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Summary: The report provides a description of the Norwegian State Project Model, also referred to as the government's scheme for external quality assurance of major public investment projects (the QA scheme). The scheme was introduced year 2000 (QA1) and extended in 2005 (QA1). The first experiences can now be presented, mostly in the area of cost estimation and cost management (QA2). The results show that 80% of projects now remain within or on the Parliament approved cost frame. This is a very good result compared with what might be expected earlier. Evidence indicates that the QA2 scheme and the methodology used for cost estimation have had a positive effect. Some preliminary experience with quality assurance of the choice of concept (QA1) is also presented in the report.

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Preface

The Norwegian scheme for external quality assurance of major public investment projects was introduced year 2000 (QA2) and extended in 2005 (QA1). It is applied during the front-end phase and includes two checkpoints where measures are taken to ensure the quality of documentation (1) prior to the Cabinet's decision regarding conceptual solution and (2) the Parliament's approval of the project's cost frame. The basis for these decisions is subjected to external quality assurance by consultants who are pre-approved by the Ministry of Finance. This model is referred to here as the State Project Model.

The Concept research program was founded by the Ministry of Finance, assigned to collect data and study the projects subjected to quality assurance. The first projects are now completed and into their operational phase. This allows for a preliminary review of how the system works and its first effects. So far this is restricted to the effects of cost estimation and project management (QA2). This report sheds light on what we currently know about the effects of the QA scheme, the focus is mainly on cost management of completed projects, while other results are summarized briefly and will be the subject of separate reports later.

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Summary

This report provides a description of the background to, and content of, what is here called the State Project Model, which is also referred to as the Ministry of Finance's scheme for external quality assurance of large investment projects, or the QA scheme. The reason behind the scheme was the unfortunate experience with some of the large public investment projects in the past, i.e. large cost overruns, delays and limited economic benefit of investments. The State Project Model was introduced year 2000 to deal with the cost and management issues (the so called QA 2 scheme), and extended in 2005 to improve the choice of conceptual solutions and thus the utility of investments (called QA1 scheme). The principle is shown in figure 01.

The model is very basic, with only two overarching decision points. These are in turn based at the highest decision-making level: (1) selection of conceptual solution in the cabinet, and (2) approval of the cost frame in Parliament. This ensures authority, while flexibility for those responsible for the project is maintained.

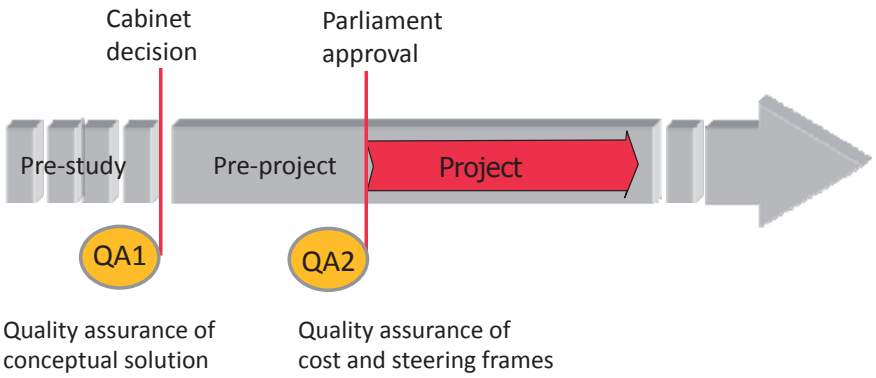

Figure 01 The State Project Model

The realization of large investment projects takes time. In the early phase, from the time the project idea comes on the agenda until the Parliament adopts the cost frame, usually takes 5-10 years, sometimes decades[1]. Subsequent planning and implementation usually takes another 5-10 years. Thus there is a considerable time lag from start to finish, and still the impacts of the investment can only be ascertained after a few years of the operational phase. This is illustrated in chapter 3, figure 6.

1 An international study showed that large infrastructure projects take seven years on average for this phase, Miller and Lessard (2000)

Since its inception, more than 200 projects have been subjected to quality assurance under the scheme, i.e. about 20 projects each year. Because of the time lag, only a small share of these has been completed to date. As per March 2013, only 40 projects have so far produced their final cost figures.

This report provides a summary of the first lessons from the introduction of the State Project Model. The most tangible findings pertain to the experience of cost estimation and cost management. The purpose of QA2 is to improve cost management and ensure successful implementation of projects in general. Taking the situation in the 1990s as the point of departure, major cost overruns were so common, some claimed, that it was what was expected. An in-depth review of 11 public investment projects in Norway in 1999, concluded that only three projects were delivered within the agreed cost frame, while the combined cost overrun was 84% (Berg, et.al., 1999). This was a problem not only in Norway but also in other countries. An international study of a large number of projects showed that the situation neither improved nor worsened over the past 70 years (Flyvbjerg, 2003).

Quality assurance of costs, estimation and cost control (QA2)

Major projects are always affected by uncertainty during their implementation. Cost estimates calculated as part of the QA2 scheme are therefore based on stochastic estimates (probability based numbers). Two key figures are termed P50 and P85 that are estimated by external quality assurers. P50 is the expected value, which means that there is 50% probability that the cost will be within this numerical value. P85 is higher, as it is 85% likely that the cost will be within this numerical value.

The *cost frame* approved by the Parliament is commonly higher than the expected cost. It takes into account the anticipated uncertainties related to the implementation, and is normally close to the P85 value. The implementing party (usually government agencies), however, will have to manage the project within a lower *steering frame*, which normally corresponds to the expected value P50. Cost increases above this figure require consent at the ministry level.

The proposed cost frame is normally P85 with deductions for possible simplifications and reductions (reduction list) that can be handled during the project if the cost frame would be in danger of being exceeded. The agency's steering frame is lower, in order to avoid incentives to use contingency reserves. (The agency should have a project management steering frame which is even lower).

The Parliament and the responsible ministry are of course not required to follow the recommendations from the external quality assurers. The final overall cost frame for the

project is decided by Parliament. Then the ministry will determine the steering frame for the executing agency. This is illustrated in figure 8.

The cost figures show that 32 of the 40 projects examined, or 80%, were completed within the cost frame approved by Parliament. For the 32 projects, the savings were approximately 5 billion NOK (1 billion USD). Eight project, or 20%, exceeded the cost frame with a combined total of approximately 1.7 billion NOK. Half of this was due to one railway project alone. The net savings for the whole portfolio of projects was approximately 7 % of the total investment.

The data indicates a tendency for railway and construction projects in the sample to have the largest cost overruns, for cost overrun to be more common in small projects, and for them to occur in the latter part of the period (projects started after 2004). The final cost compared to the approved cost frame is shown in figure 02.

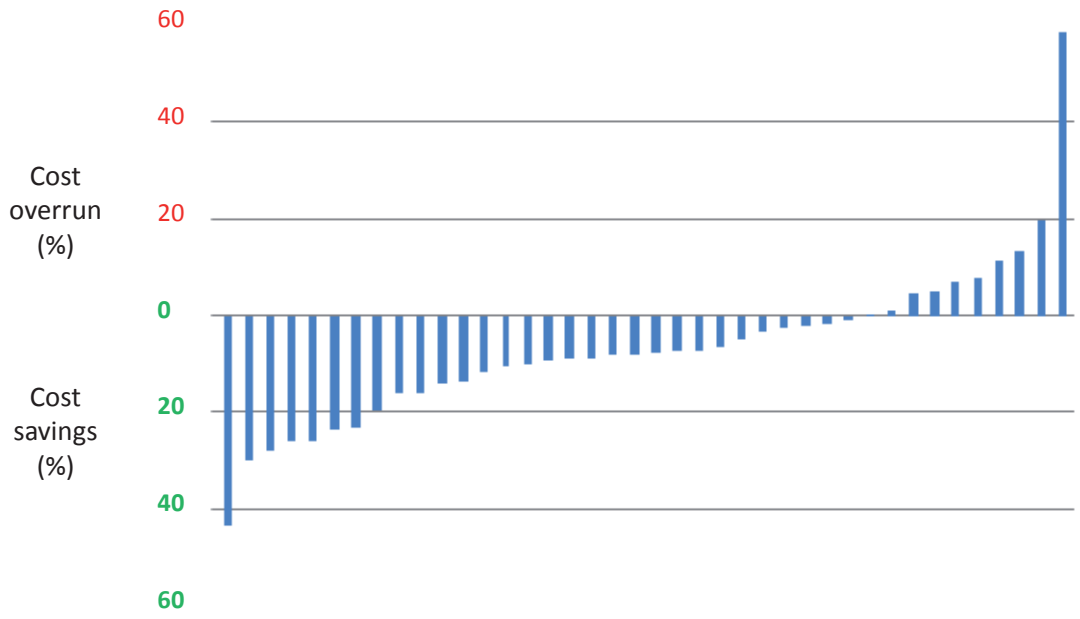

Figure 02. Deviation between the final cost and the cost frame approved by Parliament (N=40)

Figure 03 shows the difference between the final cost and the agencies' steering frame for the first 40 projects. Ideally, all projects should be completed within the expected value. However, given the uncertainty, we must not only expect but also accept deviations. If a portfolio of several projects is completed with an equal number and amounts of cost overruns and cost underruns with respect to the cost frame, the average for the whole portfolio will still be the expected value. The chart below shows that this is exactly what happened in this case. For the portfolio as a whole the combined cost is very close to the expected value and distributed symmetrically with about half above and half below the expected value. Overall, therefore, the cost deviations are acceptable.

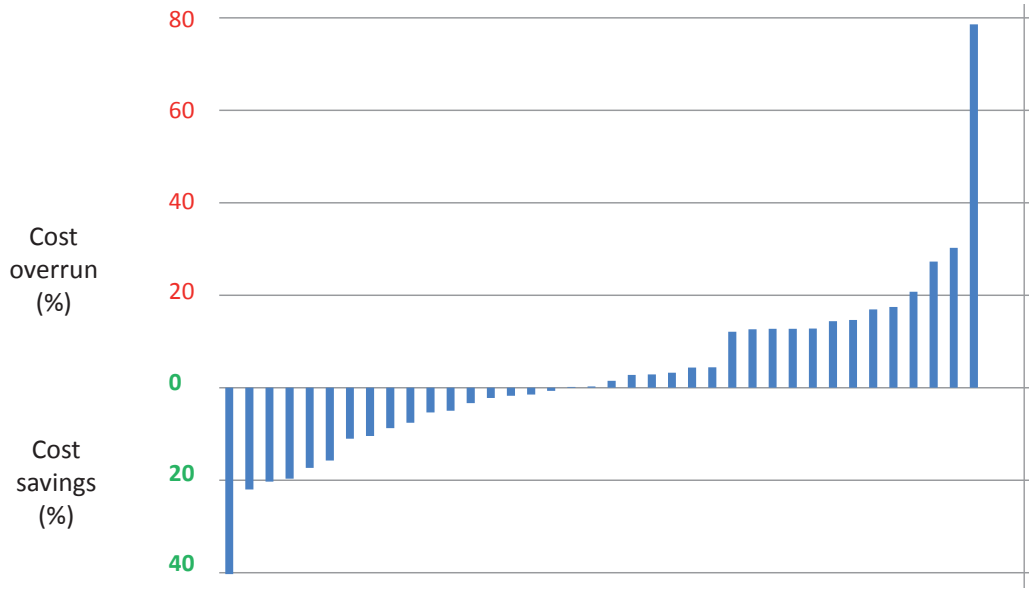

Figure 03. Deviation between final cost and the agreed steering frame for the project. N=40

Looking retrospectively at the situation before the QA-scheme was introduced and the cost performance of large infrastructure projects internationally, these are sensational results, which have gained attention both among researchers and civil servants in Norway and internationally. The question now is to what extent these encouraging results were caused by the QA scheme. This may of course be difficult to determine. Data in this study shows that the agreed cost frames were largely based on the recommendations of the quality assurers, which in turn were based on probability based (stochastic) cost estimation. The final costs of the projects are distributed symmetrically about the expected value; the cost impact of the uncertainties that eventually materialized during implementation was, on average, the same as that identified in the quality assurance reports. This suggests that the QA2 scheme and the methodology used for cost estimation have produced reliable cost estimates.

There is also evidence to suggest that cost management during implementation has improved, since the majority of projects are (well) below the Parliament's cost frame. The practice of determining a lower steering frame for the agencies has probably been an important step to provide incentives to improve costs efficiency. In general, experience suggests that the agreed steering frame will determine which adjustments are made during implementation to avoid large overruns. The fact that the deviations compared to the agencies' steering frame are both positive and negative also suggests that incentives to use the contingency reserves (the difference between P85 and P50) have not been exploited.

