Preface

The research presented in this thesis was conducted in the Department of Civil and Transport Engineering of the Norwegian University of Science and Technology (NTNU), under the supervision of Professor Knut Samset. In January 2007, Dr. Nils O. E. Olsson, a senior research scientist at SINTEF Technology and Society, joined as assistant supervisor. I thankfully acknowledge the encouragement and assistance of these supervisors.

This thesis is based on several papers and is organized in two parts. Part 1 is a summary of the research conducted. Part 2 comprises reports of the research output in the form of 11 separate papers including a report, and of which nine are joint publications (see the list of papers, p. 6) with my supervisors and three other authors, Terry Williams, Ole Jonny Klakegg and Helene Glasspool. I acknowledge the various participant’s support and contributions but am required to point out that my contributions to the studies reported in the collective texts included in Part 2 are independent and can be verified. For the papers numbered 1, 2, and 3, I was the principal author and contributor, and my supervisors were co-authors. For paper 1, I conceived and planned the study, performed the literature review, wrote up the discussion of the literature and the description of the framework for project assessments, collected and analyzed data (for example the study of 31 projects mentioned on pages 3-4 in the paper is my separate contribution), interpreted findings, and wrote the paper. Prof. Knut Samset conceived and planned the study, collected and analyzed parts of the data, interpreted findings, and was responsible for writing pages 6-10. Paper 2, which has been published in a refereed journal, was written by me based on the sole research consisting of collection and analysis of cost data from the 31 projects mentioned in paper 1. I conceived and planned the study, collected and analyzed data, interpreted findings and wrote the paper, but gratefully point out that Nils Olsson contributed significantly to the research design of the study, interpretation and presentation of results, and final layout. Nils Olsson also significantly contributed to the submission and revision process. Likewise, in paper 3, a research paper accepted for presentation at a research conference with double blind review, also co-authored by Nils Olsson, I conceived and planned the study, collected and analysed parts of the data, interpreted findings, and wrote the paper, while Nils Olsson contributed the interpretation of findings and revised the paper. Paper 4, which I co-authored, has been published in a refereed journal. While Nils Olsson was the principal contributor who conceived and planned the study, analyzed data, interpreted findings and wrote the paper, I contributed by collecting parts of the data, as discussed on pages 29-30 and presented in Figure 2 on p. 30. I also contributed to the interpretation and presentation of the results. In paper 5, which was evaluated by anonymous referees and approved to appear in the proceedings of the 2008 PMI research conference, I participated in the study and co-authored the paper because I had the relevant subject expertise and skills related to the nature of and the experiences from the project approval process. I contributed in the interpretation of findings and presentation of results and revised the paper. Papers 6, 7 and 8 and the report listed as publication 11, are multi-author publications from a study sponsored by the Project Management Institute (PMI) Research Program, co-funded by the Concept Programme and the University of Southampton and performed by an international team of researchers in which I was fortunate to participate. I took part in the entire process, from writing the proposal, to planning and execution of specific research tasks, to analyzing data, to reporting the results. The aim of the work was to look at how the governance regimes for major investment projects in different countries may affect project performance. The research methodology was based on a qualitative cross-case analysis of a small number of cases from two countries, Norway and the United Kingdom, in which examples of governance regimes had been identified. Two projects were chosen for study in each country. My
contribution to this international research project comprised responsibility for the information gathering and the interviews with key players of the Norwegian projects included in the study.

Paper 10 is a report, in the form of a manuscript submitted for possible publication in a refereed journal, which extends research from the 2006 study described in paper 3. The extension from 31 to 61 projects, the search for explanations for observed differences and the collection and analysis of actual outcomes are based on individual research efforts. Paper 9 reports an attempt to study a sub-sample of the 61 projects of paper 10. This single-author paper has been submitted for review to a journal using double blind review.

In the course of my research, I learned that no task can be completed in professional isolation without interaction with others. Discussions arising from differences of opinion or approach, and particularly criticism, can of course be time consuming and even painful to deal with, but I believe it has not only kept me from making mistakes, but also added clarity. I owe much to those who invited me to contribute on equal terms in their field of expertise and thereby made my research enjoyable. I am grateful for the sharing of information, the professional guidance and the skilled feedback of those who became involved in my work.

I gratefully acknowledge the full financing of my research by the Concept programme.

