Ensuring Quality-at-Entry:
Challenges in Front-end Management of Projects

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In Norway, there is a Quality-at-Entry Regime of major governmental investment projects. A quality assurance and uncertainty analysis is carried out early in each project, prior to the parliament's appropriation of the project. The paper summarises some of the effects of the Quality-at-Entry Regime.

The major conclusion from our initial study is that the Quality-at-Entry Regime has increased the awareness about cost estimates of major governmental projects. In order to further improve the effect of the Regime, some identified issues should be addressed. One issue is related to the management of project reserves. Another issue is at what stage of the projects the Quality-at-Entry analysis should be made. Finally, one needs to address how to ensure a learning effect for the analysed projects, while at the same time securing the neutrality and independence of the reviewers who carry out the analysis.

Introduction

Effective from 2000, the Norwegian Ministry of Finance initiated mandatory quality assurance and uncertainty analysis of all governmental investments in Norway exceeding NOK 500 millions (68 million Euro), the so-called Quality-at-entry Regime. In the research programme Concept[1], we have begun trailing research in order to observe the effect of the Regime. The trailing research has identified a number of interesting issues related to front-end project management (Austeng and Steenberg, 2002; Lædre 2001; Torp 2001).

As illustrated in Figure 1 (from Samset, 2001), the project's front-end phase is the stage when the project only exists conceptually, before the final decision of financing the project is made. Uncertainty affecting projects is commonly considered to be at its highest at the outset and gradually decreases as the project is planned and implemented – partly because of increased access to relevant information. At this stage, the possibility to influence the final outcome is at its highest – while at the same time the knowledge of what lies ahead is at its lowest.

[1] The Concept programme is based at NTNU, the Norwegian University of Science and Technology, and is funded by the Norwegian Ministry of Finance. It focuses on front-end management of projects in general, and research on the effects of the Quality-at-Entry Regime in particular.

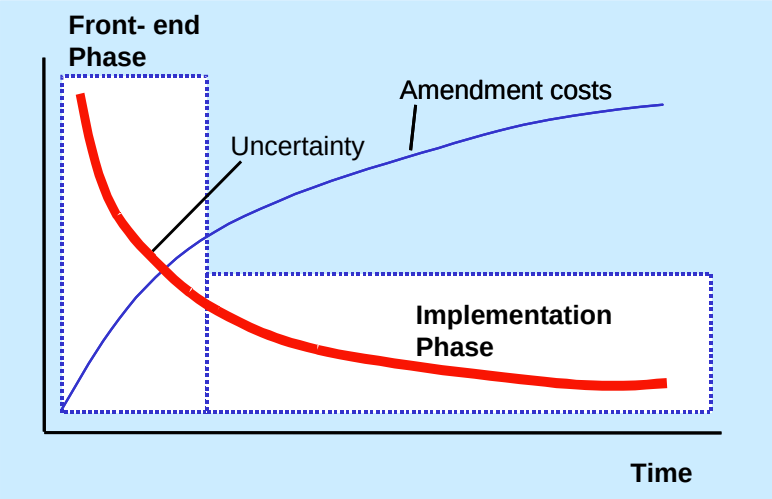

Figure 1. The Front-end phase is characterised by high uncertainty and low amendment cosst (Samset, 2001)

Two Opera Houses

A new opera house is under preparation in the Norwegian capital, Oslo. It will be located in the harbour area at the waterfront, and many see the new opera house as a new landmark for Oslo.

So far, there are at least superficial parallels between the Oslo opera and the Sydney Opera House - a project also located in a harbour area which experienced disastrous cost overruns. According to Kharbanda and Pinto (1996), the cost overrun was fifteen times the initial estimate (nearly $100 million compared to the an initial estimate of $7 million, even if it is questionable if there was an initial estimate). Subsequently, the opera has become a major landmark and a symbol of Australia. This project was considered disastrous from a pure project perspective regarding time and cost, but was later seen as a success from the society's perspective.