Quality assurance of the choice of concept (QA1)

The purpose of QA1 is to ensure the utility of investments by selecting the most appropriate conceptual solution for the project to be implemented. The choice of the conceptual solution is the most important decision that the State can make as project owner. Because e QA1 was introduced only in 2005, none of the 57 projects that have been subjected to QA1 have so far been completed. It is therefore too early to say anything definite about the effects of the scheme. The comments will have to be limited to the scope and quality of reports prepared by the ministries/agencies as the basis for quality assurance and decisions taken by government on the basis of these documents and the reports from the quality assurers.

One finding is that the scheme has resulted in considerable efforts by ministries and agencies to prepare documentation according to the format established by the Ministry of Finance. This has resulted in a relatively standardized system that ensures a fairly uniform treatment where the key issues are highlighted. Experience shows that the quality of these documents are generally satisfactory and under continuous improvement.

The scheme has been controversial, but there seems to be a widespread understanding today that such an early assessment of the conceptual solutions has benefits. Planners are forced to lift their focus and discuss societal aspects, rather than going straight to a particular technical solution and more detailed questions related to this. There is now a requirement that at least two conceptual solutions plus the zero option (not doing the project) should be investigated to the same extent. This increases the likelihood that the most effective option will be included in the analysis. One can also observe that the quality assurer's recommendation regarding the conceptual solution is largely taken into account.

Policymakers are of course free to make the final choice of conceptual solutions, according to their own preferences. Data suggests however that in 2/3 of the cases, the government has followed the recommendations of the QA1 report. Part of the reason may be that political authorities are now presented with the case at an earlier stage than before, and the pressure from various interest groups to opt for specific solutions has not yet fully materialized. It is also conceivable that an independent assurance report, which documents that a specific investment is weakly justified, can be crucial to help the government make a decision.

Of the projects that have been through QA1 so far, two have been rejected by Cabinet (estimated total cost 36 billion NOK, and net benefit minus 17 billion NOK). There has been an increased focus on overall economic viability in decision making. One can also observe significant spinoffs from the scheme in terms of increased awareness in government, altered practices, research, skills development and training on front-end management and governance of major projects. And not least, similar schemes

are being introduced also for smaller projects and in other sectors. Oslo municipality, the Ministry of Health and the Ministry of Petroleum and Energy have for example introduced similar schemes. There is also diffusion to other countries (Canada, Sweden, Denmark and England).

Chapter 1 Background

1.1 Cost overruns in large projects

Every year enormous amounts of public funds are spent on large investment projects. Examples range from roads and railway projects, major buildings in the cultural sector, defense acquisitions and large ICT projects. Cost overruns are familiar and widely commented upon. There are examples of projects that have incurred additional costs for society both during and after implementation. In Norway the problem got particular attention in 1986 when the new headquarters of the National Bank was being planned. Independent experts raised doubt about the official estimate presented to the Parliament. According to their calculations it would be five times higher. The case became a political issue and hit the newspaper headlines. After the project was completed, it turned out that the external experts were right; the final cost was more than five times the initial estimate. During the early years of North Sea oil and gas exploration and production, there were projects with tremendous cost overruns. In construction of the high speed shuttle train between Oslo and the main airport the final cost was twice as high as the estimate. And in the health sector several hospitals had large cost increases due to long lasting implementation periods and with considerable scope changes.

The problem is widely discussed in academic literature on projects. A well-known study of large projects (Morris and Hough, 1991), examined more than 4000 large government funded projects in defence, transportation, aviation, aerospace, energy, etc. The study found that very few projects were completed ahead of schedule and with lower costs than budgeted. Overruns were typically between 40 and 200 %. Overruns in the oil sector were up to 800 % and in nuclear power plants up to 4000 %. In the UK, MacDonald (2002) showed that the final cost of 50 major projects was 24-36 % higher than the budget. In another extensive study, Flyvbjerg et.al. (2003) analysed 258 infrastructure projects in 20 countries over a period of 70 years. The conclusion was that the cost overruns were significant and that the cost estimates had not improved or worsened during the period. Nine out of ten projects had cost overruns with an average of 28 %. Berechman and Wu. (2006) studied 128 road projects in Vancouver, Canada, that opened in the years 1993 to 2003 and found that as many as 104 of these had considerable cost overrun. Makovšek et al. (2011) found that a majority of Slovenian road projects had cost overruns 30% higher on average in projects opened in the period 1994-1999 and 19% higher for projects opened since 1999.

Negative reports in the media of projects with significant overruns may have contributed to a somewhat inaccurate picture of project activities as such. Although many projects are delayed or more expensive than planned, one should not ignore the fact that most projects that are initiated are completed and commissioned for operation in some way or another.

There are three common explanations why cost overruns occur:
- Technical problems which are difficult to foresee due to insufficient information, experience, complexity, technologies, etc.
- Cognitive factors related to our limited ability to predict, optimistic bias, etc.
- Political explanations, for instance that low cost estimates are accepted deliberately in order to increase the chance that the project will be accepted.

In addition, unforeseen circumstances may necessitate change during implementation, government regulations may increase the cost, and cost management may be insufficient. An American professor stated that cost overruns have become so common in the United States that it is no longer a question of systematic underestimation, but that cost deviations have become the norm (Pinto, 2006). He claimed that a culture has developed where decision makers no longer see any reason to give credence to figures presented in the early phase, but acknowledge already at that stage that cost overruns will occur. If this is the case, it is highly unfortunate, and can serve as an appropriate background for justifying measures taken in Norway in recent years aimed to reduce cost overruns in major projects.

1.2 Earlier studies

In 1997, the Norwegian government initiated a study to review the systems for planning, implementation and monitoring of large public investment projects. The reason for this was a series of negative experiences with cost overruns, delays and limited viability of such investments. The study reviewed eleven project cases in the transport, defense and construction sectors. It was led by a steering committee with participation from the responsible ministries and the Ministry of Finance, and focused on (1) whether the documentation that provided the basis for decision was adequate when the project was approved, and (2) whether project implementation was satisfactory.

The study (Berg et.al., 1999) found that of the eleven projects, only three were completed within the original budget. The eleven projects had a total budget of about 5.5 billion NOK (1 billion USD). Cost overruns for eight of the projects where the final cost had been established were as much as 84 %. The cost overruns in three of these were particularly high (70-500 %). It concluded that underlying documentation was deficient in a number of projects, and failures in the initial phase of the project prior to the decision to go ahead were generally the main cause for significant cost overruns during implementation. More specifically, there were

- unsatisfactory analysis of needs and societal bebefits of alternative conceptual solutions.
- presentation of projects to Parliament at a premature level of investigation.
- inadequate use of Cost-Benefit Analysis and false assumptions
- inadequate assessment of uncertainty associated with estimates and calculations
- a number of factors related to procedures, qualifications, responsibilities, etc. that caused problems during the execution of the project.

The Work Breakdown Structure (WBS) was also a recurrent problem and it was found that *"the goals are expressions of wishes and intensions that are not broken down into operative units suitable for management for the projects. There is no priority setting between the goals, they are too many and cannot be realized at the same time. Commonly, what is expressed as goals are not objectives at all, but rather activities. Often projects have been initiated without an overall goal."* (Berg et.al., 1999)

At about the same time a government white paper on lessons from investments in North Sea oil exploration was published (NOU 1999:11). This report showed that in a sample of 13 projects all had cost overruns between 17 and 107 %, averaging 37 % of a total investment of about 30 billion NOK (6 billion USD). For all such projects that were approved in the period 1994-1998 the total cost overrun was about 26 billion or an average cost overrun of 13 %.

The findings in these two studies suggested implicitly that in the 1990s cost overruns in relation to budgets could be expected to be between 20 and 40 % in major public investment projects. A normalization of the situation at this level was not considered acceptable; hence the introduction of external quality assurance in the decision phase for the largest public projects, or what is now referred to as the State Project Model. The purpose would be to provide more successful projects and more benefits for every dollar, inter alia through reduced costs.

1.3 The introduction of the QA scheme

The Ministry of Finance was responsible for managing the scheme. The requirement for external quality assurance was formally rooted in the government's *Regulations on Financial Management in Central Government requirements for financial management* (Reglement for økonomistyring i staten), chaper 5.3.8. Major procurements. (Ministry of Finance, 2003). The scheme would initially only include quality assurance of cost estimate and control measures for projects to be submitted to Parliament for final appropriation of funds (later referred to as QA2).

The ministry conducted a tender and signed framework agreements with five groups of consultants that would be mandatory to use as quality assurers for the sectoral ministries. The groups of consultants have extensive expertise in project management and project cost estimation. The agreement was effective from year 2000. It stipulated

that only projects with an estimated cost above 500 million NOK would be subjected to the scheme. The oil and gas sector was excepted, as well as state owned enterprises and state owned operations, which themselves determine and manages their own investments (this includes hospitals). The scheme therefore would in reality apply to transport infrastructure projects (excluding aviation), defense projects and government building construction projects.

When the framework agreements were renewed year 2005, the scheme was extended to include quality assurance of the choice of conceptual solution prior to the cabinet's decision on whether or not to proceed with a project viability study (referred to as QA1). The reason for this was the recognition that the choice of concept is the most important decision for the State as the project owner. This agreement period applied from June 2005 to 2010, and introduced a system with two consecutive control points, QA1 and QA2.

The third and currently applicable framework agreement was signed March 2011 and is valid until the end of 2014. The scheme is largely a continuation of the previous, but with some adjustments. One important change is that the threshold value is raised from 500 to 750 million. Details about the contents of the scheme and how it is implemented are described in chapter 3.

Chapter 2 Project governance

In this context the term ”project governance” refers to the processes, systems and regulations that society (the financing party) must have in place to ensure that projects are successful. The Norwegian QA-scheme is an example of such an arrangement. This chapter discusses briefly the overall management of public investment projects in general, as well as the measures available to the State, and describes the QA scheme in light of this.

2.1 Definition of project success

What is meant by successful projects can be understood in different ways. It may be useful to distinguish between three levels of success:

1. Operational success: The delivery of the project is as promised and is both time- and cost efficient.
2. Tactical success: The project produces the maximum utility/benefit for the users at the lowest possible cost.
3. Strategic success: The project contributes to a desired societal development (as expressed by its long term objective), at the lowest possible cost and in a financially sustainable manner.

This is in accordance with the three levels of achievements seen in project management literature, i.e. (1) the outputs (project delivery), (2) the outcome (first-order effects for users), and (3) societal objective (wide and long term effect for society), (Samset, 2008).

Since public resources are scarce, one cannot define success by achievement alone, but must also require that the goals be achieved without a waste of resources. In economics we talk about three levels of effectiveness: (1) cost efficiency - a given amount of goods and services produced with minimal use of resources, (2) purpose effectiveness – the intended effects should be produced with the minimum use of resources, and (3) allocation efficiency – the society’s resources are used efficiently also in prioritizing between different objectives, user groups and sectors. See figure 1.

In practice, most of the focus is on operational success. This is because the project outputs can be verified immediately once the project is completed, and it is easy to benchmark cost efficiency against other projects. Tactical and strategic success can only be considered in the longer term and seen in relation to other measures and societal processes. Since major public investments typically have a broad societal perspective, the assessment of tactical and strategic performance will be vital aspects of the assessment of their success.

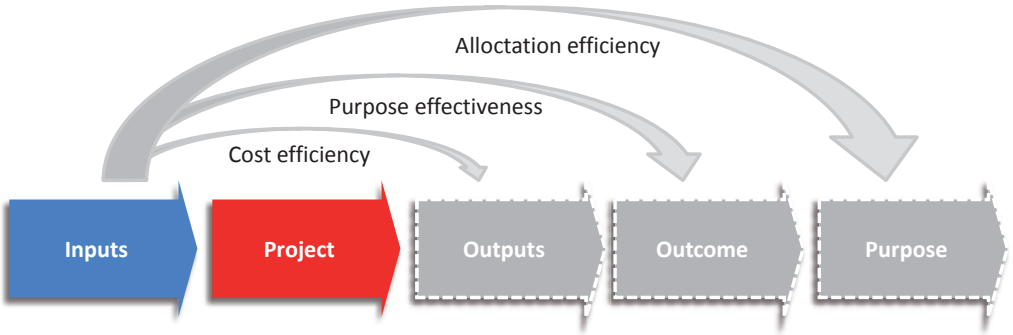

Figure 1. Three levels of efficiency. A successful project should realize agreed objectives, but it is also required that this is done efficiently, on time and with minimum cost.

