Risk Management in Small Sized Construction Projects

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Abstract

Risks and other uncertainties can cause losses, which lead to increasing costs and time delays, both during the project and at the end. The need to prevent failures during the construction process and other losses related to construction has been emphasised in various reports. Example consequences are failure costs in civil works which can be close to 8% of the total budget for projects – more than 60% of these are costs due to ‘self-inflicted’ uncertainty. However, this paper is focused on small sized construction projects (in the range 1-15 MSEK), which are dominant in the Swedish construction sector today. They account for 83% of the total number of projects.

The aim of this paper is to describe how risks and uncertainties are managed in small sized construction projects. Some characteristics of these projects are presented, for example their organisation, financial size and type of contract undertaken. The paper identifies and describes the ways in which risk analyses are performed on a number of small projects today and where the common risks are believed to lie. The study is based on interviews with personnel selected from a number of construction companies. In order to be able to make improvements in the construction sector, a clear focus on uncertainties, which means both opportunities as well as risks, is needed. Organisations working mainly on small projects, that wish to improve their performance, need systematic methods for managing risks.

Small sized construction projects are found to be managed both intuitively, i.e. based on experience and systematically, i.e. using methodologies for risk and uncertainty management. The systems are, however, developed with the intention of fitting all sizes of projects and not specifically small sized projects. Some common risk sources in these projects are contract documentation and tight schedules, the client, individual planning and logistics, cost estimates used to compile the tender, subcontractors, technical solutions, safety of third parties and weather.

Keywords: Risk, uncertainty, risk management, uncertainty management, small projects
1. Introduction

1.1 Background

Risks and other uncertainties can cause losses, which lead to increased costs and time delays, during the currency of projects and at their end. The need to prevent failures in the construction process and other losses relating to projects has been highlighted many times over the years and figures strongly in a recent major report in Sweden [1].

The most common project size in the Swedish construction sector is less than 15 MSEK (roughly €1.65m). In the study reported in this paper, projects in the range 1-15 MSEK have been chosen, whilst those in the range of 0-1 MSEK have been excluded. According to Sveriges Byggindustrier [2], as much as 83% by number of projects are in the range of 1-15 MSEK. The reason for choosing this particular segment is that the smallest projects, the ones between 0-1 MSEK, are less interesting from a project risk management perspective. Their nature is inherently more like continuous business than project-based.

![Figure 1. Number of projects divided into segments in relation to their size in the Swedish construction sector 2004.](image)

Risk management and other types of applied management have been used routinely in construction projects, but have often been exclusive to large and exposed projects. Studies tend to cover large-scale projects, often with many different participants [3], [4] and [5]. The risks cover a spectrum of events from financial, political and legal to technical, often relating to complex construction.

In one study [6], failure costs for civil works were identified as being close to 8% of the total budget for projects and more than 60% of those costs were due to ‘self-inflicted’ uncertainty. The
study also focused on large projects and clients’ perspectives. ‘Self-inflicted’ uncertainty is due to ignorance of earlier experience of failures that continue to appear in similar projects in the future.

In small sized projects, the risks are more moderate and the consequences are less dramatic. These projects are more vulnerable to changes of the kind that have an impact on time since there is less chance of catching up if the schedule slips. On the other hand, the nature of the construction work and the project environments are often rather straightforward and the technical challenge is limited. This picture of the situation for small sized construction projects is based on the author’s own observations and that of the study’s reference group.

1.2 Aim and Objectives

The aim of this paper is to describe how risks and uncertainties are managed in small sized construction projects. Three specific objectives have been set as follows.

- Present the characteristics of small sized construction projects.
- Describe the ways in which the risk analyses are performed today.
- Define common risks that occur in small sized construction projects.

In order to reach these objectives, interviews have been conducted to collect data.

This paper presents the results of a pre-study forming a part of a research project which is investigating uncertainties in small sized construction projects. The research question to be answered in the pilot study is ‘how to find out how risks and uncertainties are managed in small sized construction projects today’. Further research questions to be addressed in the research project are related to the relationship between theories, companies’ policies and practical work, and also to the identification of obstacles and ambitions/incentives for uncertainty management in small sized construction projects.