In the initial discussion regarding where to locate the new Oslo opera, an estimate of 240 million Euro was used. The cost then hiked up step by step and the current budget is now 440 million Euro. However, none of these estimates include the cost of a major reconstruction needed in the area, which everybody seems to take for granted.

The preparation of the opera has implications far beyond what concerns the actual building. The opera will be located in a previously neglected part of central Oslo, and many see the new opera as a vitamin injection to trigger a wider urban development scene. The project has also become part of a long time discussion regarding the use of Oslo's harbour areas. Finally, a wide range of opinions regarding the opera has of course emerged from the cultural establishment.

The discussion regarding the opera house illustrates a classic conflict of objectives: is the opera primarily a cultural scene, a prestigious landmark building or an urban development project? Of course, it has all of these perspectives. The case illustrates some aspects of how the public sees major governmental investments. Some complain about what they see as irresponsible use of public funds. Others take the user perspective and argue that once it has been decided to build a new opera, we better do it well, and with less concern for the costs involved.

The Oslo opera also illustrates a commonly used technique in major public projects, termed "strategic budgeting", i.e. to initiate the project using a low budget to "get the ball rolling" before the project concept is settled, including the project's objectives and strategy. In this case this was done by commissioning at an early stage a competition for the design of the opera building. Once the planning had gained momentum, the possibilities for reversing or terminating the project were limited.

The total cost of the project, including area development, roads, etc., could run as high as 2 700 million Euro or more. Seen from this perspective, it might be cheaper to sponsor airline tickets to Sydney for the small opera audience in Oslo, than to build the new opera to service their needs.

The Plague of Project Overruns

Large projects are often ridden with cost overruns, delays and other negative consequences, for example environmental impact. For offshore oil and gas development projects, an analysis conducted by a Norwegian Parliamentary committee (Kaasen, 1999) revealed a total budget overrun of 13% or 3 470 million Euro for the total set of projects between 1994 and 1998. A smaller subset of projects analysed in more detail had a total budget overrun of 27% or 4 000 million Euro. Kolltveit and Grønhaug (2002) gives a summary of this study and of other Norwegian offshore projects.

The negative publicity some large projects with significant overruns have received may affect people's view of projects in general. After all, most projects attain their objectives in one way or another, even though many often are delayed and more expensive than originally planned. There is a contradiction between the increasing use of projects and the fundamental problem of projects often exceeding their budgets or their set time limits.

One of the most comprehensive studies of major projects draws experience from 31 separate studies from the period 1959-86 covering more than 4000 projects (Morris and Hough 1991). Most of these are major, publicly financed projects within the sectors of defence, transport, air travel, aerospace and energy supply. The main conclusion is that very few projects were completed ahead of schedule and below the budgeted cost. Usually, there were overruns, typically between 40 and 200 %. In the oil sector overruns up to 800 % were registered, and in the construction of nuclear power plants there were overruns as high as 4 000 %.

Project overruns have almost become so common that they are taken for granted. However, practitioners and academics in project management continuously strive to find means of avoiding and controlling the overruns. Major problems often occur as a result of poor design of projects. Experience indicates that measures to ensure Quality-at-Entry often pays off in the long term as well as in the short term (see for example Miller and Lassard, 2000).

A Remedy: Ensuring Quality-at-Entry

The largest public investment projects in Norway amount to about 2 670 million Euro per year, mainly channelled through the Ministries of Labour and Government Administration, Finance, Defence, and Transport and Communications (St.prp 1, 2001-2002).

The initiative to ensure Quality-at-Entry of major Government funded projects prior to the parliament's appropriation of the project, came in response to the situation with large overruns (Berg, 1999). This requires the respectively responsible ministries to undertake assessments during the front-end stage of major projects, with a particular aim to review cost estimates and major risks that might affect the projects when implemented. The aim is to establish realistic cost and time frames for the projects. Four consulting groups have been commissioned to undertake such assessments.

