi-disciplinary team for risk identification, analysis and response, and Rahman and Kumaraswamy (2005) propose joint RM to unify the efforts of major contracting parties. Osipova and Eriksson (2011) argue that successful MORM requires the support of collaboration agreements and incentives. Partnering- and alliancing-related concepts of RM (Bresnen and Marshall, 2000; Chan *et al.*, 2004) aim to direct the research focus from risk allocation (i.e. procurement) to sharing and caring for risks. A common nominator for MORM concepts is the utilization and sharing of collective knowledge for the best of the project.

Research methodology

The case study approach allows capturing rich information and retaining a holistic and meaningful picture of complex contexts (Barrett and Sutrisna, 2009). The three case studies of large-scale construction projects undertaken by professional public and private clients representing both building and infrastructure construction are summarized in Table I.

The selected projects involve multi-organizational approaches to RM and employ professionals interested in developing MORM. The case projects are unusually large, unique, and/or time-pressured public or private construction projects, where the owner needs or wants to be involved throughout the project.

In the absence of exhaustive RM process maps information needed to be retrieved from project participants. Interviewing enables both identification of complex links between practices that are assigned varying names and functions depending on the interviewed individual and discussing future development needs without being limited to the researchers' prior knowledge; these would not have been possible with a survey method.

A total of 35 semi-structured theme interviews were conducted between March 2011 and October 2012. Case 1 is represented by six interviews, case 2 by 20 interviews, and case 3 by nine interviews. The interviewees are aimed to represent a holistic overview of the key participants of large construction projects: seven owner representatives, two PM consultants, 12 construction managers/CMs (who are PM consultants or main contractors, depending on the CM variant), five architects (who represent the design group), four designers/engineers, two contractors, two user representatives and one external RM expert.

The analysis of the interviews focussed on building an understanding on themes related to integration within RM processes, as guided by the selected complexity-based approach: the interviewee's role in MORM, multi-organizational interfaces that are covered and not covered by RM processes, and the desirable future of MORM. Describing the role of the participant (group) in MORM was based on identifying their comments on which risks they are interested in and on how they are involved in managing risks. Results on multi-organizational integration of RM are based on participants' descriptions on what types of processes they are involved with. The processes were deemed collaborative if they involve participants from two or more organizations. The participants' expressions of development needs were observed related to any of the processes or integration (e.g. missing links between companies related to RM collaboration).

The interview structure was tailored to suit each occasion based on the interviewee's role and the researcher's prior knowledge about the project. Therefore, the interview method enabled simultaneous and cyclical data collection and analysis. All interviews were carried out by a single researcher. The majority of the interviews (27) were tape-recorded and transcribed. The rest of the interviews were captured in research diaries. These records were revisited after all interviews were carried out. Finally, the synthesis of the analysis was completed by constructing a MORM model, which is based on observed needs to extend and complement the single-organizational standard RM framework of PMBOK (Project Management Institute, 2009).

Results

The MORM roles

Owners. The owners were more concerned about risks related to the investment, stakeholder network, collaboration, and politics than other participants. Some items

Table I. The case studies

	Description	Delivery method	Schedule	Data
Case 1	Music center 38,000 m^2 ca. 170 M€	CM contracting owner-client: public, professional government property manager	Design 2001-2011 (incl. interruptions) construction works 2006-2008/2011 interviews made 4-5/2011	6 interviewees 2 owner representative 2 PM consultants 1 architect 1 CM (main contractor role)
Case 2	Shopping center 60,000 m^2, over 80 commercial tenants	CM service owner-client: private professional large, stock-listed retail sector company	Design 2008-2011 (with break) construction works 11/2010-9/2012 interviews made 3/2011-10/2012	20 interviewees 4 owner representatives 7 CMs (main contractor role) 2 architects 4 engineers 1 contractor (trade contractor role) 2 user representatives
Case 3	Metro line extension 14 km, 8 stations ca. 714 M€ (target)	CM consultancy developer-client: public professional company established for the project purpose	Design 2007-2014 construction works 2009-2015 (target) interviews made 6-10/2012	9 interviewees 1 owner representative 4 CMs (PM consultant role) 2 architects 1 contractor (main contractor role) 1 external RM expert

about the owners' risk lists are not part of any other delivery team members' interests, such as taxation and tenant acquisition. However, several client responsibilities, such as permits, user information management, and, in some cases, design management influence the decision making and construction schedule, indicating that they are contractors' concerns as well. Information management and decision making within the owner team was identified involving significant uncertainty and management needs in all cases. "Most challenging has been the integration of communication networks. That is, to connect the people, information, meeting practices, so that it works" (Case 1 Owner).