Finally, I am grateful to my wife, Camilla and our sons, Oskar and Alfred, for their love, patience and support throughout the course of this work.

Ole Morten Magnussen

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## PART 2 RESEARCH PAPERS
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1 The papers are included in Part 2 of the thesis.
Summary/abstract

The work reported in this thesis comprises an exploration of the up-front assessment and quality assurance of major investment projects. It was conducted by investigating a sequence of projects planned and executed under a common framework for project improvement launched by the Norwegian Government in 2000. The investigation included a detailed examination of the project approval process, its theoretical underpinnings and its embedded principles, as well as of how it is carried out in practice and more specifically of the outcome of the process in terms of cost estimation and budgeting, risk assessment and management frame.

Project management research has traditionally been concerned with the implementation phase of projects and has sought answers on how planning and control of project execution may affect actual outcomes. The work reported in this thesis attempts to break new ground in the sense that it concentrates on empirical investigation of improvement measures introduced in the front-end.

The work reported is covered in 10 papers that have been presented at international conferences or published in scientific journals, eight of which were submitted to peer review. Part of the work also has been described in a report published by the Project Management Institute. These papers and the report constitute the substantial and major part of the thesis and are included as Part 2 of it. Part 1 provides a summary of the research process and overviews of how the study was conceived and designed and how data were collected and analyzed, and concludes with the major findings as well as recommendations for further research in the field.

Chapter 1 comprises a brief introduction to the topic area. It presents some of the key issues that are addressed and specifically focuses on some fundamental problems that frequently are associated with projects. In turn, this provides justification for studies in this particular area. Some key questions are identified, and the basic attributes of the thesis are outlined.

Chapter 2 starts with a more detailed overview of the methodological issues involved. The epistemological and paradigmatic bases that underlie research on projects and on their management are discussed. It continues with a description of and reflection the challenges and dilemmas in the theories and concepts being drawn upon. After this overall discussion of how we know what we know through research about projects, the chapter goes on to describe the relevant data and sources of information. Then there’s a discussion of the extent to which the work provides reliable and valid information and produces consistent results. In a sub-chapter dedicated to research design and methods, there’s an overview of the key characteristics of the specific approaches and tools used to undertake research activities. The work is based on an extensive approach in which a number of methods have been used to collect data, including document studies, case studies and semi-structured interviews. Also, a variety of publicly-available and limited data files on projects subjected to quality assurance have made it possible to weigh multiple sources of information. Some reservations regarding the interpretation of results are made, particularly with respect to resource limitedness and sample sizes. It is pointed out that the work may be regarded as a partial and preliminary report from an evolving area of study, although possible answers to some key issues are put forth.

In Chapter 3 some basic concepts that are important in the exploration of up-front assessment and quality assurance are defined, to ensure that the work has relevant theoretical underpinnings. The focus is on the main concepts involved (the project and management aspects, the meaning of and the role of the project life cycle), on the particular essential characteristics of the front-end
(uncertainty and strategic importance), and on the approaches to how project outcomes are assessed. One fundamental dilemma is acknowledged: the work focuses on the front-end (which is mainly associated with strategic, long-term issues), but is designed to explore issues primarily associated with the immediate outputs of a project. Again, it should be kept in mind that this study may be seen to be a first step towards dealing with more fundamental issues.

Chapter 4 provides a summary of the main results from the papers presented in Part 2, which constitute the research work, in order to arrive at a brief, integrated overview of central issues that emerge. Finally, Chapter 5 highlights some lessons learned and some possible implications of the work. It is understood that more extensive studies are needed to provide more reliable answers, so a few avenues for future research are identified.
Part 1
Presentation of the research work
1 Introduction

Projects are increasingly used to organize and perform tasks in the private and public sectors. But as projects have grown more commonplace and larger, the problems associated with them have become more complex. Despite recent emphasis on improved methods of analyzing and managing projects, fundamental problems remain, including inadequate needs assessments, initial poor designs, insufficient tactical budgeting by planners and decision makers, inadequate cost estimation and risk assessment, etc. Project management is by definition primarily concerned with planning and controlling project execution. In recent years, authors in the field have highlighted the importance of improving the design process to ensure project success, and the focus has expanded from factors associated with the implementation of projects to also include long-term effects and the fulfillment of overall objectives. Conceivably, efforts to improve the initial and fundamental designs and to avoid some of the common problems encountered in the implementation of projects may bring about savings and enhance added value.