2.2 Government measures

In order for projects to reach their goals many conditions must be met such as (i) the basis for decisions is adequate and realistic, (ii) the decision making process is transparent and as rational as possible, and (iii) project management and control is satisfactory. To ensure good governance, the financing party (the State) relies mainly on three groups of instruments: (1) Regulations (prohibitions and injunctions), (2) financial instruments (economic incentives and sanctions), and (3) information and training. The QA scheme contains elements of regulation, in terms of requirements for underlying documentation and external quality assurance of the basis for decisions. But there is also an emphasis on exchange of information, sharing of expertise and development of expertise among civil servants involved in the scheme. An important incentive mechanism is that the government may refuse to consider the proposed projects if it is not analyzed and documented well enough.

As regards (ii) above, the QA scheme affects decision processes only indirectly. The decisions are taken at the political level without any obligation to follow the recommendations by the quality assurers. A challenge in public investments in Norway has been that planning processes are often sectorially and locally based. What happens during the front-end phase has typically been a bottom-up process where ideas are generated locally by those who benefit from the project. Broader economic analysis will typically be done late, and there may be incentives to overestimate utility and underestimate costs. This is a classical principal-agent problem. The QA1 scheme represents more of a top-down process based in the Ministry of Finance, with a requirement that decision documents should adopt a broader societal perspective, and be reviewed by an independent third party. The implication could be that it will be more difficult to get state funding for projects that are economically non-viable or purpose ineffective.

Governance regimes pertaining to major investment projects may be more or less detailed. Previous studies indicate that a good approach is to establish general requirements for structures, processes, results, etc, but not interfere in project implementation

as such. (Samset et al., 2006). The current QA-system has established requirements for the type of documentation that must exist, but does not require that agencies use specific tools, formats, etc and will not interfere during implementation once the project has been initiated. This is in line with the current reform processes that aim towards "freedom with responsibility", management by objectives and performance management, etc (often referred to as new public management, or post-new public management), (Christensen, 2009). The idea is that this provides the best pre-conditions for efficiency.

2.3 Project Models

A project model is a standard classification of project phases (P) with specific decision points (R) and corresponding documentation requirements (D) etc. Decision points are introduced at particular critical stages, and a project cannot proceed to its next phase until positive go ahead is decided. Figure 2 shows a general example of a project model.

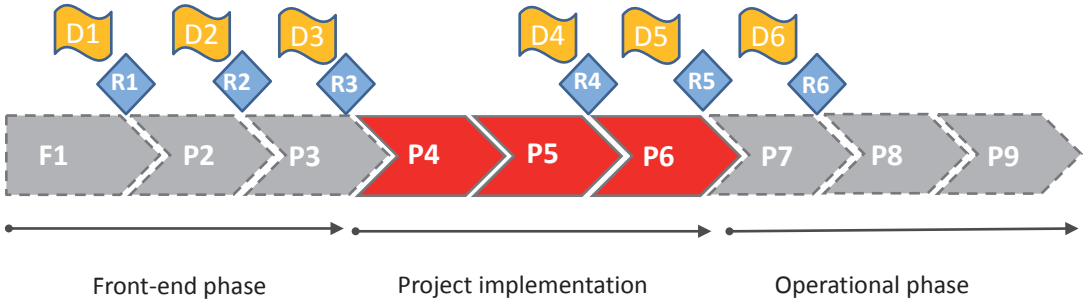

Figure 2. Example of a general project model with phases, decision points and documentation requirements.

Many institutions, both public and private, have established their own project models to ensure proper implementation, see e.g. Haanæs et al. (2005). It is less common to establish a model aimed to ensure successful projects in a broad societal perspective, which applies to several sectors. It should be noted that Britain has introduced a model somewhat similar to the Norwegian. The State Project Model has defined the following project phases (Ministry of Finance, 2010a)

1. Idea phase
2. Pre-study
3. Pre project
4. Engineering phase
5. Implementation
6. Start up
7. First year of operation
8. Adjustment/completion after the first year of operation

The QA-system, however, has only two decision points and associated documentation requirements. This is after phase 2, the pre-study (QA1), and after phase 3, pre project (QA2). The explanation is as mentioned above. This is a general overriding model for all major projects in several sectors to ensure good governance at a higher level. It implicitly assumes that the individual agencies have appropriate procedures for project implementation.

2.4 Further regarding the State Project Model

Figure 3 shows the State Project Model with its two decision points. The scheme is meant to strengthen the professional quality of decision documents upfront. The two quality assurance exercises precede two different types of decisions and therefore have entirely different contents. QA1 is meant to secure tactical and strategic success, and is designed to assess the outcome and long term achievements including the results and allocation efficiency of the project. QA2 is meant to ensure the operational success, and is aimed to ensure that cost frames are realistic and that the project outputs are produced on time and in a cost effective manner.

The QA scheme does not add considerably to the burden of bureaucracy in terms of additional analysis and documentation, since it introduces measures and requirements to improve the quality of analysis and documentation that would be done anyway, and documents that agencies with good management systems will nevertheless have to prepare for these major public investments.

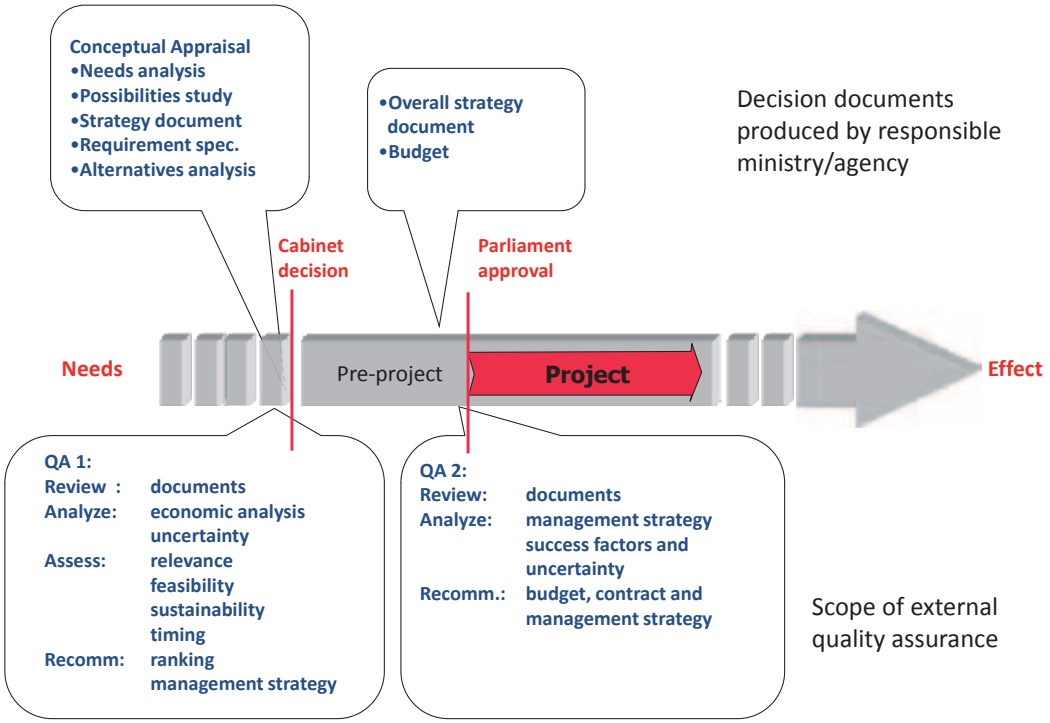

Figure 3. The State Project Model involves only two overarching decision points at the highest decision level. This ensures authority, while flexibility for those responsible is maintained.

What is added by the QA-scheme is the review done by external quality assurers. The requirements that apply to their work are somewhat more specific and systematic than the requirements imposed on ministries and agencies, although they are also allowed a certain freedom to use methods and tools they consider appropriate. The idea is that such an independent review has a disciplining effect and thus an intrinsic value. It is also understood that it could be simplified in cases where supporting documents are of good quality.

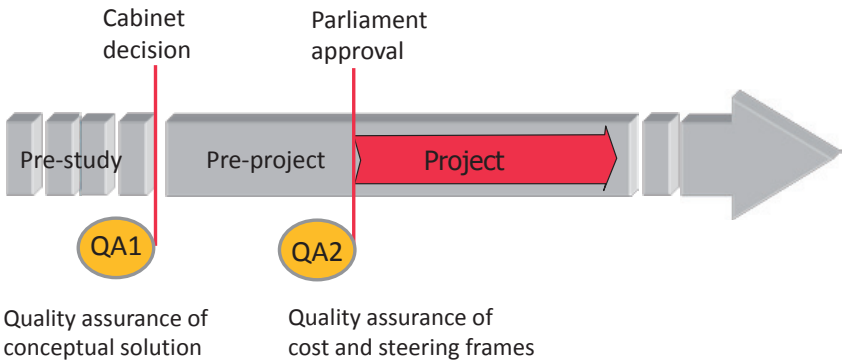

Figure 4. The quality assurance scheme. Contents of decision documents and tasks of quality assurers.

The quality assurers at QA1give their recommendation regarding the conceptual solutions, strategic framework and guidance, but the final choice of the conceptual solution is left with political decision makers. Figure 4 summarizes the documentation to be provided by the ministry/agency as the basis for quality assurance (upper part) and what the quality assurers should do (lower part).

2.5 Trailing research

The QA scheme has established a unique arena to draw lessons regarding preparation and implementation of major projects. Researchers at the Norwegian University of Science and Technology (NTNU) realized this early on and initiated a trailing research program to accumulate information about the projects over time and study the effect of measures taken during the front-end phase. The Ministry of Finance recognized the importance, among other things, that this could result in considerable spinoffs beyond the effect of the investment projects themselves, and therefore took over funding from the National Research Council in 2002.

The Concept research program is based at NTNU, but cooperates broadly with research and study centers at home and abroad in their respective fields. The program generates information about the projects on a continuous basis, which is stored in a database named Trailbase. On the basis of analysis of such data and other theoretical or methodological based studies it develops knowledge and know-how to ensure better procedures, improved quality at entry, better conceptual solutions and ultimately improved benefits and impact of large investment projects in general.

Trailing research is more an approach than a method. It emphasizes a certain involvement in processes and dialogue with stakeholders. The researchers participate in meetings and exchange sessions together with civil servants and quality assurers to discuss challenges, harmonization of practices, the need for manuals, and topics for further research. Researchers also from time to time participate in QA reviews, to learn about the practice and provide feedback to the consultants. Research results, reports etc. from the program are openly available to everyone and can be downloaded via the program's website.

The Concept research program is an independent research activity and not part of the QA-scheme or under instructions from the Ministry of Finance. It has an advisory role to the ministry with respect to the development and improvement of the methodological framework for the QA-scheme and the preparation of guidance material.

The overall objective of the Concept research program is to develop front-end management and project governance as an academic subject. Project governance as seen from the financing party's perspective has long been neglected in the field of project management. It has been widely recognized that there is a need for a more holistic and interdisciplinary orientation with a specific focus on the front-end stages of a project. The Concept research program develops learning material for teaching in the field of project management and other subjects at the university, in order to strengthen the competence of the coming generation of project managers and those responsible for governance of large investment projects.

Chapter 3 Projects subjected to external quality assurance

To date (2013) the QA2 scheme has been in operation for 13 years. About 160 reviews have been made (as per March 2013). The QA1 scheme has been in operation for eight years and about 60 Conceptual Appraisal reports and QA1 reports have been produced.

The projects (with few exceptions) represent major public investments with an expected investment cost above the threshold value of 0,5 billion NOK (0,75 billion as from 2011). The cost estimate amounts to 0.5-3 billion NOK for most of the projects, while a few have a much higher value. The acquisition of new fighter aircrafts for instance is estimated to 50 billion NOK. Their distribution across types of projects is shown in figure 5.

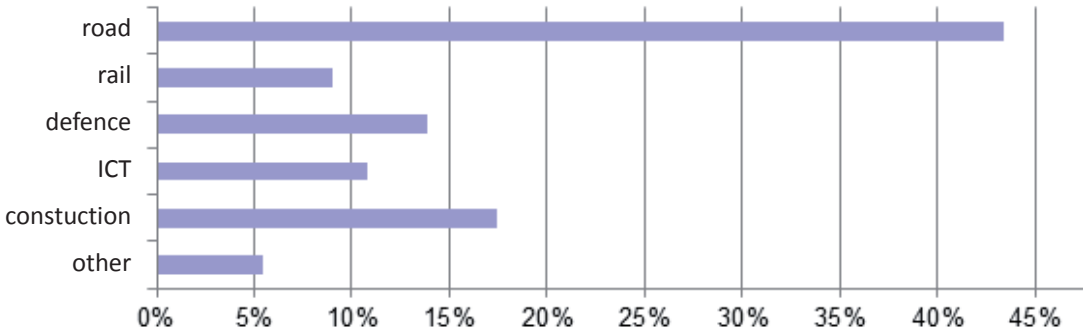

Figure 5. The distribution of projects subjected to quality assurance according to the type of project from the period 2000-2013 (both QA1 and QA2).

