

COST UNCERTAINTY IN LARGE PUBLIC INVESTMENT PROJECTS

Introduction

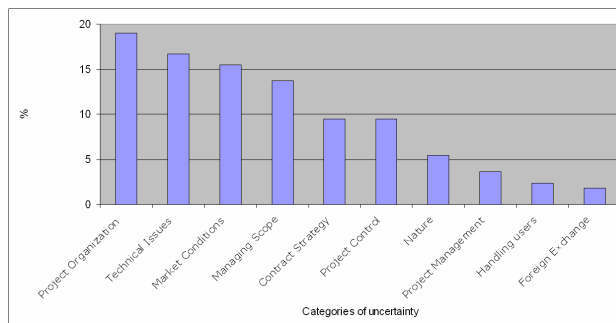
The Concept-program will support and do trailing research on the Quality Assurance Scheme. This include to collect empirical data from the large public investment projects, develop new knowledge based on facts within management of large investment projects, and to spread knowledge to public administration and industry. External consultants carry out an external review of the large public investment projects at two stages, QA1 (QA of the choice of concept) and QA2 (Quality assurance of the basis for control and management, including cost estimates and uncertainty analysis for the chosen project alternative). Concerning external reviews performed by the external consultants, empirical data related to QA2 are studied. Different aspects of cost uncertainty has been the main focus. 56 projects form the basis for the studies.

by
 Olav Torp, NTNU, Departement of Civil and Transport Engineering
 e-mail: olav.torp@ntnu.no

Uncertainty elements in Large Investment Projects

Consultants identify the most important uncertainty elements, i.e. the most important contribution to uncertainty in cost estimates. Concept has analysed these findings. The analysis consider if consultants analyses show that some uncertainty elements or groups of uncertainty elements are more important than others, and differences between uncertainty elements in different types of projects. The uncertainty elements are categorized as shown below. Technical issues, market conditions, scope management, project organization, project management and contract strategy seem to be more important than other uncertainties at the stage of QA2.

The analysis concludes that the consultants agree with the literature regarding the most important uncertainty elements in large investment projects. This could imply that the consultants are good at identifying uncertainties in projects. We do not know until the projects are finished and we hopefully are able to conclude on what is the most important uncertainties in large public investment projects.



Size of cost uncertainty in Large Investment Projects

Consultants calculate expected costs and standard deviation at the stage of QA2. Concept has analysed the size of the standard deviation relative to expected costs in different types of projects. The results is shown in the table below.

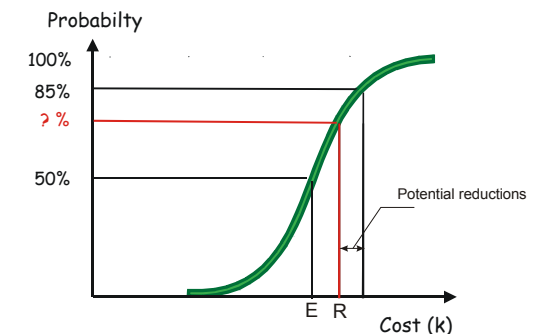
Average calculated standard deviation is around 10,5 % of expected costs in the large investment projects. This seem to agree with statements in literature regarding standard deviation at stage of QA2. Lowest standard deviation calculated is 4 % while the highest is 21 %. We have not been able to find a typical standard deviation for large investment projects. The analysis show that the calculated uncertainty is higher in road projects than in building and defence procurement projects. Railway and ICT projects we can not analyse because there are only one railway and one ICT project. Our studies show that project size has little influence on the relative standard deviation. Further research will analyse and conclude on what influence types of projects, project size and the different consultants have on size of relative standard deviation.

| Type of project | Cost Uncertainty, given by Standard Deviation (%) |
|---------------------|---|
| Road | 11,4 % |
| Building | 9,8 % |
| Defence Procurement | 8,5 % |
| Railway | 14,0 % |
| ICT | 7,0 % |
| Others | 12,0 % |

Upper financial level and probability of cost overrun

External consultants are expected to recommend upper financial level (R). Ministry of Finance have introduced a principle to find R, given by $R = P85 - \text{the value of potential reductions}$. If no potential reductions are recommended, R is equal to P85. Probability of total costs below R is then 85 %. If there are potential reductions recommended, the probability of total costs below R is less than 85 %. It is interesting to find this probability, based on empirical material from QA2, see the figure below. We also want to analyse the needs of contingencies in the portfolio of public projects.

The principle to find R by subtracting potential reduction from P85 is used in 21 of the 56 projects studied. In the cases the potential reductions are used to find the upper financial level, the average safety level is 76 %. Safety level varies from 60 % up to 85 %. Preliminary studies discussing the needs of contingencies in the portfolio of large public investment projects are done. The portfolio of road projects is analysed. Accumulated contingencies recommended by the consultants in the single projects are, when ignoring systemic uncertainty, about 3 times higher than needs of contingencies in a portfolio. When including systemic uncertainty this ratio is reduced from 3 to 1,2. This analyses are simplified, and should be given closer attention to increase the precision.



Conclusions

It seems like project organization, technical issues, market conditions and scope management are the most important uncertainty elements in the large public investment projects at the stage of QA2. The size of cost uncertainty given by standard deviation varies from 4 % to 21 %. Average safety level of the upper financial limit is calculated to 76 %. Based on findings like these we have put forward hypotheses for further research in The Concept Research Program.