1.1 Research objective including research questions

This research was initiated to explore the up-front assessment and quality assurance of major investment projects.

As illustrated in Figure 1, a project may be considered to start with the identification of needs and progress in contiguous phases to finish with an effect. As shown, the phases are pre-study, pre-planning, implementation and operation. The overall scope of studies of projects is enormous and clearly beyond the scope of this thesis. Accordingly, the focus here is on the front-end phase, which includes activities until the final decision to finance and build is made, underpins the business case, with a focus on the effects of the project after it is commissioned, which here is called the project’s effectiveness. The strategic perspective and choice of project concept are the
main concerns. The implementation phase includes detailed planning and engineering that together make ready for delivering the project as efficiently as possible. In it, project scope, cost, quality and progress are the main concerns. The quality assurance assessments studied in this work (labelled QA1 and QA2 in the Figure) are conducted at two major decision gates: the choice of concept (Decision gate 1) and the decision to finance and build (Decision gate 2).

A comprehensive study of an entire project would collect information at successive stages of it, designated CP1, 2, 3 and 4 in Figure 1, which would enable researchers to study the aspects of efficiency and effectiveness.

However, the study of the whole of a project is beyond the scope of this research, which focuses primarily on the assessment of costs in the early stages of projects, because they are believed to be decisive in determining future performance. Hence the work presented here builds principally on data acquired at CP2, just before the final decision to finance, and consequently is confined to issues concerning efficiency, that is, matters related directly to the project outputs. To the extent possible (only a few projects had been commissioned), data were also acquired at CP3, the point at which the result of the project is delivered and immediate outputs may be observed. Finally, some information around CP1 also has been gathered. However, data that describe intended benefits after the project has been in operation for some time (CP4 in Figure 1), were not sought in the work presented here. Consequently, the scope of this study concerns questions related to whether the projects are successful in terms of time, cost and quality (efficiency). Other, ostensibly more essential questions regarding the projects’ feasibility and long-term effects (effectiveness) remain to be investigated by future research efforts.

The projects included in this study are considered “major”. The term “major” is of course relative, as a project may be “major” for reasons other than having a large budget, such as its complexity, risks, and technical difficulties. A more detailed discussion of these issues follows. “Major” projects may also include those presumed to offer substantial opportunities but to entail greater than average risks.

A study of up-front assessment and quality assurance may involve a number of questions. Perhaps most important is the question of the extent to which such practices enhance project performance. Key relevant questions include:

- What are the essential features of effective up-front assessment and quality assurance?
- What is the impact of such practices on projects?

Clearly, this entails in-depth examination of such practices more in-depth and observation of responses in projects subjected to them.

A more detailed examination would include a study the effects of such practices on the development of project plans, estimates and project implementation:

- To what extent does up-front assessment and quality assurance guard against underestimation of cost?
- To what extent are agreed boundaries for cost development followed in practice?
- To what extent is improved budgetary compliance encouraged?

This section comprises an overview of the key issues addressed in the research work. For further information, see Part 2 as well as the following sections that present some of the findings in the papers. In any doctoral dissertation there’s a need for careful clarification regarding data
collection and interpretation of the research outputs. The scope of a paper-based dissertation such as this one is by nature limited and consequently cannot such issues in depth. Therefore, the next chapter discusses the epistemological and paradigmatic bases that underlie research about projects and their management. The remaining parts of Part 1 are concerned with the research output. That said, the main body of this dissertation is Part 2, the papers, which constitute and present the research.
2 Methodology

Some may argue that not making the methodology explicit is tantamount to poor research practice. Mir and Watson (2000:941) maintain that “It is self-evident that all research is premised upon a variety of assumptions, which good researchers make transparent in their work.” This view serves as a starting point for this chapter, which focuses on the methodological issues relevant to the research work presented in this thesis. Given the abundant material on the subject, the following discussion may be viewed as a summary of methodological issues relevant to the work presented in this thesis rather than an exploration of the application of methodology in research. The focus will be on the role of research methodology in project management and the aim is to make the methodology applied explicit.