The idea of the mandatory Quality-at-Entry Regime is not fundamentally new. Oil companies have had a practice in which new projects were screened by senior personnel not involved in the project. Standard projects models such as Ericsson's PROPS and its derivatives used in other companies include a sequence of decision gates, which a project has to pass to obtain final approval (Eskerod and Östergren, 2000, Elvekrok and Olsson, 2000). The activities in the decision gates include an uncertainty evaluation, which is usually carried out internally.

Trailing Research

This paper is based on initial trailing research of the Quality-at-Entry Regime. The research is trailing the activities in "real time" and aims at providing fast feed-back. A general intent in trailing research is to build learning opportunities that help stakeholders to achieve their long and short term goals (Finne, Levin and Nilsen, 1995).

A key issue in trailing research is not to close the analysis prematurely, because of the important process of interpretation in various stakeholder arenas. The results in this paper are not a final evaluation of the

Quality-at-Entry Regime, but a summary of key issues as a basis for further work. The results illustrate the challenges that occur in front-end management of major projects.

The Projects Studied

So far, 8 of about 20 Quality-at-Entry analyses carried out from the initiation of the Regime during the spring of 2000 through 2001, have been studied (Austeng and Steenberg, 2002).

In the Quality-at-Entry Regime, the consultants are revising the cost estimates of the projects. The consultants present their stochastical cost estimates with related probabilities and recommend what cost and probability level the project budget should use. This is typically presented using accumulated probability distribution curves. In addition, recommendations are made regarding the management of project reserves, organization and a general comment on the maturity of project preparations.

The types of projects studied are shown in Table 1.

Type of projects	Number of projects analyzed under the Regime	Number of projects studied by the Concept pre-project
Procurement of defense products and services	9	3
Roads, railways and other transportation infrastructure	6	3
IT systems	1	
Public service buildings	4	2
Sum	**20**	**8**

Table 1. Projects in the Quality-at-Entry Regime (2000 through November 2001) studied by the Concept pre-project

Of the 20 projects, one has been substantially changed as a consequence of the analysis.

The Regime has so far caused an increased attention among practitioners of front-end management of major projects. However, some challenges for the future have been identified and they will be presented in the following.

Different Stakeholders – Different Attitudes To The Regime

The three key stakeholders in public investment projects are: (1) the responsible ministry, (2) the project organisation and usually (3) the executing government agency between the ministry and the projects. The Quality-at-Entry analyses are carried out on behalf of the ministry. The pre-qualified consulting firms carry out the quality assurance and uncertainty assessments.

The involved ministries, being projects owners, have expressed a general satisfaction with the analyses, since they give a “second opinion” of the projects. They also feel that they get a better basis to prepare the decision proposal for the Norwegian parliament.

The project organisations, however, have mixed feelings about being subject to an external review. As a consequence, the conclusions from the assessments have only to a limited extent been used actively in the on-going preparations of the projects. In one study (Austeng and Steenberg, 2001) only one out of eight projects claimed to have gained new knowledge from the Quality-at-Entry assessment. A key issue here is how to ensure ownership of the analyses, while at the same time obtaining the benefits from an independent review.

The project organisations do not feel that the uncertainty analyses add substantial new knowledge to the project. Furthermore, there has been some examples when the consultants end up with cost estimates differing from the projects. This sparked some discussions about who was “right”.

There are some parallels to the quality movement during the late 80's and early 90's. The companies that really benefited from the quality drive were characterised by top management commitment and a good foundation of the quality drive in the organisation (Oakland, 1989). Those who for example were forced into ISO900x-certification did not benefit that much. Similarly, one has to strive for a way of achieving ownership to the front-end assessments. However, the ISO 9000 drive did put quality on the agenda to many managers who would not otherwise have heard of continuous improvement and other key ideas. The Quality-at-Entry Regime has also forced managers to focus on front-end management, which many might not have done otherwise.

Too Late

The Quality-at-Entry assessments are made prior to the decision in parliament to go ahead with the projects. At that stage, the primary focus is on the budget. Key issues in front-end management, such as definition and development of different concepts, belong to earlier phases of the projects.