About half of the projects fall under the Ministry of Transport's responsibility (road and rail), thus having gained more experience with the State Project Model than any other ministries. Then follows the Ministry of Defense which also had a larger number of quality assurance reviews specifically related to acquisition projects (combat aircrafts, combat vehicles, weapon systems, etc.). Also the Ministry of Education and Ministry of Culture have had several projects subjected to external quality assurance, such as university and public buildings. The Ministry of Government Administration, Reform and Church Affairs, with its agency for construction of public buildings (Statsbygg) is also involved, and of course the Ministry of Finance in its role as the manager of the QA scheme.

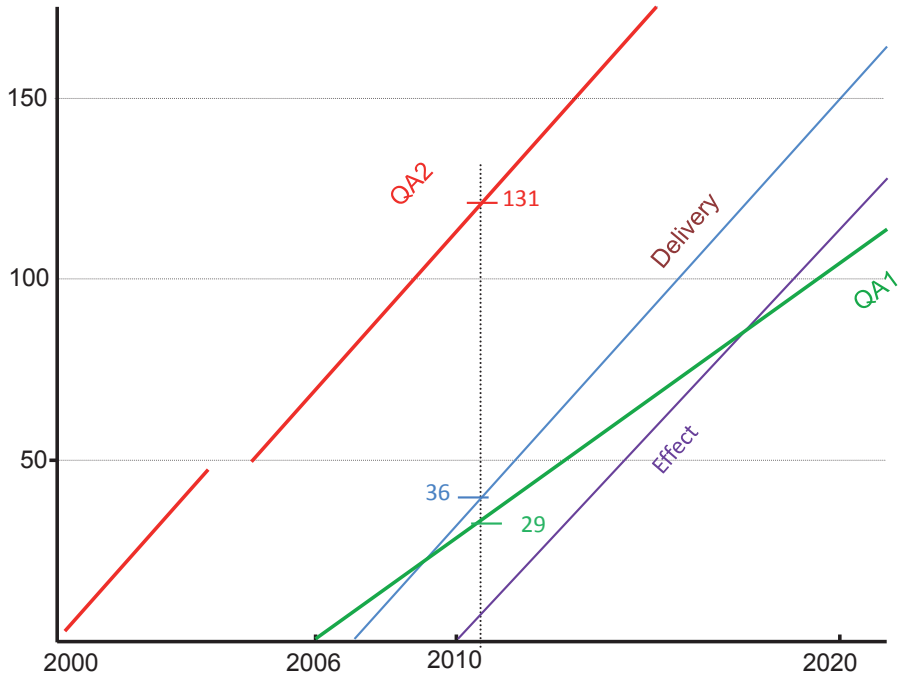

Figure 6. The cumulative number of QA2 projects in various stages over time. End of front-end phase (red line), end of implementation (blue line) and 5 years into the operational phase (violet line). Projects subjected to QA1 are marked with the green line. Stylized projection showing the principle, not actual numbers.

Since its inception, the parties have gained considerable experience with the QA scheme in several sectors. But so far it has been too early to evaluate the effects of the scheme. It is only now and in the years ahead that information will be available to say anything about this. The reason is that it takes a long time to plan and implement large investment projects. The first projects that underwent QA2 in 2000, have since undergone an engineering and construction phase which typically takes 5-10 years. This is indicated by the grey line ("delivery") in figure 6. As of 2013, approximately 50 projects have been completed and come into the operational phase. For these projects it is now possible to observe the final cost, time, quality of delivery, etc, in other words, indicators for the project's operational success. By comparing the results with the situation in the 1990's before the QA-scheme was introduced, we can also infer something about the scheme's impact. This is the topic of chapter 4.

The more comprehensive system of quality assurance of the choice of the conceptual solution QA1, introduced in 2005, is marked by the green line in the chart. The number of QA1 reviews per year, on average, is slightly lower than the number of QA2, hence a slightly less steep line. The proposed projects that have been through QA1 will first undergo a pre-project phase with subsequent QA2 review, then detailed planning/ engineering and then an implementation phase. To date, none of the projects that have been through QA1 have been completed . They would also have to be at least 3-5 years into the operational phase before they can be evaluated in a tactical and strategic

perspective, and lessons can be drawn about the effects of the QA1 exercise. The purple line ("effect") in figure 6 shows that the first projects that have been through QA2 now are 3-5 years into the operational phase and can be evaluated in a tactical and strategic perspective. However, these have not been through QA1 and such evaluations will therefore only serve as a control group for subsequent impact evaluations of QA1 projects.

Useful experience of the QA1 process itself has been gained, i.e. how it works, whether it affects the final choice of conceptual solution, etc. Indirectly, this may give some indication of its efficiency. See chapter 5 for a brief discussion of this.

Chapter 4 Lessons with the QA2 scheme: Cost management and efficiency during implementation.

Parliament to approve the project cost frame. The input to the QA2 review is essentially produced by the respective government agencies, which in turn will be responsible for following up the resulting recommendations. The sectorial ministries have the overall responsibility as owner and will commonly be the ones that establish the agencies' steering frame and control the use of contingency reserves (the difference between the cost frame and the steering frame), see figure 7. There has been a significant learning effect for both agencies and quality assurers over the years, and both parties have continually improved tools and practices for estimation and management. Several guidelines have been produced by the Ministry of Finance with direct involvement of stakeholders and these seem to be followed to a large extent.

4.1 What the scheme involves

The control aspect is essential in the QA2 review, to ascertain that the basis for the appropriation proposal to the Parliament is sufficient. But it has also a forward looking perspective to ascertain that key challenges in the implementation of the project are identified. Securing efficiency and operational success is thus important: the agreed project output shall be produced in the most time- and cost effective manner. The agency is obliged to provide the following documentation as input to the quality assurance review:

- The overall management document (steering document. This will provide an overview of all key aspects of the project, its objectives and management framework and project strategy. There are few detailed requirements regarding its content and design, since it is essentially meant as a management tool for the agencies.
- A complete base estimate for costs and if relevant also income/revenue
- An assessment of at least two alternative contract strategies

The quality assurer shall review and verify these documents and make a separate analysis of success factors/pitfalls and the overall uncertainty scenario. The cost uncertainty analysis shall be based on the base estimate and stipulate expected additions in order to establish the expected costs and associated uncertainties, see figure 7. The quality assurer shall give his recommendations regarding:

- Proposed cost frame including necessary contingency reserves, and the agency's steering frame.
- How the project should be managed in order to keep within the cost frame, including the management and authorization of contingency reserves.

The recommendation regarding the proposed cost frame is an important part of QA2, and it is based on stochastic (probability-based) cost estimation (see e.g. Concept reports 10-13). The reason for this is that simple deterministic cost estimates are often systematically skewed and also do not provide sufficient assurance that the cost frame eventually adopted by Parliament will hold. By means of stochastic estimation, either based on mathematical-analytical methods or simulation tools, the result is a cumulative probability distribution of investment cost as in figure 7. The proposed cost frame is normally P85 with deductions for possible simplifications and reductions (reduction list) that can be handled during the project if the cost frame would be in danger of being exceeded. The agency's steering frame is lower, normally at the P50-level, in order to avoid incentives to use contingency reserves. (The agency should have a project management steering frame which is even lower).

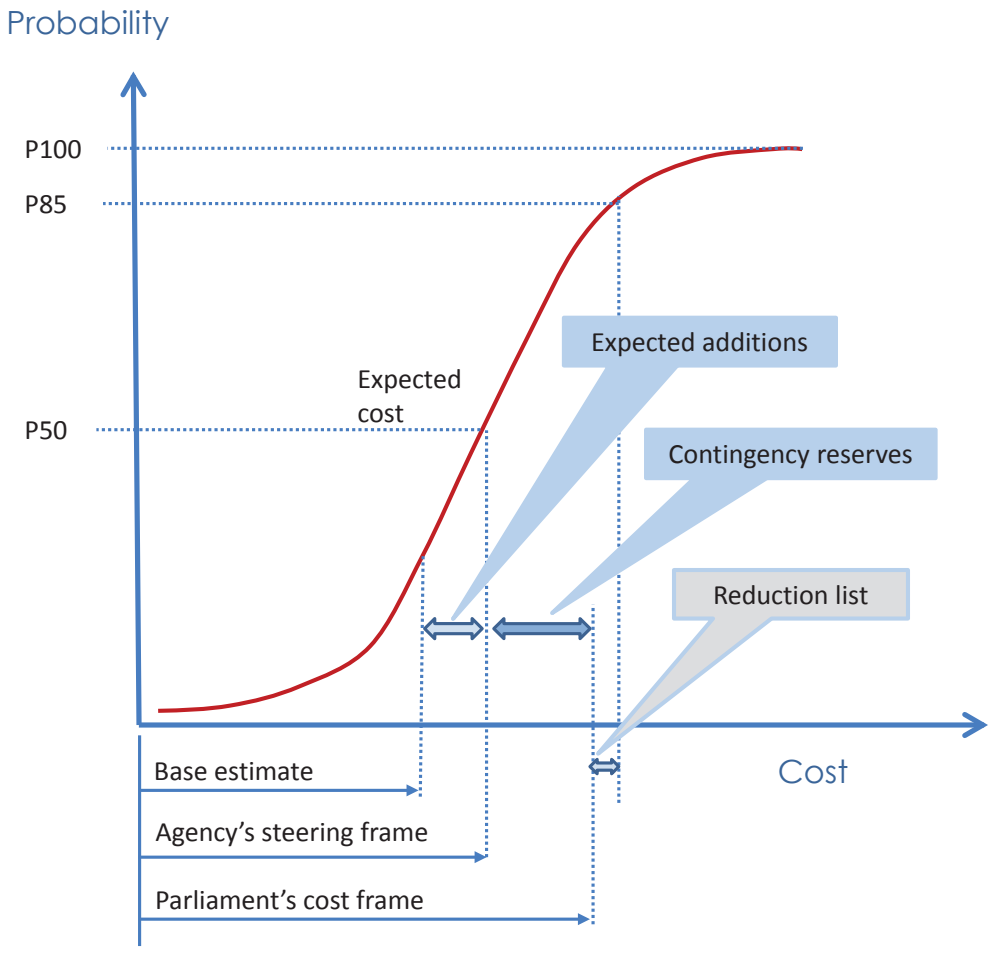

Figure 7. Stochastic cost estimation. Definition of key terms.

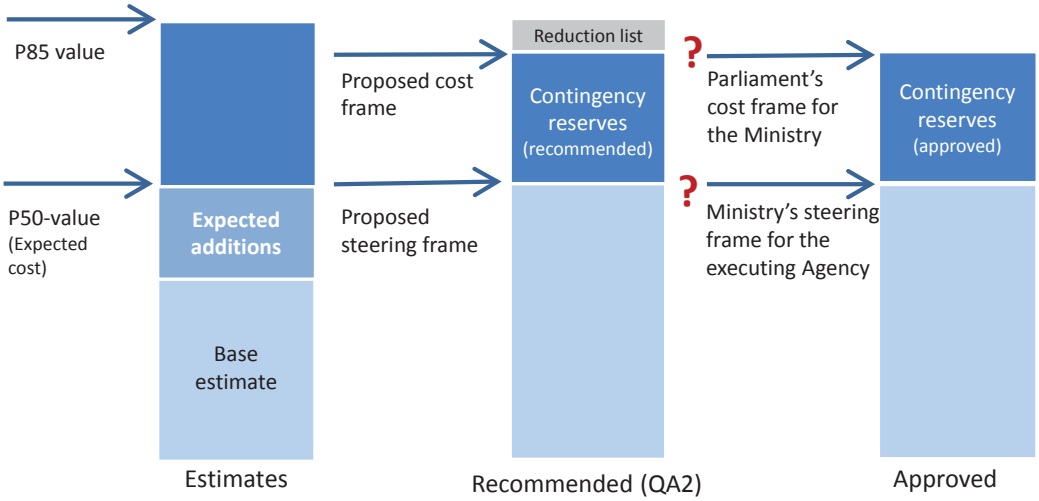

Figure 8. The relationship between the estimates made by the agency and the quality assurers, their recommendations, and the cost frames that are finally adopted for the project.

The Parliament and the responsible ministry are of course not required to follow these recommendations. The final overall cost frame for the project is decided by Parliament. Then the ministry will determine the steering frame for the executing agency. This is illustrated in figure 8.

In professional terms, the QA2 review rests heavily on project management expertise, i.e. how to ensure that project outputs are delivered on time, with agreed quality and within cost frames. Contract strategy is an important part of the exercise, but also elements of economics, including incentive theory, transaction cost theory, and organization theory more generally. One must expect that the quality assurers have expertise in all these areas.