2.1 The role of paradigms and the theoretical base of project management

A paradigm is generally considered to be a broad view of the theories and methodology of a science and is fundamental in the development of a profession or an academic field. Smyth and Morris (2007:424) describe the role of paradigms in project management in this way:

“Paradigms shape the way practitioners, professionals and academics perceive the discipline, and directly shape many of its tools and techniques, service offerings and certification programs. Project management has been subject to several such paradigms.”

Endeavours describing the theoretical base of project management research and practice are well documented in the literature (see for example Packendorff 1995, Shenhar and Dvir 1996; 2007, Kloppenborg and Opfer 2002, Söderlund 2002; 2004, Williams 2005, Winter, Smith, Morris and Ciemil 2006). Judging from the current literature, a frequent hypothesis is that both the profession of project management and research in project management research are interdisciplinary. Most definitions of projects refer to a combination of uniqueness, defined objectives, limited time-cycle, and the constraints of cost, time and quality that underline the complexity and diversity of projects. The areas of application of projects vary as widely as do the contextual settings of individual projects. This may be the root of the ongoing discussion of the underlying assumptions or the theoretical basis of project management. Turner (1999:329) recognized the extensive “body of knowledge” developed but stated that: “Project management lacks a strong theoretical base.” In a more recent contribution, Shenhar and Dvir (2007:95) go so far as to characterize project management as a discipline where there are “... no commonly accepted paradigms that are leading the perception and understanding of project management. There are no central theories that are underlying the discipline.” Accordingly, research into the application of methodologies in project management research shows, according to Smyth and Morris (2007:433) that:

“It has been found that the research methodologies are being selected and applied in ways that are often inappropriate, both to context and to issues concerning general–particular explanations. It has also been found that the majority of research from the papers reviewed failed to articulate explicitly their choice of research methodology. This renders the research difficult to locate within an epistemological and paradigmatic context. As a result the task of relating different research outputs is made more difficult.

2 “Body of knowledge” is often written “BOK” or “BoK”. It refers to attempts by professional organisations to systematise the core knowledge required to manage projects (such as for example the Project Management Institute (PMI) with their Project Management Body of Knowledge, or the International Project Management Association (IPMA) who offers the IPMA Competency Baseline).
Similarly it can be difficult to relate research within paradigms and evaluate how outputs contribute to paradigmatic development, and hence to the theories and concepts being drawn upon. It also hinders relating research to the BOKs and using findings to develop BOKs. The combined effect is to potentially hold back progress in developing the fields of project research and practice, whether operating within the paradigms of theory and practice or offering an external critique, as given by critical management.

In short, Smyth and Morris (2007) contend that the value of a research output is lowered by the inappropriate selection and application of research methodologies. This should be a concern for everyone involved in project management research. I believe that the two essential issues are how the apparent challenges discussed above may be addressed and if there indeed is no central underlying theoretical approach in project management.

Some notable works that summarizes and challenges contemporary project management are germane. In 2003, the Rethinking Project Management research network funded by the British government was established. It was a response to allegations such as “project management theory remains stuck in a 1960s time warp” and “the underlying theory of project management is obsolete”, in other words, to critique of and increasing concern about conventional project management theory and how it relates to the growing practice of managing projects across industry sectors. The research agenda of the network aimed at “…enriching and extending the subject of project management.” (Winter et al 2006:638). The overall assessment of the current conceptual base of project management in Winter et al (2006:640) is particularly interesting because it contends that: "There is no single theoretical base from which to explain and guide the management of projects. There are instead various theoretical approaches, many of which overlap.” Three dominant approaches in conventional project management are identified:

- The rational, universal, deterministic model emphasizing planning and control dimensions of project management upon which, according to the authors involved, most popular project management textbooks and methodologies are based.
- The more theoretically-based organizational design of the project as temporary organizations.
- A group of approaches focusing on major projects and emphasizing a broader view of projects (recognizing the importance of the front-end and of managing exogenous factors, as well as the more traditional ‘execution-focused’ endogenous ones). They conclude that the issues facing researchers and practitioners are beyond the hard systems approach (based on the rational, universal, deterministic model) frequently associated with project management, so there’s a need to challenge the rational deterministic model.

