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Uncertainty analysis – 5 challenges with today's practice

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Abstract

As pointed out by Venkataraman and Pinto (2010), the importance of estimating project costs arises as the estimates become the benchmarks of which future costs are compared and evaluated. Although estimates become more accurate as decisions are made and uncertainties resolved, they are also chief means for assessing project feasibility, as a comparison of cost estimates with estimates of revenues and other benefits that are crucial in determining whether the project is worthwhile to carry out or not. In this paper we will discuss whether or not the uncertainty analysis is a reliable tool for supporting the cost estimation process. We present 5 challenges in connection with the way uncertainty analyses of cost estimates are done today and present findings that indicate a need to rethink the uncertainty analyses of the projects that have a high degree of uncertainty. This paper is a product of collective reflection, experience and the knowledge of the authors. It is of a qualitative nature as we do not present any quantitative or statistical evidence or methods in our approach. It is understood, due to the diverse contextual backgrounds of the projects involved, that the explanations for differences may be equally diverse. The paper is divided into five parts; The introduction – explaining the importance of the topic; part two provides a short introduction to the applied research methods; part three explain what we mean by cost estimation under uncertainty; part four presents the five identified challenges in cost estimat*ion under uncertainty; part five presents a conclusion and proposes potential areas of further research.

Keywords: Mega project; Uncertainty analysis; Cost estimation

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1. Uncertainty analysis – tool for finding the right project and a tool for managing the uncertainty

As pointed out by Venkataraman and Pinto (2010), the importance of estimating project costs arises as the estimates become the benchmarks of which future costs are compared and evaluated. In this paper we address the following two research questions: (1) Is the uncertainty analysis a reliable tool for supporting the cost estimation process of projects? (2) Do the result from the uncertainty analysis reflect the end cost of the project, and are the results of the uncertainty analyses trustworthy in the various phases of the project?

2. Research methods and limitations

The paper is inspired by the experiences gained by the authors in working with uncertainty management over the last 15 years. The authors have worked in two large research projects with special focus on uncertainty analysis and uncertainty management; CONCEPT project "Uncertainty analyses" (2003 -2005) and "Practical uncertainty management in the project owner perspective" (the PUS-project, 2005-2010). In both projects, we did extensive literature reviews on uncertainty analysis theory and uncertainty management theory. And in both projects, ideas and concepts were developed and tested in case projects together with industry partners. The authors have been responsible for uncertainty analysis and/or the documentation of more than 100 analyses in total - We have led the 11 concept selection studies for Oslo Municipality, 2 concept studies on major road systems (Ferjefri E39). The authors have worked with health institutions (hospitals), public buildings, power companies, and road and railway constructors in Norway. The basis for this writing process is the discussions and analysis of the authors' joint experiences and interpretations of our findings. The paper is a product of collective reflection on the experiences and knowledge. The methodological approach is qualitative in the sense that we do not use any quantitative or statistical evidence or methods in our approach, It is understood, due to the diverse contextual backgrounds of the projects involved that the explanations for differences may be equally diverse. Therefore, it is aimed at analysing possible explanations and present and discuss them in a manner which could be meaningful on a level superior to that of the single project

3. Uncertainty analysis in Projects – threats and opportunities

In the project management domain, uncertainty is currently understood as lack of information but uncertainty could also be understood as lack of certainty. Rolstadås, et al, (2011) state that uncertainty in projects may take on a number of very different forms, and propose a structure for categorization of uncertainty into controllable and non-controllable factors Hetland, (2003). Rolstadås, et al, (2011) suggest that uncertainty could be negative and positive for a project. Negative implications of uncertainty are labeled as risk factors. Positive implications of uncertainty are labelled as opportunity factors. Both may have consequences if they occur. They refer to risk as the consequence of an unwanted event multiplied by the probability of the event, and opportunity as the opposite of risk, ie. events with positive consequences. Projects have traditionally strived towards predictability and to keep all critical factors under control. However, for large and complex projects, such predictability does not exist in reality (Rolstadås, et al, 2011). Major uncertainties play a large role in important areas. And especially under such conditions, it may not be a good strategy to strive for maximum predictability, but rather to choose a strategy of flexibility in the project, in order to be able to face changes in a better way (Olsson, 2006). In this paper, we adopt the term uncertainty to include both the positive effects (opportunities) and the negative effects (threats) in the execution of projects. We define uncertainty as follows: Project uncertainty is defined as controllable and non-controllable factors that may occur, and variation and foreseeable events that occur during a project execution, and that have a significant impact on the project objective Johansen et al 2012 (1) We define threats as factors, variations and events that may lead to undesired changes to objective, scope, resources, frame conditions that make the project cost more, spend more time or delivers less quality than was agreed up on in the beginning of the project. Opportunities are factors, variations and events that may lead to changes that make the project able to deliver the same quality in less time or to lower price than was agreed upon in the beginning of the project. And all such factors, variations and events that cause changes can make the project to deliver higher functionality or lead to positive NPV after the project is delivered.