4.2 The final cost of the first 40 completed projects

As outlined in figure 6, about 50 of the projects that have been subjected to QA2 are now completed and in their operational phase. A key success criterion for projects is that cost frames are adhered to and this is now for the first time possible to verify.

The Concept program has collected data on 40 of these projects. The findings are documented in more detail in a separate report, see Aass (2013). The main findings were also presented at the program's Fifth International Symposium on Project Governance, September 2012.

The sample includes all QA2 projects that were completed by the end of 2012, and where the final settlement of contracts were concluded or progressed so far that the final investment cost was known. Of these, about half were road projects (21). The other projects included building construction (7), railway (6) and defense projects (6).

This is fairly representative of the sectorial distribution of investment projects under the QA scheme to date, see also figure 5.

The projects were subjected to QA2 in the period 2000-2009, and implemented in the period 2000-2012. Some were planned and also started, in the days before QA2 was introduced.

The problem of standardization of cost figures

To calculate the final cost and compare this to the estimate and cost frame is basically a straight forward task. In practice, however, different agencies have different accounting and reporting procedures, including how to adjust for price regulations and discounting from one year to another. Among the main differences is the index used and whether price control is applied to the whole cost frame or just the remaining unused portion of the cost frame.

This becomes a challenge when one wishes to compare the results of projects from different sectors and agencies. For these reasons, the registered cost figures used in this study are not fully comparable between agencies. Each year price levels that are applied are not identical, although they center around the 2009 level. To compensate for possible errors we present the main results as percentage deviations from the projects' steering frame and cost frame. Where cost figures are mentioned in absolute terms, these must be interpreted with caution.

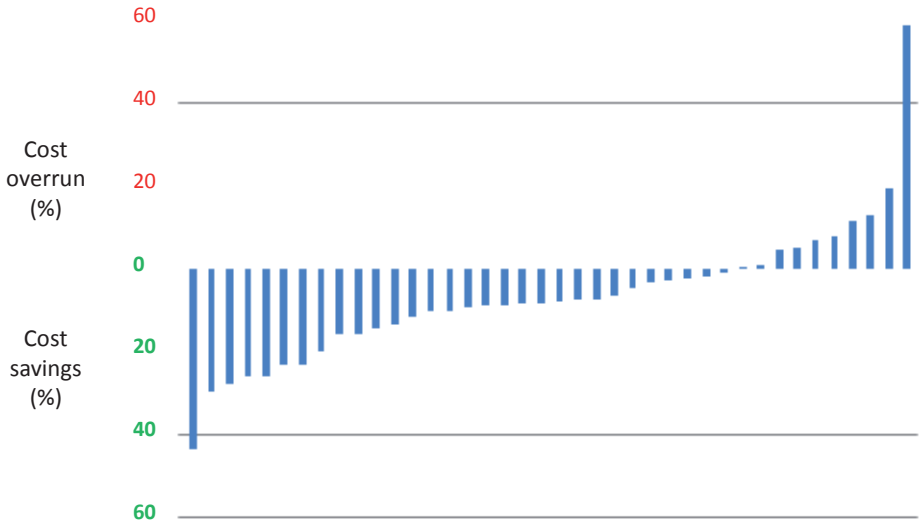

Figure 9. Deviation between the final cost and the cost frame approved by Parliament (N=40)

4.3 Final cost relative to approved cost frame.

The most essential success criterion applied on public investment projects is whether they remain within the agreed cost frame. This is also what people in general are exposed to through the media. Large cost overruns get much attention in the press from time to time. Figure 9 shows the difference between the final cost and the cost frame approved by the Parliament, where the latter largely corresponds with the P85 estimate

The data demonstrates that 32 of the 40 projects, i.e. 80%, were completed within or below the cost frame. Some of the projects had significant savings, in total about 5 billion NOK. (mostly road projects). Eight projects, however, exceeded their cost frames, totaling 1.7 billion NOK altogether. About half of this was due to one railway project alone. The total net saving for the projects taken as a whole was more than 3 billion NOK, or about 7% of the total investment.

Needless to say, this is an exceptionally good result compared to what one could expect based on past experience and findings from a number of studies in other countries.

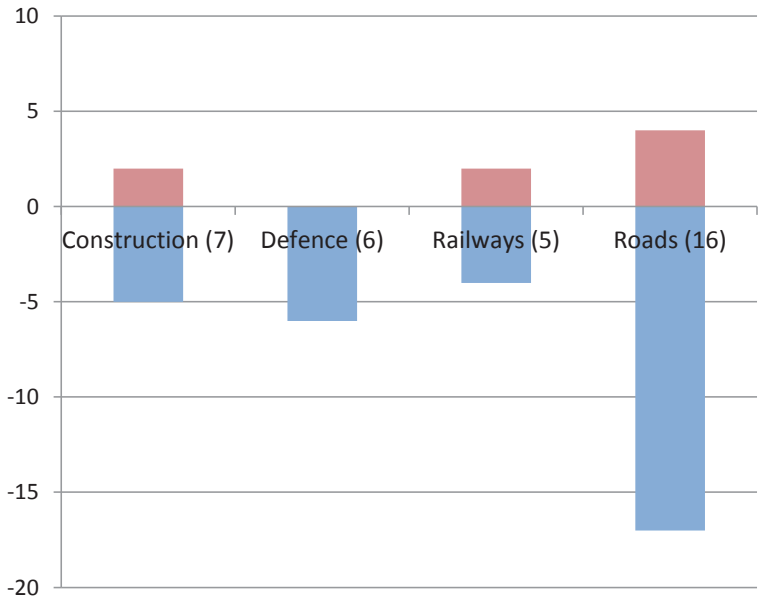

Figure 10. Number of projects respectively, with cost overruns and savings, by sector.

Cost deviations by sector

The next question is how projects in different sectors complied with approved cost frames. The number of projects in this study is obviously too small to draw any firm conclusions, but the defense sector stands out for all projects within the cost frame. The road sector represents about the average for the entire sample, with 80% within the cost frame, while the railway and construction sectors performed somewhat poorer, respectively 67% and 71%. See figure 10.

Cost deviations by project size

Figure 11 shows the projects over- and undershoot in absolute terms (billion NOK), sorted according to the size of the project. It demonstrates that all eight projects with cost overrun are smaller projects, i.e. well below 2 billion NOK. It must be added that the majority of the projects in the sample are of this size, including those which hold the cost frame. It is interesting to note, however, that all the largest projects were completed with cost savings, deviating positively from the cost frame.

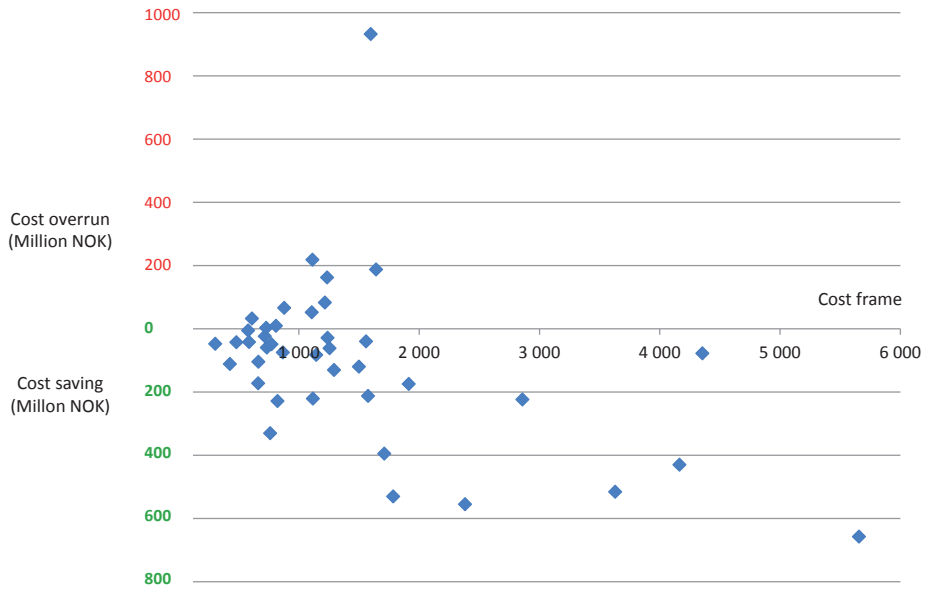

Figure 11. Difference between the final cost and the approved cost frame, by the size of projects. Only the smaller projects had cost overruns.

Cost deviation by date

Another factor that may influence the probability of cost overrun is the date of the commissioning of the project. One could imagine that the outcome is affected positively or negatively by learning effects, or effects of economic cycles that projects do not get compensated for through price controls, and which has not been captured by the uncertainty analysis.

Figure 13 shows the difference between the final cost and the approved cost frame for the projects, now sorted by time of inception, from 1999 to 2008. We then find (with one extreme exception) a tendency that cost overruns have been in the latter part of the period. This may be due to strong increases in costs in the construction industry that occurred towards the end of this period. It could also be that the subsequent Global Financial Crisis of 2007-2008 have had unforeseen consequences. Beyond this it is difficult to determine any cause of the vague tendency that is observed.

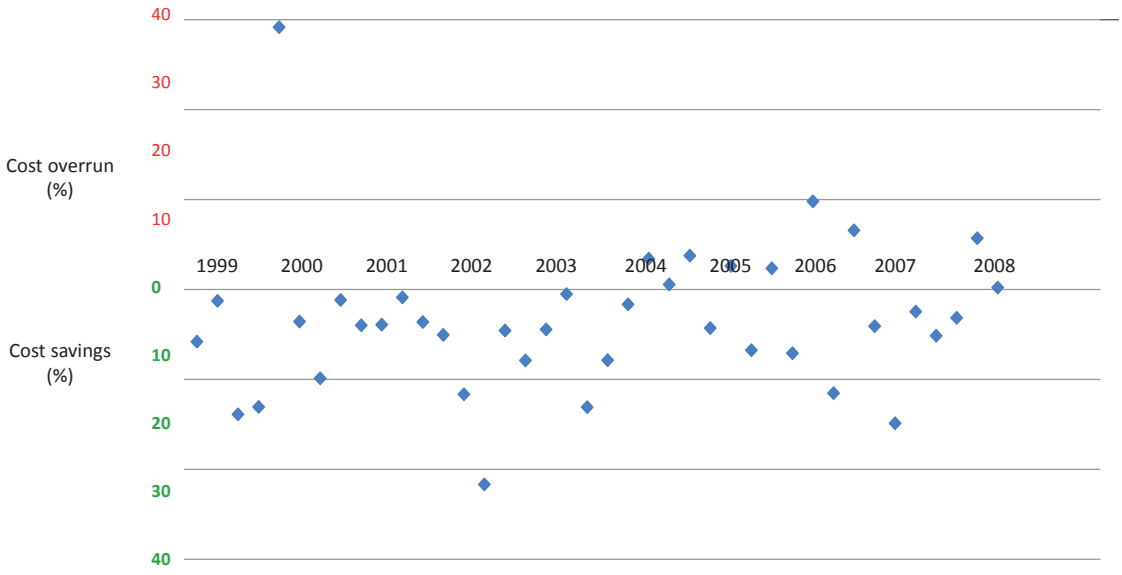

Figure 12. Deviations between final cost and approved cost frame, by the time of commissioning of the project.

4.4 Final cost in relation to the agency's steering frame

The steering frame for the executing agency coincides as mentioned to a large extent with the estimated expected value (P50). Ideally, all projects should be completed at the expected value. However, given the uncertainty associated with implementation one must not only expect, but also accept deviations. The principle is that if a portfolio of several projects together is completed with equal sizes of overruns and underruns in relation to the steering frame, the average for the whole portfolio will still be around the expected value.

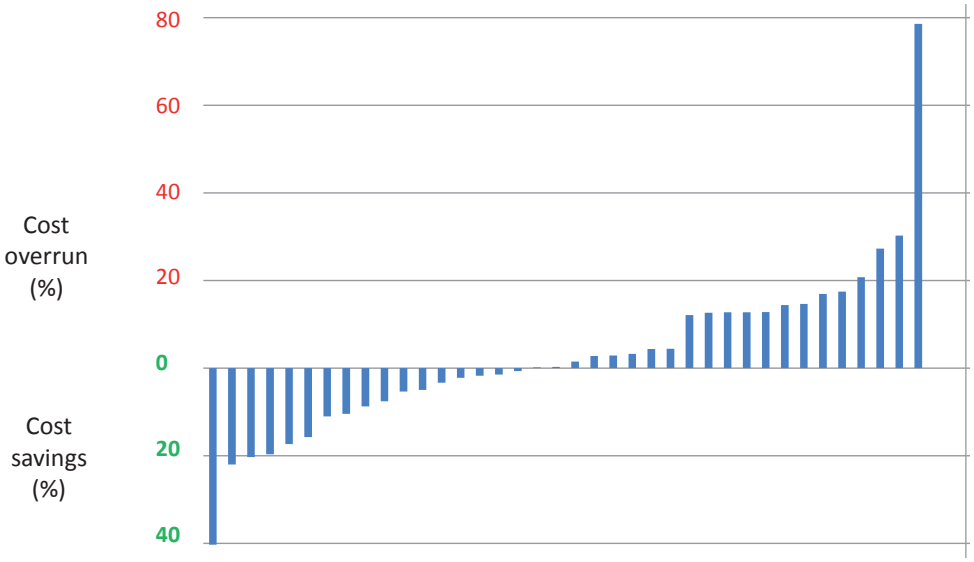

Figure 13. Deviation between final cost and the agreed steering frame for the project. N=40

The differences between the final cost and the steering frames are illustrated in figure 14, which shows that exactly this is the case in the projects in this study. The differences are symmetrically distributed about the expected value, and the portfolio as a whole will correspond with the P50 value fairly accurately.