The fit for use required risk identification and management in collaboration with the architects, engineers, and contractors. For example, the functionality of the music center acoustics in case 1 and the experience and response of the potential customers of the shopping center in case 2 were the keys for success. "What if we kept to the budget and schedule but no-one would use the shopping mall? Would that be a successful project?" (Case 2 Owner). In case 3, the owner's main target is to create a safe, functional, and comfortable metro line for the public, which requires broad design and CM collaboration with a focus on quality.

The owners regard the construction phase as being significant determinant of their goals. Generally, they are more concerned on the risks that relate to the multi-organizational collaboration itself than to the technical solutions. In CM projects, an important share of cost and quality optimization occurs during the project in collaboration with the project's owner, consultant, architect, and main contractor(s). The owners in all cases are actively involved in the project's supervision with an interest on their investment and image. "I want to know everything that matters on site works. Rather too much than too little. And I'm the one they (media) call if there is something to ask. I rather hear it from the site first" (Case 3 Owner).

Main contractors. The main contractors regard their role in project RM mainly in terms of schedule and safety management. "Design and risk management through scheduling" (Case 2 CM). The schedule marks the baseline for expectations and the foundation for RM. "Different kinds of risks are included (in the schedule review) that emerge from this location, weather, and if a sub-contractor is unable to perform" (Case 1 Main contractor).

The contractors' stance regarding risks is purely on the threat side; deviations from the already tight construction schedules and costs are rarely positive. Often the risks are connected to other parties, typically designers. "The worst risks are in the designers, in fitting together procurement and design activities" (Case 2 CM). For example, "designs are delayed or there is a lack of clarity in designs" (Case 3 Contractor). Obviously, safety deviations may only be regarded as being negative. From the contractors' perspective, the complex owner organizations and complicated design management procedures are threats as well.

PM consultants. The PM consultants are in a role that aims to integrate the actions of the other parties. Therefore, the interviewed PM consultants raised risks related to both investment and site management. In RM processes, they are in the role of gathering and sharing risk information. Therefore, they are familiar with the ambiguous or divergent perceptions of risk. "The biggest problem in RM at the moment is that we must understand what the risk is. – What is a risk for the contractor is not a risk for the owner or for the contractor, and vice versa" (Case 3 PM consultant).

The PM consultants' primary task is to supervise the performance according to the owner's goals. This may involve work on identifying and prioritizing the

goals, too. "Upper management risk has been related to having three owners (end users). – Always in the production there are terribly many different interests. – They (end users) have been strongly involved in the design management" (Case 1 PM consultant). On the other hand, the PM consultants' success criteria are close to those of the contractors: construction schedule, time, and quality. The aim is to identify "unusual, unique risks" (Case 3 PM consultant) related to the construction works. "It is a constant process, this scheduling. – this kind of fitting together (of design and procurement packages)" (Case 1 PM consultant).

Design group. The architects' and other design and engineering professionals' role in the case projects' RM is that of the owners' advisor. These professionals are generally not an active part of any systematic RM procedure but participate when asked. "We have not thought of our own specific goals in RM, other than what are the goals of the owner or whole project" (Case 3 Architect). The architects' involvement in the projects starts long before that of the PM consultants and contractors. Therefore, they regard their expertise as being most valuable in the early phases of the project. They perform tasks related to risk identification in the early phase of the project in collaboration with the owner, although the tasks are not necessarily labeled as being RM.

Again, the ability to adhere to the schedule is viewed as an important risk. "The design schedules can only be expected to hold when we know what to design, but here the related land-use is developing concurrently, and it's impossible to create an unified schedule" (Case 3 Architect). Other main risks that the architects raise are related to their own, special designers and engineers' resources as well as information management. "If we were to make a risk-free selection (of a design firm), we could not choose poorly resourced design work" (Case 1 Architect).