The proposed alternative, or, strictly speaking, supplement to the contemporary thinking summarized in Winter et al (2006) is a practical research framework (aimed at researchers working in the field) in which one essential messages is the need to develop new models and theories that recognize and illuminate the complexity of projects. Concrete examples of what this ‘new thinking’ may mean are given, but the more important underlying message is that the multiple theoretical models that could be relevant in empirical research on projects, should be judged by their relevance and usefulness in order to understand the actual reality.

Smyth and Morris (2007) describe positivist and empiricist traditions as efforts to employ causal explanation. Their study of 68 papers published in the International Journal of Management reported and their experience of various bodies of knowledge (BOKs) in project management, led them to assert that positivism has been the dominant approach in research on projects. The result, they contend, has been a pursuit for generalizations from project research outputs that in turn may serve as a basis for project management principles. Moreover, they contend that the induction-deduction problem constitutes a general criticism of positivism in project research and that many positivist project management researchers do not work deductively but instead pursue
normative agendas, in other words, propositions of what ought to happen. They believe that the problem is that normative applications are by definition excluded from any form of positivist approach. Moreover, positivist methodology is regarded to be unsuitable for addressing many project issues. Consequently, they introduce critical realism as an alternative for project research. Figure 2 illustrates realist causality where contextual conditions are assumed to mediate and filter the enacted causal powers and liabilities of the object of study in its environment. Hence it is further assumed that final outcomes can be changed or affected by these conditions. However, the forms of the outcomes will depend upon the powers and liabilities of the contextual conditions.

![Figure 2 Realist causality (Smyth and Morris 2007:428)](image)

To summarize thus far, the literature referred to above seems to imply that the multifaceted nature of project management can be explained by the temporary, complex arrangements undertaken in a variety of contexts labelled projects. Although different approaches in attempts to generate knowledge from projects are identified, the prevailing view seems to have entailed a search for generalizations that could be helpful in the control and management of projects. The result has been a specific way of thinking that has not adequately accounted for the complexity of projects. Therefore, different approaches and techniques are called for. A salient aspect here is that we should not ignore conventional project management methods and move entirely to these proposed opposing techniques. The new approaches should be seen as ancillaries, not competitors to more traditional approaches.

How may these approaches be applicable to the work presented here? Up-front assessment and quality assurance in the front-end of projects apply knowledge that hopefully may change or affect final outcomes. It might be said that such improvement schemes, which to a limited extent are based on empirical evidence, are normative of nature. The precursory application of knowledge is expected to lead to precise, predictable outcomes. However, I believe that many applications may lead a project to a successful outcome. In other words, it’s difficult to measure the isolated effect (a term closely connected to causality) of inputs or measures that may be imposed in a project during planning or implementation. Moreover, it may be maintained that there is no commonly shared understanding of how the object of study, the single project itself, should be defined. Even more so, it might be said that what is called the ”project approval process” or ”measures to improve project success”, which are approaches assumed to affect the outcome or success of the ”project”, also are on a high level of abstraction. Even the concept of project success may be seen as elusive. Concepts such as these are difficult to visualize. One key area explored in this thesis is the extent to which specific activities or tasks, up-front assessment and quality assurance in the front-end, may influence project outcomes. That said, the approach is hardly straightforward, due to the latitude in interpretation of many of the central concepts of projects.

3 Traditionally, the uniqueness of project work, that they are special tasks that have not been done previously, has been regularly cited as a defining attribute of a project, but as stated in Crawford and Pollack (2007:90): “Given the wide range of application areas for projects, the definition of a project is necessarily vague.”
project management and the complexities involved in eliciting the true causes of project performance. Hence, as set forth in section 1.1, the focus is on a more tractable task than the assessment of effectiveness of projects, as the work mainly has been concerned with the issues of time, cost and quality. However, the individual projects and their contextual settings undoubtedly are varied. The question that then begs an answer is how may these challenges be dealt with in the work presented here? First, there are fundamental aspects of the nature of projects that require attention.

2.2 The crucial contextual conditions of projects – uniqueness, asset specificity, and high levels of uncertainty

Crawford and Pollack (2007) address “the paradox of project uniqueness” that reflects the frequent view that uniqueness is a defining attribute of a project, though it is assumed that all projects are fundamentally similar and consequently may be managed in a standardized way. How can this paradox be dealt with from a research perspective? Crawford and Pollack (2007:94) attempt to mediate the disparity between project uniqueness and the assumption of fundamental similarity by asserting that: “For a project to be unique does not mean that it is completely dissimilar to all other projects. If this were truly the case, and projects were not just unique, but also incomparable, then it is likely the field of project management would not exist.” They further state that resolving the disparity is not crucial, but it should be managed to retain the relevance of project management in various contexts. This means that one way to deal with the project uniqueness paradox apparently is to accept that there is nothing wrong in assuming that projects can be treated as similar and comparable as long as the projects’ contextual issues are properly managed. Each individual project undoubtedly contains unique elements, but there are repetitive tasks and similarities in the way we approach projects.