This is a sign of good cost control at the portfolio level. A comparison of the deviations between the final cost and the P50 values gives the same result (not shown here). Overall, the portfolio of projects has been executed with a total cost overrun about 1 billion NOK in absolute value. However, this is roughly equivalent to the very large overruns on one particular (railroad) project alone.

4.5 Estimates and recommended cost frames (QA2)

The QA2-review results in recommendations regarding cost frames, and how the project should be managed in order to keep within these frames. The recommendations are only advisory, so a relevant question is to ask to what extent the recommendation are followed when the cost frame is determined.

The cost frame

Figure 15 shows that in about 70% of the cases, the cost frames approved by Parliament are identical with the quality assurers' recommendations. In other projects there are minor deviations (up to +/-6%) mainly adjusted upward. The figure may seem to suggest an upward trend in the latter part of the period, but data is insufficient to allow any firm conclusion about this.

The quality assurer's recommendation is in turn identical to the P85 estimate for approximately one third of the cases, in a few cases it is higher (e.g. P90), while in more than half of the cases the proposed cost frame is lower since the reduction list elements have been deducted (see Figures 7 and 8).

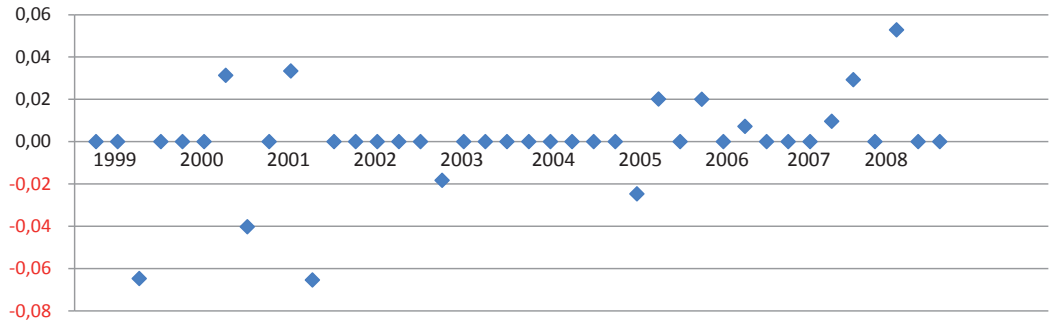

Figure 14. Deviations between the cost frame recommended by the quality assurers and the what was subsequently approved by Parliament N=40

The steering frame

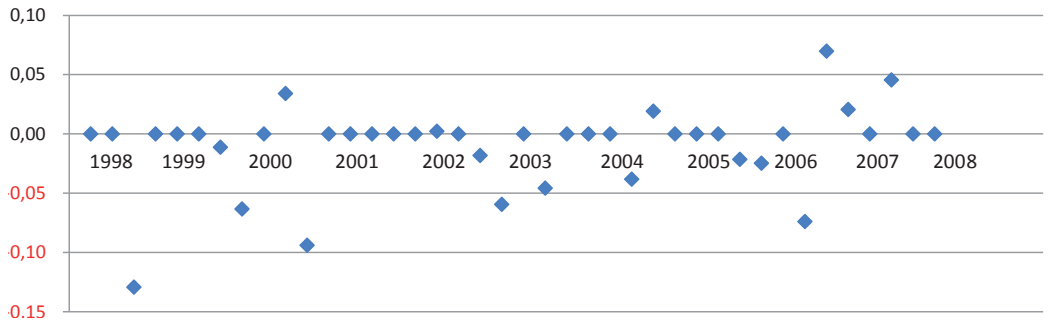

Figure 15. Difference between the quality assurer's recommended steering frame and the final steering frame. N=40.

Figure 16 shows the differences between the quality assurer's recommended steering frame and the agencies' final steering frame set by the ministries. It suggests the in 54 % of the cases, the final steering frame is the same as recommended by the quality assurers. In the remaining projects, with two exceptions, the deviations is within +/- 10 %, and the tendency is to reduce the steering frame.

The recommended steering frame is in turn identical or very close to the P50 estimate in two thirds of the cases. In the remaining projects the deviations are small and within the P45-P55 range.

4.6 Evaluating operational success in 23 projects

Researchers at the Concept program undertook in 2010 a review of the first 23 projects that had been through QA2, and which at that time were completed. The study had a broader perspective than just cost management. Large amounts of data were collected regarding how the projects were implemented, with the aim to assess both the outputs and processes, and how the projects were organized and managed. The main conclusion was that project outputs by and large were achieved as planned both in terms of time, cost and quality, and that the projects were essentially well organized and executed. The implementation phase lasted five years on average. Only two of the projects lagged more than three months behind schedule.

Researchers also looked into the extent of changes that had taken place during the implementation, with a view to identify any quality improvements or scope increases beyond what was planned. They concluded that there were no cases where cost overrun could be explained by scope changes. It was not always well documented what was the cause when the steering frames were adjusted during the implementation period (or contingency reserves were used), and clear criteria for such amendments were not always established.

Organization and management of the projects were considered favorably by the researchers, progression was good and actions were taken as needed. The weaker points were uncertainty management and contract management in some of the earlier projects, but the researchers concluded that uncertainty management in these cases was not representative for later projects where this has been highlighted, and both methodology and procedures have improved. It was suggested that project governance at the ministry level could have been better, but the researchers did not go deeply into these issues. Based on their own professional judgment researchers gave an overall assessment of the project's operational success. This is shown in figure 17.

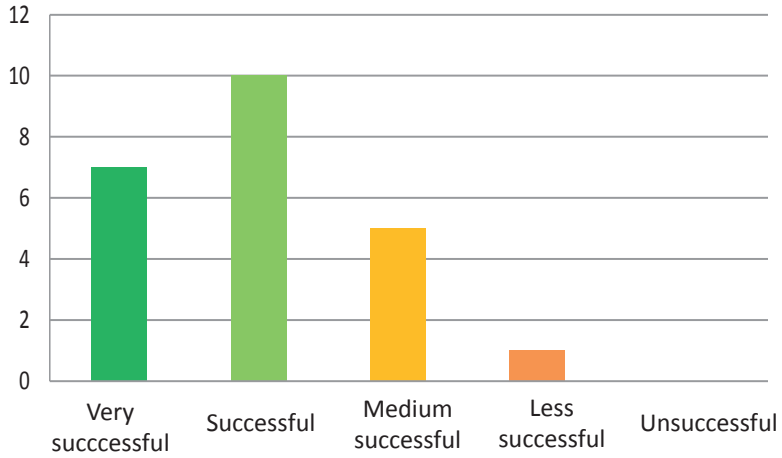

Figure 16. Operational success, the researchers' assessment. N=23.

In the seven cases considered "very successful" all project outputs were produced and performance was outstanding, for instance, by having established new best practice. In "successful" projects (10) all targets were achieved and management was good with no significant problems along the way. "Medium-successful" projects had not reached all targets, but with good explanations why this was not the case. Implementation has been acceptable but with some weaknesses. In the "less successful" projects management had been passive and outputs were produced to some extent due to luck. There was only one project in this last category. None of the projects were considered "unsuccessful" (in which very much has gone wrong and the overall impression is clearly negative).

4.7 Evaluating four case projects (QA2)

The significance of systematic evaluation of projects that have undergone quality assurance was discussed in chapter 3. As a first step towards such a practice, the Concept research program in 2012 conducted pilot evaluations of four projects that have been subjected to QA2 in order to test methodology and establish an appropriate evaluation format (Volden and Samset, 2013). Such evaluations must be sufficiently comprehensive to ensure that both the operational, tactical and strategic perspectives are captured. It must also be simple and inexpensive enough so that a sufficiently large number of

projects can be covered. And finally, the format and methodology must be the same in all evaluations so that one can compare results across projects and sectors.

Since no QA1 projects have yet been completed, the pilot evaluations were done on four QA2 projects, only. These included a border control station at the Norwegian/ Swedish border, a railway section near Oslo, a highway section near Oslo and a defense acquisition project (missile torpedo boats for the Navy).
The evaluations are documented in separate reports (Finne et al., 2012, Nilsson et al., 2012, Aass and Welde, 2012 and Whist et al., 2012). Below is only a brief summary of the assessments of operational success in the respective projects.

1. The national boarder station:
   In this project the completion date was the number one success criterion, since the station had to be completed by the 7th of June 2005, the centenary of the breakup of the Union between Norway and Sweden. This was achieved. The project was completed within the steering frame with considerable margin. Quality metrics related to the systems functionality were also largely met. Implementation appeared to be good and effective. In this project a new project management model was tested aimed to strengthen project governance, which seemed to have contributed to the good results. Evaluators gave this project score of 6 out of 6 for operational success.

2. The railway section project
   This was the first stage of the development of a new double track link between Oslo and neighboring cities to the west. A large part of the route was in tunnels. The project was delivered in a timely manner. An unforeseen additional expenditure (replacement of the signaling system) forced the project managers to make other reductions in accordance with advice from the quality assurers. The project kept within the cost frame but exceeded its steering frame. The Swedish evaluator concluded that this was a good result compared to many Swedish railway projects, and gave the project 5 out of 6 for operational success.

3. The highway section project
   This comprised a minor section of the main highway between Oslo and Stockholm. It exceeded the cost limit by approximately 5%. The evaluator explained this with inadequate planning and lack of internal resources, and partly as the result of uncertainty that had already been identified at QA2. The finished road met all technical and functional requirements, and it was completed on time. The evaluators score was 4 out of 6 for operational success.

4. The MTB defense acquisition project
   The project comprised the delivery of five missile torpedo vessels (Skjold Class) including weapon systems. The delivery was delayed by 3-4 years, compared with the original schedule, mainly due to challenges regarding new technology. The evaluator suggested that the time frame had been too optimistic. The boats' performance,

functionality and quality are satisfactory, they were delivered within the overall cost frame, but the steering frame was exceeded by 8%. In order to keep within the cost frame, the main contractor, a local shipyard, incurred considerable loss. The project still scored 4 out of 6 for operational success.

In total, three out of four projects were completed within the cost frame. The generally high score on operational success may indicate that the cost frames were realistic, and that the recommendations regarding organization and management were satisfactory. The uncertainties that affected the projects had already been identified in the QA reports, with few exceptions. It should be noted that the evaluators' assessment of tactical and strategic success was more varied. But, as mentioned, none of these projects had been subjected to quality assurance of the choice of concept (QA1).

Chapter 5 The QA1 scheme: The choice of projects' conceptual solutions

As mentioned, the QA1 scheme was introduced in 2005 as an expansion of the QA scheme in recognition that the choice of concept is the most important decision for the State as the project owner. The main issue here is how best to solve the underlying project-triggering problem and associated societal needs. QA1 is thus intended to focus on both the project's tactical success, the effectiveness, and its strategic success and allocation efficiency.

Nearly eight years after the first QA1 report was produced it is still too early to evaluate the effects of the scheme, since none of the approximately 60 projects that have been reviewed so far have yet been completed and put into operation. This chapter explains what we know so far about the projects that have undergone QA1, the work done by government agencies to produce Conceptual Appraisal reports, the quality assurance of these documents, and the resulting decisions. Indirectly, one can also infer some of the spin-off effects in government, industry and academia after the QA1 scheme was introduced.

5.1 What the scheme involves

QA1 is implemented at the end of the pre-study stage, before a decision by the Cabinet whether or not to proceed with the pre-project phase. The term "concept" refers to the conceptual solution that is chosen to meet a specific societal need. For example, the need to connect an island to the mainland can be solved in different ways for instance by constructing a bridge, a sub-sea road tunnel or continued ferry transport (the zero option); in this case, three conceptual alternatives. The purpose of QA1 is to ensure that the choice of concept has been subjected to a political process of fair and rational choice. The ultimate aim is that the chosen concept is the one that is considered the best use of public funds. The choice of concept is a political decision to be made by the Cabinet, while the quality assurer's role is restricted to assessing the quality of the documents supporting the decision.