Multi-organizational integration for RM

A total of 21 practices, processes or tools for RM were identified in the case projects, as summarized in Table II. The results indicate that in practice a significant share of the RM processes are based on multi-organizational collaboration; 16 of the identified RM practices include the collaborative participation of two or more of the reviewed key participants. The majority, i.e. 15 of the identified processes are common to more than one case project in some form. Furthermore, the practices are matched against the process steps in standard RM (Project Management Institute, 2009), which enables observing differences in coverage.

The adaptations of the RM process to the multi-organization include collaborative processes, such as meeting procedures, workshops, and multi-directional performance feedback. The practical RM processes are focused on risk identification and response planning, whereas risk analysis is clearly an overlooked area of RM in practice. Risk analysis is addressed as an intuitive part of risk identification and response planning.

Needs for further development

The MORM procedure must include clearer responsibilities and more frequent or predictable updating practices. Some roles such as the architect, designers and engineers, and (trade) contractors, are underutilized. "If we think that our role is to eliminate the sort of risks in the designs that relate to life span or economic end result, the utilization of the head designer team would be important to a larger extent" (Case 3 Architect). Furthermore, the planning and communication of each role, especially the owners' role, should be conducted transparently.

Process equivalent in PMBOK	Identified RM Practices / Multi-organizational participants	Owner	Architect	Project consultant	Main contractor
Plan risk management	Risk management plan	Responsible for investment-related RM process design (1, 3)		Responsible for project risk management process design (2)	Responsible for construction works-related RM process design (1)
Plan risk management Plan risk responses	Procurement strategy	Aims to align contractual interests with project goals in design and main construction works contracts (1, 2)		Aims to align contractual interests with project goals in main construction works contracts (1, 2)	Aims to align contractual interests with project goals in sub-contractor contracts (1, 2)
	Tenders and contracts	Performs RM competence evaluation as a part of CM service provider selection (2)	← →	Presents a RM plan (2) Requires the subcontractors to perform a risk review by the contract kick-off (after selection) (2)	
		Participates in contract-specific RM planning (3)	Participates in contract-specific RM planning (3)	Hosts contract-specific RM planning, prepares tender documents based on plan (3)	Takes over contract-specific RM plans after selection (3)
Identify risks	Project risk identification workshop	Hosts a kick-off workshop focussed on goal communication and risk identification (2, 3)	Participates in a kick-off workshop focussed on goal communication and risk identification (2, 3)	Participates in a kick-off workshop focussed on goal communication and risk identification (2, 3)	Participates in a kick-off workshop focussed on goal communication and risk identification (2)
Identify risks Perform qualitative (and quantitative) risk analysis	Risk mapping	Internal risk mapping for large investment projects (1) Provides updates at the management board's request (1)		Manages the project risk chart (2, 3)	Performs a risk review for internal purposes (1) Internal performance audit (1)
Identify risks Perform qualitative (and quantitative) risk analysis Plan risk responses	Project RM group	Hosts the project RM group that identifies, analyses, and assigns resources for project risks, involving authorities and external experts (3)	Participates in the project RM group (3)	Participates in the project RM group (3)	
	Risk list	Initiates the risk list incl. results on identification, analysis, and response planning (3)	Contributes to the risk list incl. results on identification, analysis, and response planning (3)	Contributes to and manages the risk list incl. results on identification, analysis, and response planning (3)	Manages the contract-specific risk list incl. results on identification, analysis, and response planning (3)

Table II.
Identified RM processes in the case projects

(Continued)

