From project-oriented to process-oriented risk management in construction

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Abstract

The paper sets out the results of a questionnaire survey and a series of interviews with clients, contractors and consultants involved in nine construction projects recently undertaken in Sweden. Despite the fact that risk management was a part of each project, many projects suffered from variations in cost affecting one or more actors. Risk management was not carried out systematically in those projects. Both identified and unforeseen risks often occurred in the projects and generally had a significant effect on the project cost. The purpose of the paper is to examine project risk management in practice and to understand how managing project risks from a process-oriented perspective could improve the situation. In particular, the involvement of the actors in risk management in individual projects is examined. Risk transfer and communication of risks between the project phases are explored. Finally, the factors that determine whether or not the actors consider an open discussion on risk management and risk sharing as beneficial are analysed. The main conclusion is that a shift from project-oriented to process-oriented risk management is required.

Keywords: Risk management, construction, Sweden, process modelling

1. Introduction

According to a report of the Swedish Construction Commission [1], increased construction costs, project delays and deviations in quality are the most common problems in the construction industry. Risk management is a process that aims to maximise opportunities and minimise the consequences of a risk event and is an important part of the project management process. As such, it is intended to help in safeguarding project objectives, even to increase their value to the client. When considering the effect that risk management has on the project’s goals in terms of quality and cost, it would be reasonable to expect that it was an open process across all phases of the project. Furthermore, a specific project risk should be managed by the actor who is best able to deal with it. Instead, it is often the case that the various actors try to avoid risks as far as possible and let somebody else in the value chain deal with them. Relatively little attention has been paid in the Swedish research community to deeper investigation of the possible changes in the traditional construction process in which each actor focuses on short-
term economic results and protects his/her own interests rather than the whole project. The purpose of the paper is to examine project risk management in practice and to understand how managing project risks from a process-oriented perspective could improve the situation.

The paper sets out the results of a questionnaire survey and a series of interviews with clients, contractors and consultants involved in nine construction projects recently undertaken in Sweden. The objective of the study is to explore the factors that lead, more or less, to effective risk management in the projects. In particular, we examine the actors’ understanding of risk management process and their involvement in risk management in individual projects. We analyse risk transfer and communication of risks between the project phases. Finally, the factors that determine whether or not the actors consider an open discussion on risk management and risk sharing as beneficial are analysed. Since the paper focuses on the findings of research, most space here is given to reporting empirically-derived findings instead of presenting familiar arguments on the nature of risk and the purpose of the risk management process. Nonetheless, we outline the critical issues connected with the risk management process and its application within the construction industry.

Project risks are uncertain events or conditions that may have an impact on project objectives [2, 3]. A risk has a cause and, if it is triggered, also a consequence. A questionnaire survey conducted by Akintoye and MacLeod [4] shows that the majority of project actors perceive risk as a negative event. Ward and Chapman [5] discuss the concept of risk in detail and suggest using the more general concept of *uncertainty*. Risk management is a formal process directed towards the identification, assessment and response to project risks [2, 5, 6]. Risk identification is aimed at determining potential risks, i.e. those that may affect the project. There are several approaches to classifying project risks and risk sources [7-10]. In general, the sources of risk in construction projects may be divided into external risks (e.g. financial, economic, political, legal and environmental), internal risks (e.g. design, construction, management and relationships) and force majeure risks. Several surveys conducted among construction industry actors [4, 11, 12] show that checklists and brainstorming are the most often used techniques in risk identification. During risk assessment, identified risks are evaluated and ranked. The goal is to prioritise risks for management. Several authors [4, 11, 12] cite subjective judgment, intuition and experience as being most commonly used in risk assessment. The risk response process is directed to identifying a way of dealing with project risks and consists of three main techniques: risk reduction, risk transfer and risk retention [13]. Baker et al. [14] identified risk reduction as the most frequently used technique within the construction industry in the UK. Our treatment of risk management in this paper follows broadly along the lines outlined above in terms of the recognised stages in that process.

### 2. Research Approach

The main part of the study was a questionnaire survey followed by a series of interviews with project actors. The survey sample comprised clients, contractors and consultants who employed risk management in a given project. The respondents from the client’s side were the representative signing the contract and the project manager. From the contractor’s side the
respondents were the representative signing the contract, site manager and estimator. Finally, the respondent from the consultant’s side was the architect or design manager.

A draft questionnaire was developed consisting of five sections. The first section contained general questions about the respondent. In the second section, aspects of the risk management process through the different phases of the project were covered. The third section investigated relationships between the actors in the project. The fourth section focused on software management systems, which the company used in the risk management process. The fifth section was a concluding one for miscellaneous comments regarding the risk management process in the project. In total, 54 questionnaires were sent and 36 completed, usable responses were received, representing a two-thirds’ response rate.

