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Cost uncertainty in major public investment projects

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Cost uncertainty in large public investment projects; Empirical studies based on QA2

Kostnadsusikkerhet i store statlige investeringsprosjekter

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Summary: This report discuss different aspects of uvcertainty in the early phase of major public investment projects. The study is based on empirical data from eksternal quality assurance (QA2) of the basis for control and cost estimates of investment projects with a cost exceeding 500 MNOK. The purpose of the study has been establishing a basis for understanding of the empirical basis found in QA-reports from these projekts, related to uncertainty analysis, and to adress interesting iissues for further research in different areas.

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Summary

This report presents to the reader a lot of questions, but hardly any answers. It is a result of trailing research in the research programme Concept, which has a mandate to support and follow the Norwegian Quality Assurance Scheme, and collect empirical data from the large public investment projects, disseminate knowledge to public administration and industry, and to develop new knowledge based on facts within management of large investment projects. External consultants carry out an external review of the large public investment projects at two stages, QA1 (regarding the choice of concept) and QA2 (regarding the basis for control and management, including cost estimates and uncertainty analysis for the chosen project alternative). Empirical studies are done, concerning analysis done of the external consultants related to QA2. It is not possible to do such studies related to QA1 yet. The present report presents findings from a study of some key problems concerning QA2 and cost uncertainty.

Deviation in cost estimates

The Ministries and responsible government agencies produce their own cost estimates of proposed projects. External consultants will then perform an external review of expected costs (P50) and advice on cost frame for the project. On the basis of the project organisation's cost estimate and the external consultant's advice, the Parliament makes its decision on cost frame for the project. The objective of this analysis is to assess how reliable the performed analyses are, considering the project organisation's cost estimate, and the decision made by Parliament.

The consultant's estimates are in average 6 % higher than the project organisation's estimates. The gap has decreased since the Quality Assurance Scheme was introduced and until 2005. The conclusion from the study is that the consultant's estimates and the project organisation's estimates have become more and more aligned during the time of the QA Scheme. Some possible reasons have been suggested, but further studies are necessary to reveal the explanations for this.

The Parliament's decision has in about 60 % of the projects agreed on budget totals equal to the consultant's estimates. This illustrates some of the immediate effects of the QA scheme so far.

Identified uncertainty elements

The consultants identify what is considered the most essential uncertainty elements, i.e. the most important contribution to uncertainty in the cost estimate. The objective of this analysis has been to assert the quality of the uncertainty identification process. Are there uncertainty elements or groups of uncertainty elements that are considered more important than others by the consultants, and are there differences between different types of projects? Uncertainty elements have been categorized, and the most frequently identified uncertainty elements are the following: technical issues/cost elements, market conditions, scope management, project organisation, project management and contract strategy/purchasing.

The analysis concludes that this is in agreement with relevant literature, and indicates that we are good at identifying uncertainty in projects. However, this could only be confirmed when the projects are completed, and the effect of uncertainty in the project has been revealed.

Potential Success Factors and Pitfalls

The objective of this analysis is to assert what the consultants consider to be the most typical success factors and pitfalls in different types of projects. This can be used in planning and management of the projects. The analysis disregards the distinction between success factors and pitfalls, and they are all treated as and named success factors. The most essential categories of success factors in large projects was found to be project management, project organisation, contract strategy/purchasing, scope management and framework conditions.

The results from the empirical study correspond well with evaluation of success factors in recent literature. However, only when some of the projects are completed, we will have the opportunity to compare these studies to what actually have happened, and can determine the degree to which we are able to predict what affects projects success.

Recommended measures to reduce risk

The objective of this study has been to identify what measures or categories of measures the consultants recommend, and to do the results available for planning. The basis for the analysis is the measures recommended by external consultants. Measures are categorized in the same way as uncertainty elements and success factors. The focus was on what measures or categories of measures that are most

often recommended, and if there are different types of measures recommended for different types of projects. There are four categories of measures that seem to be more important than others. This is measures related to the project organisation, contract strategy/purchasing, project management and scope management.

The Ministry of Finance has asked the consultants to point out measures that will reduce risks. We also recommend that consultants should focus more on opportunities, or the potential positive aspect of uncertainty, and measures to utilize opportunities in large public investment projects.

Linking uncertainty, success factors and measures to reduce risk

Objective of this analysis has been to identify the right measures, in consideration of the combination of uncertainty elements and success factors. The analysis found that measures recommended by consultants are largely relevant in view of the type of uncertainty elements and success factors identified. However there are some cases that would require further analysis.

An essential question in further research is what measures are actually implemented, and the linking between those measures, the consultant's recommendations, assessments done by the project, and their effect.

Cost estimates and their probability distributions

Objective of this analysis was to find the assumed size of deviation in cost estimates in large investment projects at the stage of QA2. The analysis has shown what influence project type, project size and the consultant have on the scope of estimated uncertainty and contingencies.

Average estimated uncertainty (size of standard deviation) is about 10 % in these projects. There are large differences in calculated uncertainty in different projects. The analysis has shown that the calculated uncertainty is higher in road projects than in building and defence procurement projects. It seems like the project size has no influence on the calculated uncertainty. There are noticeable differences between the consultants regarding calculated uncertainty. We can not conclude on why there are differences. Coming trailing research can focus on the reasons for the identified differences.

Safety level on the cost frame

Cost frame (R) should be found by $R = P85$ minus the value of potential reductions. The objective of this analysis is to find the average recommended safety level on the cost frame for the projects, based on the assumption that the potential reductions is not used when needed. We have found an average safety level and differences between types and size of the projects.

In the cases the potential reductions are used to find the cost frame, the average safety level is 76 %. With the assumption that the potential reductions rarely will be used, this means that the safety level is below what is suggested by the Ministry of Finance.

Potential reductions

Objective of this analysis has been to verify if the reduction list is a suitable tool, and how it can be implemented in planning. The analysis has discussed to what extent reductions are identified by the consultants, when along the project time line reductions manifest themselves, and examined what types of reductions that are recommended.

The analysis include recommended reductions, only, but not what actually happens in the projects, regarding reductions. Clearly, it is too early to make an assessment of reductions as a tool to avoid cost overruns. So far evidence seem to suggest that project organisations may be reluctant to use reduction list as recommended.

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