Identify risks Plan risk responses	RM theme groups	Hosts the RM theme groups that identify and plan responses for specific risks (e.g., logistics, ground works etc.). Involves authorities and external experts. (3)	Participates the RM theme groups (3)	Participates the RM theme groups (3)	Participates the RM theme groups (3)
	Design meetings & design reviews	Identifies and manages risks related to user information (1, 2) Identifies and manages risks related to design solutions (1, 2, 3)	Identifies and manages risks related to user information (1, 2) Identifies and manages risks related to design solutions (1, 2, 3)	Identifies and manages risks related to user information (2) Identifies and manages risks related to design solutions (1, 2, 3)	Identifies risks related to construction schedule, safety, costs, and feasibility in design reviews (1, 2, 3)
	Cost-saving workshops	Seeks innovative opportunities for cost savings through design development (1)	Seeks innovative opportunities for cost savings through design development (1)	Seeks innovative opportunities for cost savings through design development (1)	Seeks innovative opportunities for cost savings through design development (1)
	Site steering group	Identifies and manages risks related to site performance (1, 2, 3) Identifies potential threats related to collaboration with the main contractor (1)		Identifies and manages risks related to site performance (2)	Identifies risks related to the owner's operations (1, 2, 3)
	Site meetings	Risk discussion forum with sub-contractors (2)		Risk discussion forum with sub-contractors (1, 2)	Risk discussion forum with sub-contractors. Risk items on agenda (1, 2, 3)
	Sub-contractor meetings				Risk discussion forum with sub-contractors (1)
	Collaboration with authorities	Plans for upcoming project issues with consultation of authorities (1, 2, 3)	Plans for upcoming project issues with consultation of authorities (1, 2, 3)	Plans for upcoming project issues with consultation of authorities (1, 2, 3)	Plans for upcoming project issues with consultation of authorities (1, 2, 3)
	Project feedback	Initiates project feedback collection and sharing in the middle of project (2)	Utilizes feedback results for improved practices and performance (2)	Initiates project feedback collection and sharing at the end of the project (2) Utilizes feedback results for improved practices and performance (2)	
	Take-over planning	Identifies issues and procedures for user take-over (1, 2)		Identifies issues and procedures for user take-over (1, 2)	

(Continued)

Table II.

Plan risk responses	Risk response plan	Manages a chart of assigned responsibilities for the investment risk response (1) May be assigned risk response responsibilities (2)	May be assigned risk response responsibilities (1, 2, 3)	May be assigned risk response responsibilities (1, 2, 3) Manages a chart of assigned responsibilities for the project (2, 3)	May be assigned risk response responsibilities (1, 2, 3) Manages site schedule related risk response plan (1)
	Small groups	Participates in response to specific issues if needed (1, 2, 3)	Participates in response to specific issues if needed (1, 2, 3)	Participates in response to specific issues if needed (1, 2, 3)	Participates in response to specific issues if needed (1, 2, 3)
Identify risks Plan risk responses Monitor and control risks	Owner's steering group	Manages user information and responsible for making users understand their role in the project (risks) (1, 2) Supervises and guides project RM (3) Forum for updating risk response plans (1, 2, 3)			
	Schedule management	Regards as crucial for project RM success (1, 2, 3) Participates in planning and reviews of design schedule (1, 2, 3)	Participates in planning and reviews of designing schedules (1, 2) Manages the planning and reviews of designing schedule (3)	Manages design schedule (1) Participates in planning and reviews of design schedule (2, 3) Manages construction schedule (cs) (2) Participates the planning and reviews of construction schedule (1, 3)	Considers as the main tool for RM (1, 2, 3) Manages frequent reviews of construction schedule (1, 2, 3) Construction works' risk analysis phase by phase (1)
Monitor and control risks	Continuous supervision	Regards as crucial for project RM success (1, 2, 3) Participates supervising the main contractor (1)		Regards as crucial for project RM success (1, 2, 3) Participates supervising the main contractor (1, 3)	Regards as crucial for project RM success (1, 2, 3) Participates supervising the sub-contractors (1, 2, 3)

Notes: Relevant case projects are marked in parentheses (1, 2, 3). The link symbols refer to multi-organizational interfaces where the process is shared by the marked participants. Where the participants sharing the RM process are not represented in adjacent columns, the link is marked with a double-ended arrow

Table II.

The thoroughness of MORM practices should involve parties through smart procurement practices more systematically than in the past. "If risks are to be shared, goals and interests need to be shared" (Case 1 Owner) "The (sub)contractors need to be involved" (Case 2 CM). "We would be interested in being assessed by our understanding on project risks in the tender phase" (Case 1 Architect, Case 2 Contractor). "In smaller contracts, RM could (still) be taken in after the contractor selection but in larger already in the tender phase" (Case 2 CM).