The responsible ministry and/or executing agency is required to prepare a *Conceptual Appraisal (CA)*, which should include the following chapters:

1. A needs analysis mapping all stakeholders and affected parties, and assessing the project's relevance in relation to societal needs and priorities.
2. Overall strategy defining the project's goal and purpose (first order and long term effects), with emphasis on consistency, realism and verifiability.

3. Overall requirements specifying essential requirements which need to be fulfilled when the project is implemented.
4. Poissibilities study. Needs, goals, purpose and requirements will together constitute an "opportunity space". It is essential to ensure that the opportunity space is not too narrow and allow alternative conceptual solutions to be identified.
5. Alternatives analysis, which should include the zero option and at least two alternative conceptual solutions. The alternatives should be subjected to a benefit-cost analysis.
6. Guidelines for the pre-project phase, including the implementation strategy for the chosen concept.

The first four chapters of the Conceptual Appraisal are largely based on the principles of systems analysis (see e.g. Samset, 2008 and Samset et al., 2013). This is a methodological approach and procedure used to find an optimal solution to a problem, and which is particularly well suited in an open-ended appraisal process. Rather than start with the project of choice, the idea is to clarify the underlying problem that needs to be resolved, describe the conditions and requirements that will have to be fulfilled and then identify solutions and assess their feasibility against these conditions and requirements. The Conceptual Appraisal plays a significant role in QA1 and it is critically important not to narrow down the opportunity space too much, in order to allow the best concept to be identified and included in subsequent evaluation.

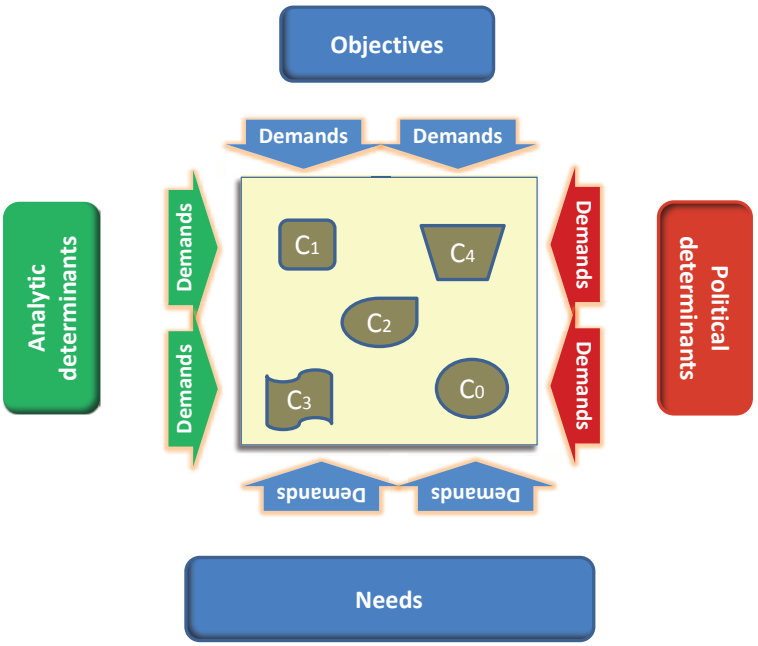

Figure 18. The opportunity space is defined by the overriding demands that all the relevant conceptual solutions C_1, C_2, C_3, etc. will have to fulfill. The demands are largely expressions of priorities and needs in the society. (Source: Samset et al., 2013)

Systems analysis provides a logically coherent chain of analysis where the problem is interpreted as a system or an opportunity space with requirements that have to be fulfilled for the system to be functional and take into consideration the needs and objectives of key stakeholders. The requirements limit the scope of the opportunity space in the sense that they establish the basis for what is permissible and what is not. As illustrated in figure 18, this is an analysis that has to balance between on the one hand the *rational* (what is technically and economically feasible) and on the other side what is *politically* possible.

Public resources are scarce, and alternatives will have to be ranked according to economic feasibility. A Cost-Benefit Analysis is therefore an essential part of the Alternatives analysis in chapter 5 of the Conceptual Appraisal. This part of the process will have to be based on agreed economic theory and practice (see Ministry of Finance (2005)). Through comprehensive economic analysis the direct and indirect economic consequences of the alternatives should be identified and clarified. The zero option (to do nothing) should be included along with the identified alternatives. Economic effects should be expressed in monetary terms to the extent possible. The main principle of evaluation is that the monetary value of a positive effect shall be equal to what the population is willing to pay to obtain it. For a project to be considered economically viable, the population in total should be willing to pay at least as much as the project costs. Costs and benefits that cannot be expressed in monetary terms, must also be described in other ways (quantitatively or qualitatively) and be included in the analysis. In some cases, a cost-effectiveness analysis can be made and alternatives ranked based on cost per unit of utility (such as the number of lives saved, etc.).

The quality assurer shall perform an independent review of the Conceptual Appraisal with respect to consistency within and between chapters, whether the specified alternatives are relevant and valid in relation to needs, strategy, overall demands and utilization of the opportunity space. The quality assurer shall also conduct its own uncertainty analysis and economic analysis as well as provide recommendations regarding the decision making strategy. Alternatives should be ranked based on an assessment of monetary and non-monetary costs and benefits. Quality assurance thus involves a separate independent professional review, in addition to providing a control of estimates done by the executing agencies, which might have a vested interest to overestimate benefits and underestimate costs of certain preferred alternative solutions.

And finally, the quality assurer shall assess the implementation strategy and give his recommendations on guidelines for the pre-project phase. This includes which elements from the QA1 review that should be included in the project's steering document.

5.2 The experiences with Conceptual Appraisals and QA1 after eight years.

In the period from 2006 to March 2013, 57 investment projects with full or partial government funding were subjected to QA1.

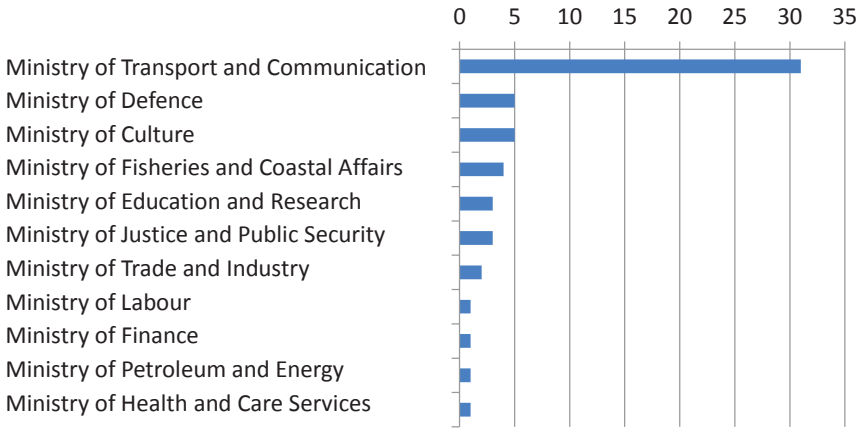

Figure 19. Distribution of QA1 reviews per ministry, during 2006 to 2013. N=57

Figure 19 shows how these projects are distributed among ministries. The Ministry of Transport stands out with more than half of the QA1 reviews during this period. Of these, about half are (sections of) road projects and the remaining are combined transport solutions in cities, railway projects and joint studies for road and rail.

Figure 20 shows the distribution of QA1 reviews undertaken within the last eight years. The average per year is seven with considerable variation. The peak years are caused by the Ministry of Transport and its work with the national transport plan 2010-19, and again the plan 2014-23 plan four years later.

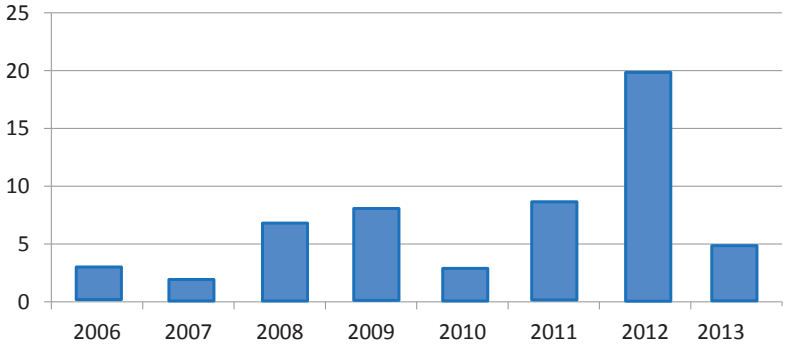

Figure 20. The number of QA1 reviews per year for the period 2006-2013. N=57

5.3 Conceptual Appraisals and the quality reviews

Several agencies such as the Norwegian Public Roads Administration and the Agency for Railway Services have acquired considerable experience in doing conceptual appraisals over the years. These agencies have been delegated the responsibility for producing conceptual appraisal reports from their parent ministries. In other sectors, particularly those without strong and competent specialized agencies, the ministry itself has been strongly involved in conceptual appraisals. In many cases external consultants have been used.

There is little doubt that the quality of conceptual appraisals has improved steadily over time and that there is a convergence towards a common best practice. The same can be said about the quality assurance reports – also the quality assurers have been through years with a positive learning curve. Exchange of experience through a wide range of quality forums organized by the Ministry of Finance and the Concept research program has played an important role, and has resulted in the production of various guidelines, including a guide on conceptual appraisal (Ministry of Finance, 2010b). Several agencies have also developed their own guidelines and templates for conceptual appraisal work, see e.g. NPRA and Rail (2006), NPRA (2010), Rail (2011) and the Ministry of Defense (undated). The military has integrated the conceptual appraisal into their project model PRINSIX. Also, the requirement of the conceptual appraisals has added pressure to keep guides and templates for economic analysis up to date in ministries and agencies.

There are already some reviews prepared regarding how the CA/QA1 process perform in the transport sector, and the participants' experience with the scheme, see e.g. Rasmussen et al. (2010), NPRA (2012), and Bjertnæs (2012). These studies assert that the CA/QA1 process can be time and resource consuming, but that the main picture is that agencies seem to benefit from the scheme. Conceptual appraisals in particular represent a more systematic approach to early identification of project ideas than in the past. Planners are forced to take a broader perspective and discuss societal aspects, rather than going straight to the issue of selecting road sections and their technical solution. This allows for ideas to mature and stimulates creativity in the agencies. It also increases the likelihood that the most effective option will be included in the analysis.

The State Project Model provides the ministry as well as the government with more direct influence in the early stages of a process than before, and in relation to local stakeholders who traditionally have had significant influence, especially in road projects. The ministry is drawn more actively into the process and can provide guidance on what kind of needs and societal objectives are essential, before specific solutions are discussed in consultation with local stakeholders.

The above mentioned studies also indicate that there is still room for improvement when it comes to practice and the content of the analysis. This includes in particular the possibilities study, which is essential to ensure that the best conceptual solutions are identified. Concept Report number 34 presents an analysis of how the opportunity

space is defined and utilized in 17 CA/QA1 reports (Samset et al., 2013). This study documents a recurrent problem that the selection of conceptual solution has been done before the conceptual appraisal, either as the result of path dependency in the agencies or as the results of political constraints and limitations. There are indications however of improvements, especially after the requirement for a separate possibilities study was introduced in 2011.

Both practical and fundamental issues related to economic analysis (Cost-Benefit Analysis) have been highlighted by recent studies. Several studies by the Concept research program have looked into methodological issues related to economic analysis, including environmental economic issues, the issue of discount rates, effects on competition in markets, and systematic risk. One has also reviewed current practices based on systematic scrutiny of previous analysis; one conclusion was that the analysis in the first 24 QA1 reports often had a relatively short and narrow economic perspective (Lædre et al., 2012). Another study, (NPRA, 2012), suggests that the quality assurers seem to give disproportionate attention to profitability as a criterion, and that there is a need for a more balanced presentation of economic impacts and achievement of various objectives. It may also be noted that an ongoing study by the Concept research program is looking specifically into how non-monetary impacts are handled in economic analysis.

Some ministries and agencies have drawn attention to the futility of conducting a full CA/QA1 process in cases where there are simply no alternatives but only one feasible conceptual solution. Rasmussen et al. (2010) propose a two-stage process with an early broad and overarching analysis (as in the transport sector where all transport modes are discussed in combination) and a subsequent process to consider conceptual solutions in greater details based on a more refined economic analysis.

5.4 To what extent are the recommendations applied?

The experience so far indicates that the CA/QA1 reports constitute a basis for decisions that is taken seriously by policymakers and that recommendations are followed to a relatively large extent. A simple count made by the Ministry of Finance in 2011 showed that the government followed the recommendations made by the quality assurers in two thirds of the cases (Concept Newsletters 2011-4).