Among the project owners and the consultants who carry out the analyses, there is an understanding that the analyses should be carried out at an earlier stage of the projects. For some projects, the evaluations are carried out later in the project development than intended because the regime only recently has been implemented. However, even if the analyses had been carried out when intended, the issue of late involvement remains.

Three of the main aspects of front-end project management are. (1) definitions of different project concepts, (2) development of concepts and (3) evaluation of the concepts. The present Quality-at-Entry Regime partly covers the latter aspect. Only two alternatives that remain prior to the decision of financing; to continue with the proposed project or to stop the development.

Do They Really Want To Know?

To the responsible ministry, the cost and feasibility of a new project is obviously of prime interest. To other stakeholders in a project, other issues might be more important, such as creating support for a particular project concept. In this perspective, the Quality-at-Entry analyses might represent a potential threat to some stakeholders, especially if they are carried out even earlier in the projects, when different alternatives are still open.

Basically, two factors must be present to achieve successful front-end project management:

1. top management must be interested in evaluating different alternatives and to open-mindedly address the uncertainty related to the alternatives
2. the organisation must be able to generate this information

Even if uncertainty analyses now are mandatory prior to the final financing decision, the earliest concept evaluation is not covered. In this phase, one is relying on the will of the involved parties to open-mindedly assess different alternatives. In political decision processes, one cannot always expect such unbiased analyses.

To the public, there is still a wide spread impression that early estimates are made low in order to initiate a desired project. Once the project has been set in motion and is difficult to stop, it is revealed that it will be more expensive. As mentioned before, this has been an issue regarding the new Oslo opera.

Management of Reserves

Total project costs have traditionally been estimated to an expected cost plus 10-20% in order to cover unexpected expenses. As a consequence of the Quality-at-Entry Regime, a more sophisticated overview of the project cost is presented. Figure 2 gives an example.

The projects are typically assigned a budget which consists of the expected cost including expected extras. In addition, reserves are allocated to the major governmental investments in order to avoid the need for additional funding. The practice of using reserves is introduced by the Quality-at-Entry Regime. There is a need to analyse and develop management systems for the handling of the reserves. A key issue is the management of project reserves for portfolios of projects, since many of the involved ministries have more than one major project at the same time.

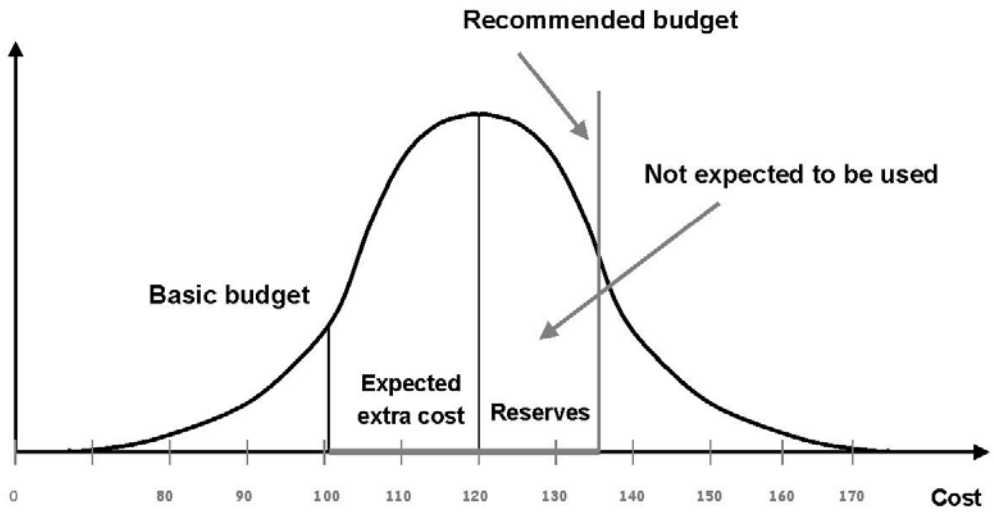

Figure 2. Project budget and reserves (based on Berntsen, 2002)

It is a part of the consultants' assignment to recommend a budget for the project. The total budget corresponds to a probability in percent that the project will be carried out on the defined budget. This is typically between 75 % and 85 %. If a budget based on 85% subjective probability is chosen, this means that there is only a 15% probability that this sum will be exceeded.