RM collaboration should be extended to participants other than those working in the delivery organization – most importantly, end users and key authorities. A key success criterion is that "the take-over of the building is successful. And then they start paying you rent, and you start to gain back the money you invested from the satisfied client" (Case 1 Owner). Therefore, the end user processes must be thoroughly planned as part of RM. Similarly, RM requires collaboration with authorities and other experts. The management of such a variety of stakeholders and risk knowledge requires advanced processes. Multi-organizational risk identification and treatment at the multi-organizational level may require polishing.

Finally, learning is regarded as part of RM development. The development in the future "would require gathering the footage on where risks appeared even though there were tools for RM" (Case 2 Owner). Therefore, the development of functional lessons learned, rather than the unutilized data banks, would be crucial.

Toward systematic MORM

At the time of writing this paper, case projects 1 and 2 have been finished and deemed successful. Case project 3 is under construction and is so far on track to meet objectives. The project results imply that the project RM procedures have been adequate and successful. Therefore, the results provide useful material for contrasting against and complementing existing RM literature and standards in search of development opportunities.

Although all the activities listed in the PMBOK RM standard process were found within the case studies, the sequence, and proportions do not conform to the standard. Four key differences stand out from the multi-organizational RM practices compared to the process depicted in the PMBOK standard RM process:

(1) The "generic" RM process described in the standards is, in reality, spread among the participants and several forums in the multi-organization. This implies that to adapt the standards (such as PMBOK by Project Management Institute, 2009) to the project organization (ISO 31000:2009), considerable work needs to be done in each project. Risks are handled from diverse perspectives depending on the role of the participant, and there is usually no universal, systematic procedure for the collection of the risk data. Many of the interviewees sought more systematic procedures but the system for collecting risk information would need to be able to differentiate between different levels of risk according to the expertise and interest of each participant. However, these concerns are hardly discussed in literature, which implies a significant research gap.

(2) MORM processes will only function efficiently if all participants have a similar understanding of the risks and an incentive to participate in handling them. This understanding addresses the importance of the early phases of the participants' relationship, and is related to procurement and incentive

strategies. The multi-organizational project owner (or PM consultant) must also plan the process of selecting and committing the key participants for MORM. The need for additional collaboration or partnering agreements was not identified by the participants. However, they did address the need for aligning contractual incentives by providing payment schemes that support accomplishing project objectives. To facilitate collaborative RM it may be useful to apply the principles of relational contracting, as described by Lahdenperä (2009). For instance, Ling *et al.* (2006) and Osipova and Eriksson (2011) recommend more contractual incentives to align the goals and create opportunities for increased participation. Several participants mentioned the willingness to be assessed by their ability to demonstrate RM competence in the tendering phase. Devising this inclination would improve integrating project key participants as part of MORM. Furthermore, the architects and designers/engineers are frequently left out of contractual incentives, i.e. profit sharing although their role in RM is significant. The explanation of the owners' goals is sometimes described as a specific step of the RM process (e.g. Lichtenberg, 2000) and a good number of studies address RM considerations related to contractor selection (e.g. Kashiwagi, 2010). The importance of these RM considerations would be better appreciated if they were added as an explicit step in the MORM process, which is currently rare.

(3) The activities involved in the identification and analysis of risk are in practice intertwined. Risk analysis in the case projects is often intuitive, and the main assessment is simply made between the qualitative categories, "significant" and "insignificant." The finding aligns with Chapman and Ward (2004) who suggest that the "best practice in project RM is concerned with managing *uncertainty that matters* in an effective and efficient manner." The identified processes seem to be more based on heuristics and intuition than calculative analytics, as described by Slovic *et al.* (2004). Forbes *et al.* (2008) point out that there are numerous tools to support risk analysis but they are hardly used. In this study, quantitative risk analysis appears to be practically relevant only in investment risk analysis and not during the construction project. However, most research on risk analysis focusses on analytic reasoning. These findings suggest that research should rather be concerned with understanding and supporting the mechanisms of assessing what type of uncertainty matters and how to identify and manage it. Alternatively, the finding can be taken as a challenge of identifying or innovating the quantitative techniques that would, in fact, fit into the project practice resulting into less biased and more easily visualized risk information.