1.3 Definitions

1.3.1 Small Sized Construction Projects

Searches of the literature did not provide conclusive evidence of what exactly characterises a small sized construction project, neither did discussions with different actors in the sector. The characteristics of a small sized project were subsequently discussed and agreed within the study’s reference group. The result is sufficient description to distinguish these projects from very small projects, which are more in the nature of continuous business operations and, at the other end of the scale, from large projects.
The characteristics agreed upon of small sized projects for the purpose of this study are:

- contract value between 1-15 MSEK
- a site manager responsible for a maximum of two projects simultaneously
- limited construction time, maximum 12 months
- established technique, no development work
- project environment is independent
- personnel involved are more generalist than specialist

1.3.2 Risk and Uncertainty

In order to be able to discuss risks and uncertainties there needs to be some sort of definition of these concepts within the study. Uncertainty is part of everyday life, since we are not able to predict the future accurately. The amount of uncertainty and the ways in which we can handle this uncertainty could, however, be defined and structured.

According to Aven [7] uncertainty could be either aleatory or epistemic. An aleatory uncertainty is of a random nature and is hard to predict. An epistemic uncertainty is “lack of knowledge about fundamental phenomena”, which refers, for example, to the use of models and assumptions. In this study, uncertainty refers to both aleatory and epistemic uncertainty using Aven’s terminology.

Chapman and Ward [8] state that there is a need for a clearer focus on the upside effects, i.e. the opportunities. They also think that it is desirable to let go of the historically close connection to events, conditions and sets of circumstances and instead shift attention to the different sources of uncertainty that could lead to threats of failure or, equally, opportunities. Their opinion is that it is vital to understand where and why uncertainty is important in a given project context and not to focus solely on threats and opportunities connected to given events, conditions or circumstances. Chapman and Ward [8] continue their line of argument with the suggestion that “uncertainty management” should replace traditional “risk management” to indicate that a wider perspective is being sought. This study starts with the aims of Chapman and Ward in order to widen the concept of risk management and use the concept of uncertainty management in its place.

The definitions of risk and uncertainty found in the literature are not consistent. There are several different definitions and approaches from different areas of research. According to the Project Management Institute [9] a definition of risk should take into account both positive and negative effects on a project objective. This is a broad view in terms of threats and opportunities and how they are connected to an event, a condition or a specific circumstance. Even if the risk according to [9] includes upside effects, the tradition is to focus on the downside, i.e. the negative effects. Project risk is defined as the “combination of the probability of an event and its consequences for project objectives” [10]. This definition is well known in the construction sector and elsewhere
and is, by tradition, closely associated with a threat. Conversely, opportunity is neglected despite the enlightened definition found in [9].

It is necessary that each study defines its own approach and view of risk and uncertainty. In this study, the term uncertainty is used to point out the possibilities for both types: “risks”, with the negative effects; and “opportunities”, with positive effects. The definition of risk used here focuses on the negative outcome of an uncertainty and is seen as more dramatic than uncertainty.

Uncertainties are handled everyday on a construction project, but not all are of the type that needs special attention. In this study, uncertainty is defined as something that occurs and which was neither foreseen in the project description nor in the contract, being often caused by lack of knowledge on the part of one or more of the parties. The uncertainty could be an event that occurs during the project. It could also be something that is known from the beginning that makes the project unique, i.e., that makes it different from the standard procedure. Those uncertainties could lead either to risks or opportunities and need to be taken into account.

1.4 Research Limitations

Risks appear at different levels and likewise have different consequences for their surroundings. Depending on the approach taken, different risks will be found. In this study, risks in construction projects are examined, from the contractor’s perspective. Risks that appear at other levels are not considered, although they could affect the project’s objectives (figure 2).