This can probably be explained by the fact that political authorities are now being presented with the case at an earlier stage than before when the pressure to choose between specific solutions has not yet fully materialized. There is evidence to suggest that an independent QA report documenting that an investment is poorly justified may give weight to decision makers and be essential for the government to make a decision in a controversial case.

Recommendations made by the quality assurers are essentially based on economic analysis. The one third of the cases where the government did not follow the quality assurer's advice were mainly road projects and other controversial localization issues. It is well documented, most recently in Welde et al. (2013), that there is no tradition of letting economic viability determine prioritization of road projects in Norway. This applies to politicians as well as government agencies' prioritization. The QA scheme can clearly not change this in a few years. But what it can do is to ensure that decision makers are well informed, both about alternatives and their economic implications. Over time, it is therefore possible that it will be more difficult to select conceptual solutions that are obviously non-viable in cases where there are clearly better alternatives available.

5.5 Some preliminary conclusions regarding the effects of CA/QA1

What seems to be the situation so far is that the CA/QA1 scheme is perceived as meaningful by the involved agencies, and that decision makers more often than not follow the recommendations of the quality assurers. Their impact can also be less visible, for instance in cases where the opportunity space is broadened during the process as the result of advice by the quality assurers. Their role is not only as controller but also as adviser, and in several cases new and improved versions of the CA document has been produced during the QA process. In addition, there is reason to believe – but difficult to prove – that many of the worst thought out investment proposals now are screened out before they even reach the CA/QA1 stage. This would be the result of improved processes and procedures in the involved ministries and agencies, and will probably be the most important beneficial effect of the QA scheme.

There are also other spin-offs to be observed. Other agencies have voluntarily introduced variants of the scheme. This includes investment projects run by health authorities (Myrbostad et al., 2010), high voltage electricity transmission and distribution projects (St. Meld. Nr 14 (2011-2012)) and investment projects by Oslo municipal authority (Oslo Kommune 2011). Other countries have shown interest in the scheme. In Sweden a variant of the Conceptual Appraisal report was introduced in 2013 as a new step in early planning, directly inspired by the Norwegian scheme. The Province of Quebec, Canada has introduced a similar scheme, and the UK has recently established a Major Projects Authority, directly under the Cabinet Office, which seems to operate on similar principles.

Chapter 6 Summary and conclusions

To avoid problems with inadequate basis for decision making and failing cost control in large public investment projects, in year 2000 the Ministry of Finance introduced a system for external quality assurance of the largest investment projects. The arrangement is referred to here as the State Project Model, and involves a set of general requirements regarding the documentation to be produced by the responsible ministry/agency at two times during the early preparation of the projects. There are no detailed requirements for format and content, in order to interfere as little as possible in the agencies' existing management systems and procedures.

This report highlights the experiences and effects of the QA scheme to date. As of 2013, the QA2 scheme has worked for 13 years involving 160 projects, and the QA1 scheme for eight years involving approximately 60 projects.

6.1 Experiences with QA2

The purpose of QA2 is to improve cost management and ensure operational success more generally. The situation in the 1990s was that major cost overrun was a norm rather than an exception, both in Norway and other countries. International research (Flybjerg, 2003) has shown that the situation has neither improved nor worsened over the past 70 years.

The results from the 40 first projects that have been subjected to QA2 show that about 80% have been completed within the cost frame. This is a remarkable improvement compared to the past. The difference between the final cost and the steering frame is almost symmetrical around the expected value. This means that at the portfolio level, the State is now in good control of the cost in major investment projects. The fact that the deviations are both positive and negative to the same extent also suggests that there is no incentive to spend contingency reserves.

The cost frames are largely based on the recommendations of the QA2 reports and based on stochastic cost estimation. This indicates that the quantitative uncertainty analysis provides robust results for a sufficiently large portfolio of projects. Most risk factors that do in deed materialize are identified in the QA reports. The practice of establishing a lower steering frame for the executing agency (typically at the P50 level) has probably been an important step to provide incentives for cost efficiency.

The data indicates the tendencies that rail and building construction projects have the largest overruns in relation to their cost frames, that it is particularly the smaller projects that have larger cost overruns, and that overruns have occurred in the latter part of the

period (i.e. projects started after 2004). The study, however, covers only 40 projects and it will be important over time to monitor whether these tendencies hold up or not.

What we have not discussed in this report is the question of how the project content, scope and cost estimate evolves in the process that precedes QA2. To avoid cost overruns in relation to the cost frame is no doubt important. But before the cost frame is set, projects have commonly been through a long front end phase with great expectations among user groups and stakeholders. When the project is presented to Parliament it may be too late to turn down the proposal even in cases where the QA2 estimate is higher than would normally be accepted. It is at the QA1 stage that the cost estimate is compared with expected benefits to decide whether the project is worthwhile to implement. If the cost estimate, however, increases between QA1 and QA2, the assessment of the project's tactical and strategic success from the QA1 stage will no longer be valid. Only now, we can observe the first projects that have been subjected to both QA1 and QA2, and the researchers will expand their focus correspondingly.

6.2 Experiences with QA1

The choice of concept is a key issue and directly related to the project's tactical and strategic success. Nearly eight years after the first QA1 report it is still very limited what can be said about the effects of the scheme, since none of the QA1 projects have yet been completed.

It seems clear, however, that systematic appraisal of the choice of conceptual solutions has benefits. Planners are forced to explore and discuss societal aspects of the investments, rather than going straight to the more detailed questions related to only one specific technical solution. It also increases the likelihood that the most effective option will be included in the analysis. Furthermore, we have observed that the quality assurer's recommended choice of concept is largely taken into account by decision makers, and that there is much to suggest that QA1 in many cases has helped to improve effectiveness. We are also starting to see some indirect spinoffs of the scheme, in terms of other ministries or organizations establishing similar systems on a voluntary basis.

The final test whether the QA1 scheme works or not is of course that the projects prove to be both tactical and strategic successful. In the years to come the Concept research program will follow up with systematic evaluation of QA projects to find the answer to this.

The QA scheme in its current configuration appears to be suitable for the purpose for which it was designed. However, governance regimes should not be static. They need to be flexible so that they can be altered if they do not work as intended or if changes in operating conditions and characteristics of the projects should necessitate change.

References

Austeng, K., O. Torp, J. T. Midtbø, I. Jordanger and O. M. Magnussen (2005a). *Usikkerhetsanalyse – Kontekst og grunnlag,* Concept report No. 10

Austeng, K., J. T. Midtbø, V. Helland, O. Torp and I. Jordanger (2005b): *Metoder og usikkerhetsanalyse,* Concept report No. 12

Austeng, K., V. Binz and F. Drevland (2005c). *Usikkerhetsanalyse – Feilkilder i metode og beregning,* Concept report No. 13

Berechman, J. and Wu, Q. (2006). *Cost overruns Risk Analysis in Transportation Infrastructure Investments.* Working Paper 2006-05. Phelps Centre for the Study of Government and Business. University of British Columbia.

Berg, P. et.al. (1999): *Styring av statlige investeringer. Sluttrapport fra styringsgruppen, Finansdepartementet,* 10 February 1999.

Bjertnæs, A. M. (2012): *Konseptvalgutredninger – intensjon og forbedringer,* Master thesis, NTNU

Christensen, T. (2009): *The Norwegian Front-End Governance Regime of Major Public Projects – a Theoretically Based Analysis,* Concept report No. 23

Concept Newsletter (2011): *Hvilken rolle spiller KS-ordningen i dag,* No. 4 2011

Drevland, F., K. Austeng and O. Torp (2005): *Usikkerhetsanalyse – Modellering, estimering og beregning,* Concept report No. 11

Finne, H., H. Bull-Berg and K. Samset (2012): *Klarering, kontroll og kø på grensen. Evaluering av felles statlig kontrollområde for toll, vegvesen og politi på Svinesund,* SINTEF report A23491

Flyvbjerg, B., M. K. Skamris Holm and S. L. Buhl (2003): "How common and how large are cost overruns in transport infrastructure projects?" *Transport Review,* 2003, Vol. 23, No. 1, 71-88

Haanæs, S., E. Holte and S. Larsen (2005): *Beslutningsunderlag og beslutninger i store statlige investeringsprosjekter,* Concept report No. 3

Jernbaneverket (2011): *Metodehåndbok JD 205 Samfunnsøkonomiske analyser for jernbanen,* versjon 3.0 juli 2011

Lædre, O., G. H. Volden and T. Haavaldsen (2012), *Levedyktighet og investeringstiltak. Erfaringer fra kvalitetssikring av statlige investeringsprosjekter,* Concept report No. 29

MacDonald, M., 2002. *Review of Large Public Procurement in the UK.* London: HM Treasury.

Makovšek, D., Tominc, P. and Logožar, K. (2012). A cost performance analysis of transport infrastructure construction in Slovenia. Transportation, 39 (1), pp. 197-214.

Ministry of Defence; *Konseptuell løsning (KL) for prosjekt XXX, (udatert rapportmal)*

Ministry of Finance (2003): *Reglement for økonomistyring i staten. Bestemmelser om økonomistyring i staten.* (with changes 8 June 2010)

Ministry of Finance (2005): Veileder i samfunnsøkonomiske analyser

Ministry of Finance (2010a): *Konkurransegrunnlag med innarbeidet kravspesifikasjon og kontraktspesifikasjoner til rammeavtale om konsulenttjenester vedrørende kvalitetssikring av konseptvalg, samt styringsunderlag og kostnadsoverslag for valgt prosjektalternativ,* November 2010

Ministry of Finance (2010b): *Veileder nr. 9. Utarbeidelse av KVU/KL dokumenter*

Ministry of Finance, 2010, *Regulations on Financial Management in Central Government. Provisions on Financial Management in Central Government,* Adopted December 12th 2003 with adjustments latest on June 8th 2010, Ministry of Finance, Oslo

Morris, P.W.G. and Hough, G.H. (1991): *The Anatomy of Major Projects. A Study of the Reality of Project Management,* John Wiley & Sons, Chichester, UK, ISBN 0-471-91551-3

Myrbostad, A., T. Rohde, P. Martinussen and M. Lauvsnes (2010): *Regime for planlegging og beslutning i sykehusprosjekter,* Concept report No. 25

Nilsson, J.-E., J. Nyström and R. Pyddoke (2012): *Före och efter – uppföljning av en järnvägsinvestering i Oslo,* VTI report 38-2012

NOU 1999: 11, *Analyse av investeringsutviklingen på kontinentalsokkelen*

Oslo kommune (2011): *Konseptvalgutredning (KVU) i Oslo kommune. Krav og veiledning*

Pinto J.K., Slevin D.P. (2006): *Organizational Governance and Project Success: Lessons from Boston's Big Dig,* Concept Symposium 2006, NTNU, Trondheim

Rasmussen, I., N. Heldal, T. Homleid, K. Ibenholt, J. M. Skjelvik and H. Vennemo (2010): *På vei til kvalitet? Evaluering av KS1 i transportsektoren,* Vista Analyse report 2010/10

Samset, K., P. Berg and O. J. Klakegg (2006): *Front-end Governance of Major Public Projects,* paper presented at the EURAM conference 2006

Samset, K. (2008): *Prosjekt i tidligfasen: Valg av konsept,* Tapir Akademisk forlag

Samset, K., B. Andersen and K. Austeng (2013): *Mulighetsrommet. En studie om konseptutredninger og konseptvalg,* Concept report No. 34

Statens vegvesen and Jernbaneverket (2006): *KS1 – Ekstern kvalitetssikring i samferdselssektoren*

Statens vegvesen (2010): *Konseptvalgutredninger i Statens vegvesen. Mal for konseptvalgutredning*

Statens vegvesen (2012): *Evaluering av KVU/KS1. Færre og bedre KVU-er*

St.meld. Nr.14 (2011-2012): Vi bygger Norge – om utbygging av strømnettet

Volden, G.H. and K. Samset (2013): *Etterevaluering av statlige investeringsprosjekter. Konklusjoner, erfaringer og råd basert på pilotevaluering av fire prosjekter,* Concept report No. 30

Welde, M., J. Eliasson, J. Odeck and M. Börjesson (2013): *Planprosesser, beregningsverktøy og bruk av nytte-kostnadsanalyser i vegsektor. En sammenligning av praksis av Norge og Sverige,* Concept report No. 33

Whist, E., T. Aass and B. Andersen (2012): Evaluering prosjekt 6300 Skjold-klassen MTB-er, Scanteam report, Oslo 2012

Aass, T. and M. Welde (2012): *Evaluering av investeringen E18 Momarken – Sekkelsten,* working paper from the Concept research program

Aass, T. (2013): *Kostnadskontroll i prosjekter som har vært underlagt ekstern kvalitetssikring KS2*, working paper from the Concept research program

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