Project budgets based on 50% subjective probability was typically used prior to the introduction of the Quality-at-Entry Regime. There is a concern that the use of budgets based on 85% subjective probability reduces the pressure on the project management. The routines related to the management of the project reserves are critical tools to reduce these risks.

On the other hand, it is expected that the new practice will reduce the risk for projects needing additional funding. If this is the case, increased reliability of the cost estimate is achieved. However, some projects may become more expensive than they would have been otherwise. The tendency that a project at least fills its allocated budget is well known, and for example discussed by Christensen and Kreiner (1991). The knowledge of the allocated reserves might also trigger a temptation to increase the scope of the project by planned use of the reserves.

Even though research has been done on this issue (see for example Williams, 1995), continued trailing research in the Concept programme will probably provide interesting new knowledge about the issue.

Concluding Discussion

The Quality-at-Entry Regime with external reviews of projects, has increased the awareness about front-end management and uncertainty analysis in major governmental projects.

The Quality-at-Entry Regime has fulfilled the intention of undertaking independent reviews of major public investments. The analyses of the projects are carried out by external consultants in order to ensure a neutral assessment. To achieve maximum benefit from such an analysis, it is desirable that the project organisation itself addresses the uncertainties identified in the analysis and continuously monitors these and other uncertainties related to the project. The trailing research has revealed a need for ensuring ownership of the results from the Quality-at-Entry analyses, while at the same time obtaining the benefits from an independent review. The responsible ministries report that they have got a better understanding of the projects and a better decision base. On the other hand, the project organisations do not feel that they have benefited much from the analyses.

In its present form, the Quality-at-Entry Regime covers only parts of a complete front-end-assessment. The analysis is carried out shortly prior to the final decision of committing funding to the project. This is too late to get the opportunity to influence the fundamentals of the project and to facilitate a real choice

between alternative project concepts. A more complete front-end-assessment should include definitions of different project concepts, development of concepts and evaluation of the concepts.

Different stakeholders may have entirely different interests in a project and in different project concepts. This means that there might not be an uniform desire to get a neutral analysis of all available alternatives.

To make sure that the governmental projects do not require additional funding, project reserves are allocated. The use of this type of project reserves in major governmental investments is new in Norway. Our research and literature studies about project portfolio management indicate that there is a need for routines describing the management of such projects reserves.

There is a concern that the allocation of project reserves will reduce the pressure on project management to keep the project cost within a budget based on 50% subjective probability, which used to be the old standard. However, it is expected that the practices used in the Quality-at-Entry Regime will reduce the risk that projects need additional funding. If this is the case, increased reliability of the cost estimate might be achieved at the expense of some projects being more expensive than they might otherwise have been. There is a need for routines and organisational structures that will keep pressure on the cost awareness at the same time as the allocated reserves are properly allocated.

Key issues that require further attention in terms of research include:

- How to achieve an unbiased analysis of the projects and at the same time ensure ownership to the Quality-at-Entry analyses?
- How to carry out the Quality-at-Entry analyses in a way that provides increased knowledge about the projects for all key stakeholders
- At what stage or stages in the project cycle should such a project uncertainty analysis be carried out?
- Do decision makers always want all alternative concepts for a project evaluated?
- How to manage the allocated projects reserves in a way that keeps the pressure up on cost awareness and at the same time make the funds available when really needed?
- How to manage the combined reserves for a portfolio of projects in an efficient manner?

This paper has pointed out some issues to have in mind in the continued work with the Quality-at-Entry Regime. We also hope that the experiences presented are of interest for other academics and practitioners within the field of front-end assessments.

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