Based on the compiled results of this questionnaire survey, 18 interviews across eight projects were then conducted. The objective of the interviews was a deeper analysis of the risk management process in the projects. Since it was impossible to interview all survey respondents within the time constraints, the number of interviewees was limited to the two or three persons responsible for risk management in the project. From the client side, it was a project manager, from the contractor side a site manager and from the consultant side an architect or design manager. Each interview took approximately one and a half hours and consisted of three main parts. First, the important definitions in risk management were discussed. Since the questionnaire contains the terms risk, risk management, risk identification, risk assessment, risk response etc., it is important to understand the perception of these terms by the respondents. Next, the results of the survey were presented and the respondents were asked to explain their answers. Finally, the respondents were given an opportunity to express their thoughts about risk management in the project.

3. Description of Construction Projects

The study involves nine construction projects recently undertaken in Sweden.

**Project 1** included the new construction of a house for meetings at the university campus in the northern part of Sweden. The project was executed over 15 months between 2003 and 2004. The contract sum was 41.1 MSEK and the final cost was 43.5 MSEK. Design-build, with a lump sum payment mechanism, was the chosen form of procurement. The project implementation was very good in terms of time and fairly good in terms of quality. In terms of budget, the project was very good for the client and fairly bad for the contractor. The identified risks occurred in the project, but their effect on the project cost was fairly small. The unforeseen risks during the project execution led to a fairly large increase in the project cost.

**Project 2** included the rebuilding, refurbishment and additional construction of university premises, located in the northern part of Sweden. The project was undertaken between 2004 and 2005 and took 10 months to complete. The contract sum was 17.9 MSEK and the final cost of the project was 19.6 MSEK. A lump sum payment mechanism was chosen and a performance-based contract was signed between the client and the contractor. The technical characteristics of
the final product were evaluated as high and the time constraints for project execution were kept. However, the poor quality of design documents increased the contractor’s costs significantly. Identified risks occurred in the project and had a large effect on the project cost; even so, the consequences of unforeseen risks were fairly small.

**Project 3** included the construction of infrastructure in the north of Sweden. The project was executed over 13 months in 2006 and 2007. The contract sum was 53 MSEK and design-build procurement, with a lump sum payment mechanism, was chosen. The project execution in terms of function, time and cost was fairly good. Both identified and unforeseen risks occurred in the project and had a moderate effect on the project cost.

**Project 4** included the construction of a road in the north of Sweden and was performed under 14 months between 2005 and 2006. The contract sum was 19.7 MSEK and the final cost was 24.5 MSEK. The contractor was procured on a performance-based basis, with a lump sum payment mechanism. The project implementation was fairly good in terms of cost and function and very good in terms of time. Both identified and unforeseen risks occurred in the project and had a fairly large effect on the contractor’s cost.

**Project 5** included the construction of a road in the north of Sweden and took 10 months between 2005 and 2006 to complete. The contract sum was 4.9 MSEK and the final sum was 4.7 MSEK. The performance-based form of procurement with a lump sum payment mechanism was chosen. The project execution was fairly good in terms of function and cost and fairly bad in terms of time. An insufficient geotechnical survey led to identified risks occurring in the project, but their effect on the project cost was fairly small. No unforeseen risks occurred.

**Project 6** included the construction of a residential building in Stockholm. The project was executed between 2005 and 2006 and took 17 months. The contract sum was 81 MSEK and the final sum was 84 MSEK. The procurement form was design-build, with a lump sum payment mechanism. The quality of the final product was evaluated as very good, time constraints were kept to a fairly good level. In terms of cost, the client evaluated the project execution as very good while the contractor’s evaluation was fairly bad. Both identified and unforeseen risks occurred in the project, but had a fairly small effect on the project cost.

**Project 7** included the reconstruction of a residential building in Stockholm and was executed over 12 months between 2004 and 2005. The contract sum was 47.7 MSEK and design-build procurement, with a lump sum payment mechanism, was chosen. The project implementation was very good in terms of time and function, very good in terms of cost for the client and fairly good for the contractor. Neither identified nor unforeseen risks occurred during the project execution.

**Project 8** included the reconstruction of infrastructure facilities in Stockholm. The building period was three years between 2004 and 2007. A performance-based contract with a lump sum payment mechanism was chosen for the project. The contract sum was 95 MSEK. In terms of cost, project implementation was very good for the contractor and very bad for the client.
Unforeseen risks caused significant delays and high costs for the client. The quality of the final product was fairly good. The identified risks occurred and had an impact on project cost.

**Project 9** included the reconstruction of a residential building, located in Stockholm. The reconstruction was executed in 2005 and took 6 months. The project was implemented as a form of partnering with a cost reimbursable payment mechanism. The contract sum was 15 MSEK. The project implementation in terms of function, cost and time was good. Together, the client and the contractor succeeded in decreasing project costs. Both identified and unforeseen risks occurred in the project, but did not have a large effect on the project total cost.