(4) The functionality of multi-organizational collaboration must serve as the foundational "tool" for MORM. Several interviewees indicated that motivation for MORM must be based on functional collaboration and that the same practices that are used to facilitate RM be used to improve conditions for collaboration. Therefore, the monitoring and controlling of collaborative performance should be an acknowledged part of the RM process. Relational contracting and the collaboration-based project delivery models give a good foundation for MORM (Osipova and Eriksson, 2011; Bresnen and Marshall, 2000; Chan *et al.*, 2004), but more specific processes need to be added to utilize

and support collaboration for RM. For example, the multi-organizational project feedback system that was used in case project 2 may be utilized for collecting information on multi-organizational performance. The results enable the identification of risks for project performance as well as the development of ideas for improving the efficiency of collaborative work.

Practical implications

The success of construction projects depends increasingly on the collaboration and coordination between multi-organizational participants (Latham, 1994). In volatile construction projects, comprehensive processes enabling RM, and (fast) learning as integrated parts of project management will play key roles. Therefore, guidance on setting up MORM processes will be valuable, and the results of this study aim to establish feasible hypotheses regarding useful processes in CM projects.

Murtonen and Aaltonen (2009) reason that new RM practices and tools must be fitted to the existing working practices and project environments to enable the smooth implementation and systematic utilization of practices. Therefore, the identified differences between practice and theory (standards) may be utilized as a basis for complementary RM frameworks in multi-organizational contexts.

Suggested amendments to the RM standard process flow, based on the research results, are illustrated in Figure 3. The novel RM process is designed to better fit the requirements of construction multi-organizations and is herein called MORM. The MORM process is further detailed into several parallel processes occurring in the key participant organizations.

Limitations and needs for further research

It is not within the scope of this (or any other) case study to draw conclusions regarding particular causal relationships, prove any RM process' success, or to provide widely generalizable results. The findings of the empirical study must be interpreted consciously of their context. First, the cases represent unique, large-scale CM projects, which are run by professional owners. The described practices may not be practical in smaller projects, in the case of one-off owners (non-professionals), in non-CM projects, or in countries with differing project participant roles. However, similar processes may be applicable in other collaboration-based construction projects, such as alliancing, and partnering, which require sharing information between the owner, architect, designers, and contractors throughout the project delivery lifecycle.

Second, the case project sample is naturally only partly representative of CM projects in general, as the aim of this exploratory type of research is to produce analytical, rather than statistical, generalizations (Yin, 1993). The cases were purposefully selected to represent successful projects with a known interest in advanced MORM approaches, not average current practices in the construction industry. It is feasible that more and/or different multi-organizational RM practices may be found in other projects, other countries, and other industries.

Third, the owners' view is proportionally dominant. The project owners in this study were found to be active and already to be relatively advanced risk managers in the early phase of the project, which is a significant pre-condition for successful RM. The inclusion of users and other stakeholders would be useful to improve the coverage of the MORM process. Future research should be directed toward efficient methods of including these users in multi-organizational RM.