![Diagram](image)

*Figure 2. Selected approach for this project.*
In the context of a construction project some further limitations regarding uncertainties and risks are considered in the study. Risk sources which are outside the framework of the study are, for example, political decisions, the financial situation of the client as well as the contractor, changes in organisation and illness among personnel involved in the project. These risks could have both positive as well as negative effects on the project’s objectives, but are often out of the control of the site manager. For that reason, they will be left outside this study. Risk sources that are to be considered in this study are the project’s economic boundaries, relationships with the client, technical solutions, aspects of production and weather. These risks are either within the control of the site manager or affect the project directly without interference from other levels of the company’s organisation, for example, weather. Between these defined areas, risk sources from geotechnical engineering and the work environment will be found. These two areas represent many of the risks in the construction sector and have been studied separately earlier in other studies [3]. For this reason, they will not receive any special attention in this study.

Figure 3. Risks and uncertainties in relation to the project.
2. Risk Management Today

2.1 Collection of Data

2.1.1 Method for Data Collection

The principal method used to collect data is interviews with managers of different projects from different companies. The strategy used for selecting projects is that the project must be either in a state of production or "fresh in memory". Projects that have just started have not been selected because of the risk of the researcher affecting how risks are managed if the project is in the planning phase. There could be, as well, uncertainties in the answers if the projects were finished and the site manager had moved on to another project. Projects should also be selected according to criteria in the definition of small sized projects, not by who happens to be the site manager. Interviews with managers of projects from different construction companies have been adopted to provide a flavour of the wider construction sector.

In order to be able to see patterns in data from the interviews, the information has been sorted into different categories. Projects have been sorted by type: buildings, new production and renovation, and ground works. There is also some categorisation relating to the geographical situation, i.e. a medium sized community such as Luleå and a large city such as Stockholm, and the age of the site managers.

2.1.2 Interviews

Ten interviews have been undertaken with personnel from five different construction companies in Luleå and Stockholm, Sweden. The interviews were conducted in a semi-structured manner with a number of questions prepared in advance. The interviewees were free to speak about risks and opportunities in their projects and the researcher asked questions and gave some guidance to ensure that the prepared questions were covered. The interviews were conducted in a positive atmosphere and the interviewees have expressed an interest in seeing the final results of the study.

2.2 Findings

The findings from the interviews give a picture of what site managers in a few small sized construction projects think about risk management. They have shared both how they work with uncertainties, risks and opportunities and also indicated what they regard as the most common risks from their perspective. They have also given their view on what is defined as risk and uncertainty.
2.2.1 Perspectives on Risk Management

According to the site managers, risk is something that can have negative consequences for the project and is more dramatic than uncertainty. Conversely, uncertainty is regarded as something that can have positive as well as negative effects.

According to the site managers of the projects investigated, there exists a systematic framework for how risks and uncertainties are managed. There are manuals, routines and patterns to be used, not specifically for small sized construction projects, but specific to the actual type of project. For example, there are manuals for risk identification in ground works, general construction and buildings.

Managers of these small sized projects use the manuals and patterns to a certain extent, with some differences in application amongst them. They apply what they think is useful and leave the rest of the documentation alone. It is notable that there is a difference between the interviewees with respect to their age and experience. The older and more experienced managers tend to document less than others. This means that there are some who actually follow a systematic approach and others who work on intuition based on experience. Common for several of the managers is that they think continuous planning is the best way to manage uncertainties. “Risk analysis is quite good, but it is good planning and logistics that offer the best possibility for minimising uncertainties” (Andreas Rydberg, site manager NCC). In terms of planning, they are able to identify new uncertainties and to take precautions with respect to risks identified in the risk analysis. Risk analysis is performed for the tender and is part of the information the site manager gets before he takes on the project. The site managers refer to this risk analysis as a “living document” that should follow the project throughout the construction process. However, there are differences in how this is actually performed.