### 4. Results

Despite the fact that risk management was a part of each project, many projects suffered from variations in cost for one or several actors. Risk management was not carried out systematically in those projects. Both identified and unforeseen risks often occurred in the projects and generally had a significant effect on the project cost. In sections below we discuss the factors that lead to more or less effective risk management.

#### 4.1 Understanding of risk management

The majority of respondents have what might be described as a fair understanding or knowledge of risk management and did not have any special training in the subject. Experience within construction industry is the main source of knowledge. To quote from three respondents:

“I have worked very long time in construction; no one can do it better than me”. (Client in project 7)

“Experience takes over, you learn during all these years of working in construction”. (Contractor in project 7)

“I have only my experience; it would be good to get more theoretical knowledge”. (Consultant in project 9)

Some companies organised internal courses in risk management but most respondents identified the lack of the theoretical understanding or knowledge. Many companies have a set of procedures to follow in the risk management process. The largest problem identified with the procedures is their complexity and documentation requirements.

“To do risk management systematically on paper is a big problem. We get a lot of documents from the system and nobody looks at them later”. (Client in project 4)

“Many people do not like to fill in papers; therefore they skip documentation of risks”. (Contractor in project 6)
In the risk management process, simple tools are familiar to the respondents: checklists and brainstorming for risk identification; probability-consequence judgment in risk assessment; and risk transfer as a way to respond to risk. In practice, the use of theoretical tools was limited.

“When assessing risks we do not use any theoretical tools but [instead use] experience, feelings and relationship with the client”. (Contractor in project 2)

Insights into this more theoretical view of risk management is shown in figure 1, which is based on best practice advice informed by numerous studies and reapplied from one project to the next.

![Figure 1 - A more theoretical and formal treatment of the risk management process.](image)

Figure 2 decomposes the higher level activity of risk identification into a lower level of analysis.
4.2 Participation in different project phases

A construction process is sequential by nature and many actors are involved only in some project phases and focus on their own part of work rather than on the whole project. This leads to the less effective communication of identified risks and the loss of knowledge between the phases.

“It happens very often that people involved in different phases do not see the overall picture”. (Client in project 7)

There was a very low participation in the programming (planning) phase overall. In particular, no contractors participated in this phase of the projects. However, the respondents recognised that the early involvement of the contractor is important for effective risk management. It allows the actors to choose the best technical solutions, decrease costs and obtain a deeper understanding of the potential problems.

“The sooner we get the contractor’s expertise in the project, the greater is a chance to avoid the problems in production”. (Client in project 4)

“We lose a lot of important information if we join the project when design is done”. (Contractor in project 2)

The actors felt that the newer organisational forms like partnering can help in ensuring early involvement of the actors and, therefore, better understanding of project risks.
4.3 Risk identification, assessment and response

Systematic scrutiny of potential and possible risks in the project was identified by interviewees as a very important factor for successful risk management. Systematic means that risk identification, assessment and response are performed in each phase of the project and the results of the processes are communicated between the project actors. However, in just one project were these steps in the risk management processes carried out systematically.

“We identify and assess risk, fill in the template and it’s done! Then we start construction, everybody is busy and forgets about risk management and early assessments”. (Contractor in project 1)

The design and production phases are critical for risk management. Risk identification, assessment and response were mostly performed in these phases. Despite the recognised importance of the programming (planning) phase, very little work in risk management was performed.

“The programming phase is very important... We did not work systematically in the programming phase; we did not talk in terms of risks”. (Client in project 1)

“Historically we have not worked with risks in the programming phase, but now it is coming”. (Client in project 8)

“We have little focus on risks in the programming phase because the project is very abstract”. (Contractor in project 2)

Within three groups of actors, contractors were the most active in performing risk identification, assessment and response in the project. Almost all contractors documented potential project risks and preventive measures. Moreover, contractors had the largest influence on risk management in the project.

“Contractors have to deal with most risks; we are forced to be active in risk management”. (Contractor in project 2)

Consultants were not involved sufficiently in work with risks and had a low influence on risk management. The actors agreed that consultants should play a more important role in risk management, because design-related risks can affect the project’s performance significantly.

“Consultants still have a passive behaviour when it comes to risk management. Risk management is not a part of their assignment”. (Client in project 2)

“I think our competence is not used by 100%, probably we have to start talking that we are good and can much more”. (Consultant in project 1)
The role of the client in risk management depends on the form of contract. In the performance-based projects, where the clients were responsible for a design, they had a larger influence on risk management and were more active in risk identification and risk response. The clients concurred that even in design-build projects, where the contractor is responsible for a design, the client has to play an active role in risk management.