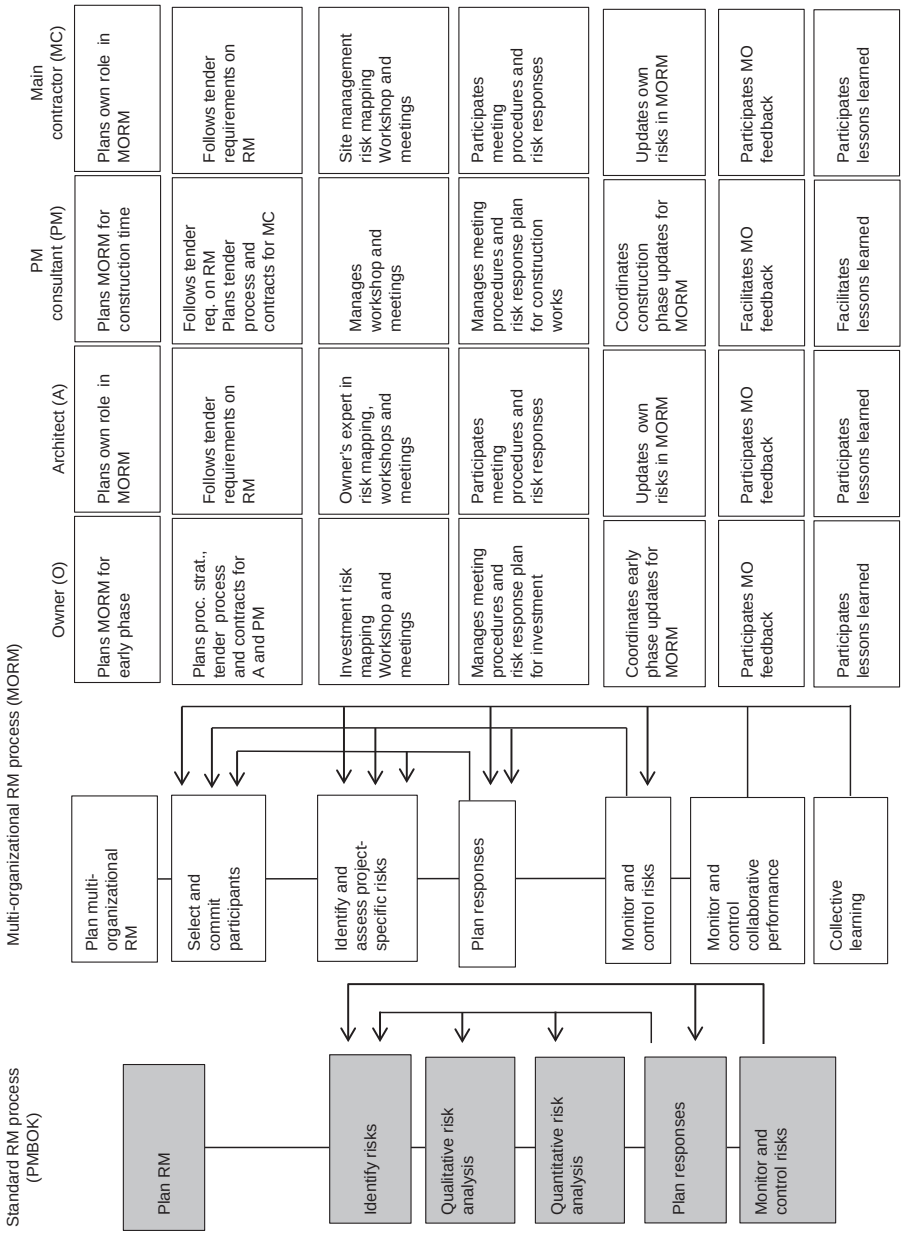

Figure 3.
Project RM flow diagram in PMBOK contrasted with the complementary and parallel processes in MORM

At this point, the suggested MORM model can be taken as a hypothesis of feasible and beneficial RM processes, which may be validated and further developed in future projects. For example, a certain risk theme, such as sustainability, could be selected as a starting point for a study that aims to draw conclusions regarding the effectiveness of MORM.

Conclusions

This study identified practical processes that aim to bridge the gap between single-organizational RM standards and MORM needs. The 35 interviews with Finnish CM project owners, PM consultants, design groups, and contractors uncovered the participants' appropriate roles in MORM, the practical interfaces where RM activities are integrated with other participating organizations, and future development needs of MORM.

The results challenge the typical single-organization-focussed RM standards. Most (16 of 21) of the identified RM practices are multi-organizational; i.e. they involve two or more key organizations. Notably, not all useful channels for sharing RM knowledge exist only between contractual parties. These multi-organizational (especially non-contractual) interfaces of RM processes are overlooked in the current literature, standards, and frameworks.

The results are mapped as a systematic presentation of parallel RM processes in the multi-organizations formed of CM project owners, CMs, architects, and contractors, here called the MORM model. These complementary RM processes stretch traditional, standard-based, single-organization focussed RM processes beyond discipline-specific organizational boundaries. The model is intended to guide CM project managers in more efficiently setting up the RM process.

The advancement of RM research and standards would benefit from adopting the multi-organizational project structure as a starting point for RM process design, not only as a source of risk but also as an organizational interface to be mobilized for effective RM. From a research perspective, theoretical bases addressing multi-organizational complexity are useful.

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