Risk analysis and “risk thinking” is not dependent on project size according the site managers interviewed. The approach to risk thinking is more dependent on the type of project than on the contract size of the project. It is the consequences of the risk that decides if the risk is qualified in the risk analysis and, in the first instance, the consequences for health and safety (Patrik Lamberg, Skanska). There are neither differences in available documentation nor in the extent of information in the documentation between large and small sized projects. This means that in very small projects the managers think that more time would be consumed to do documentation for the sake of the system than is actually required for production. The consequence of this is that the managers skip part of the documentation, if not most of it. There is also a time related aspect of these small sized projects expressed by this site manager: “In small projects it is vital that the personnel involved start off immediately since the time available is limited” (Leif Eklund, NCC). There are more possibilities to save a large project if a risk should appear, but the consequences of that risk if not saved might be large. The consequences of that same risk in the small project would be less, but might not be as easy to save due to tight schedule.
2.2.2 Identified Risks

In the small sized projects there are some risks that are more common than others. The relation to the client is one; lack of information in documents provided by the client is another. Yet another risk or actual uncertainty is the tender that establishes the boundary of the project. It is not possible to receive more money than the tender (i.e. contract) sum. The interviewees also think that there is a considerable difference in approach to risks and opportunities depending on what kind of contract is used. General contracts are considered safer in all respects. All aspects should be included and if something is missing it is the client’s responsibility to solve the problem, not the contractor’s responsibility.

For ground works projects the managers feel that there are a few risks. Small projects are rather straightforward, with known technology and known conditions in the project environment. The risks that appear are the same ones from time-to-time and there is limited uncertainty that crops up along the way.

In renovation projects, more uncertainties appear during production. The activities and technical solutions often need to be adjusted at the site level due to lack of information in the tender about the existing building. There are seldom standard solutions and whether something is a risk or an opportunity is much dependent upon the attitude of the client. Since there is a lot of uncertainty when doing renovation work it is hard to achieve a complete and reliable cost estimate for the tender. The tender (and, hence, the contract sum) does, however, define the financial boundaries for reaching the objectives of the project. This is also to be considered as an uncertainty.

One considerable uncertainty in new building projects is a tight schedule. Physical factors such as drying time for concrete are sometimes neglected, with the consequence that projects can end up with damp concrete. The risk of built-in faults could cause higher costs for both the contractor and client if not handled properly. Building projects also often include subcontractors and this involves uncertainties in relationships as well as in their attitudes to risk and uncertainty management.

Common risks for the small sized projects in this study are, without any ranking:

- contract documentation and tight schedules
- the client
- individual planning and logistics
- cost estimates in the tender
- subcontractors
- technical solutions
- safety for third parties
- weather
3. Conclusions and Further Research

The definition and characteristics for small sized projects are:

- contract value between 1-15 MSEK
- a site manager responsible for a maximum two projects simultaneously
- limited construction time, maximum 12 months
- established technique, no development work
- project environment is independent
- personnel involved are more generalist than specialist

Results from interviews show that there are common factors for small sized projects. These projects are managed both on intuition based on experience and systems for risk and uncertainty management. The systems are, however, developed with the intention of fitting all sizes of projects and are not specific to small sized projects. This leads to differences in the ways of applying risk management and is much dependent upon who is doing the risk analysis more than what the management system might advise. Site managers are also dependent on their own planning rather than having support from other personnel in the organisation.

Results from this pre-study have helped to sharpen the questions to be addressed in the next stage. The aim is also to give a picture of where risk management in small sized construction projects stands today. Knowledge about this situation makes it possible to continue with the remaining research questions:

- What are the differences between theories, companies guiding principles and the practical work in order to conduct uncertainty analyses?
- Why does uncertainty management work satisfactorily in some projects and not in others? What are the obstacles and ambitions of uncertainty management?

The plan for future work is to perform case studies during late 2005. In those case studies, further empirical results will be collected in order to arrive at an understanding for the performance of uncertainty management in small sized construction projects. The result of this future work will be a licentiate thesis to be finished by late 2006.

Acknowledgements

The author would like to thank the people involved in the research project’s reference group for inputs and discussions in the research area. They have been of great help in the task of finding definitions and defining research boundaries. The reference group consists of people from different companies representing clients, contractors and consultants with practical as well as
research experience. They have all reached advanced positions in their field and it is a major benefit for this study to have access to their experience and knowledge.

Thanks are also due to Valter Hultén of Sveriges Byggindustrier for his help with statistics on number of projects.

References

[1] Contacts with and information from Valter Hultén, Sveriges Byggindustrier