“The client is always responsible for commitment of other actors. I don’t believe in ‘good’ contractors and consultants, they adapt to the clients’ requirements”. (Client in project 8)

Risk identification, assessment and response are needed in each phase of the project. This iterative approach, as illustrated in figure 3, is at odds with the previous portrayal of the risk management process in figure 1, which tends to regard the risk management process as a rather sequential activity running across the project phases.

4.4 Risk transfer and communication of risks

The majority of respondents agreed that the risks always are transferred between the project’s actors. Clients transfer risk to contractors because they believe that they, the contractors, have better ability to manage risks. Some risks stay with the client, for example environmental and market risks.

Two ways of risk transfer were identified by the actors: positive and negative. A positive way means that the risk is identified and the actor who will manage the risk is aware of it. This way demands open dialogue about known risks between the actors. A negative way implies, for
example, that the client lowers the cost by omitting important investigations and information before the project start date with the effect that risks appear in the production phase.

“Prior investigations are expensive and sometimes the client does not do all necessary investigations”. (Client in project 4)

The contractor transfers risks to the subcontractors and sometimes back to the client; for example, design risks in those cases where the client was responsible for the design. The majority of contractors are convinced that the client tries to transfer all possible risks to the contractor. Despite the fact that risk allocation is formalised by general contract conditions, which are used in all projects, clients tend to make some changes and include special conditions which imply more risk allocated to the contractors.

“The client’s way of thinking is ‘risks to the contractor, opportunities to us!’”. (Contractor in project 2)

The communication of known risks in the procurement phase was very low from both the client and the contractor. Two opposite views were shown: one group stated that it is a strategic choice not to show all risks in the procurement phase in order to keep the bid price at a lower level.

“The client feels that he can transfer risks to the contractor and pay a lower price. The contractor thinks there is a possibility for earning more money and keeps silent”. (Contractor in project 8)

The other group said that it happens because the actors, especially the client, are not aware of all possible risks. Both groups agreed that there is a need to change the situation. When risks are not communicated at a detailed level, the chance that they will occur is much higher and their consequences can impact more.

“In any case somebody pays for mistakes made by others”. (Client in project 7)

“We can put more money to the risk pot but in this case the client will pay higher price for those risks which never will happen”. (Contractor in project 2)

Due to the limited participation of the actors in some project phases, the communication of project risks between them does not function properly. Many problems appear when the consultant and client are not involved in the production phase. Additionally, risk management processes are carried out most intensively in the production phase, which implies more responsibility in managing risks for the contractor and more passive behaviour by other actors.

4.5 Joint risk management

According to the respondents, joint risk management means that each actor is aware of all project risks and takes responsibility for them. It is important to start risk discussions early in
the project and risks are discussed continuously. Known risks should be communicated at a detailed level between the actors and the project’s phases. Fair sharing of both risks and opportunities is an important driving force for joint management of risks.

In seven of the projects, the actors had good collaboration in risk management. The actors in two projects stated that there was no joint risk management. Most of the actors responded that collaboration existed in the risk identification and risk assessment processes. The risk response process had a lower degree of collaboration according to the contractors. They stated that contractors are usually forced to manage most of risks alone.

To achieve good collaboration in risk management and an open discussion of project risks and risk sharing, the following factors are considered important:

- Active participation of all project actors in discussions on risk and risks;
- Open and effective communication and information exchange: all risks are “placed on the table”;
- Project actors’ ability to raise the problems as soon as they appear, dare to ask questions and work without prestige;
- Personal commitment, motivation and responsibility;
- Trust;
- Respect for each others’ roles and competence;
- Fair distribution of opportunities.

5. Conclusions

The findings of our research show that risk management is not carried out systematically in all phases of a project. The actors’ participation in the risk management process is generally limited by their roles in the project. The absence of systematic risk management is especially noted in the programming (planning) phase, where it arguably has the greatest potential impact. The production phase is where most interest and activity is to be found. Unfortunately, this can easily prove to be too late in the day to mitigate some risks, including those that might have been avoided at an earlier phase. Whilst this is self-evident, scant attention to early identification of risks confirms this practice as commonplace. As a concept and matter of practice, the communication of risks between the actors simply does not work to the extent that it must if projects are to be delivered with certainty, irrespective of the form of procurement. If risks are to be properly managed, it is also self-evident that the risk management process must be present, transparent and activated within each phase. It is the lack of an iterative approach to risk management that is a weakness in current procurement practices and this aspect must be addressed if the risk management process is to serve projects and, thus, their clients. Implicit in this thinking is that the project’s other actors will be better able to cope with circumstances that might threaten the time, cost or function of the project if they can be engaged in the risk management process from the outset. A shift from project-oriented to process-oriented risk management is required in order to manage project risks successfully.
References