Miller and Lessard (2000:6) state that “… each project is unique” and that “generalizations are therefore impossible”. But how do they then in practice go about measuring or identifying what leads to success or failure in projects? Their answer is that variables measuring project performance should comprise characteristics, traits or attributes that can be meaningful above the level of the single project. In other words, they seek insights or explanations at an aggregate, generally applicable level.

The aim of this work is not to solve or overcome all the challenges posed by obvious disparities in the theories and concepts being drawn upon. Nonetheless, I believe that the disparities should be kept in mind so that potential flaws and ambiguities can be dealt with and reduced. The discussion above reflects a wish to be explicit about the assumptions that underlie the research carried out.

In this thesis it is assumed that projects typically exhibit uniqueness, asset specificity, and high levels of uncertainty. This calls for a methodology that recognizes these critical contextual conditions.

In the context of this research in which single projects are the units of analysis, it is assumed that certain events or outcomes should be interpreted not from the viewpoint that one single input causes a certain effect, but rather that certain inputs might cause certain events or outcomes. Though a large number of projects and quantitative approaches may be used, there generally will be no search for explanations that rely upon identified general patterns based upon cause and effect. Hence, there is no search for an ideal cause-effect relationship. Projects carry critical contextual conditions that must be taken into account; precise and predictable outcomes do not exist in the
world of projects. The choice of methodology does not imply that it is impossible to judge or observe the effect of inputs, but that one cannot expect to observe automatic outcomes of a specified input.

2.3 Research design and methods

The objectives of this research include arriving at answers to basic questions concerning up-front assessment and quality assurance. Various approaches were employed, because the field was explored in a relatively broad manner to answer an array of questions. The underlying assumptions are discussed above, and the specific approaches and tools in the research activities are described in greater detail in the separate papers. However, selected key characteristics are highlighted and there are some explanations of the approaches to dealing with some of the challenges related to the scientific requirements outlined above.

The key characteristics of the output of the research work are set forth in the papers listed on page 6. In paper 1, Magnussen and Samset (2005) use a theoretical approach. They summarize the approval processes of large public projects over five years and concentrate on the description of an approach to up-front assessment, its theoretical underpinnings, embedded principles, and how it may work in practice. Papers 2 (Magnussen and Olsson (2006)), 4 (Olsson and Magnussen (2007)), 5 (Olsson and Magnussen (2008)), 9 (Magnussen (2009a)) and 10 (Magnussen (2009b)) are principally empirical and quantitative contributions that are based on studies of evaluation reports and discuss topics within relevant focus areas. Some major topics include uncertainty analyses of costs, differences in estimates, the size of reserves, and the assessment of uncertainty.

Papers 3 (Magnussen and Olsson (2007)), 6 (Klakegg, Williams, Magnussen and Glasspool (2008)), 7 (Williams, Klakegg, Magnussen and Glasspool (2008)), and 8 (Williams, Klakegg, Magnussen and Glasspool (forthcoming)) are empirical and mostly qualitative in the sense that they deal with in-depth reviews of one or a few selected cases. Paper 3 (Magnussen and Olsson (2007)) is slightly more theoretical, as its focus is on challenging traditional perceptions of projects and their environments, based on a social exchange theory approach. Nonetheless, an analysis of the early phase of a public building project is included to illustrate the practical use of the approach. In papers 6 (Klakegg, Williams, Magnussen and Glasspool (2008)), 7 (Williams, Klakegg, Magnussen and Glasspool (2008)) and 8 (Williams, Klakegg, Magnussen and Glasspool (forthcoming)) the question under study is investigated by looking in depth at a small number of cases. Semi-structured interviews were held with personnel representing the project organization as well as with representatives of the experts responsible for external review, in order to better capture context dependent information associated with the selected cases.

2.4 Data and information sources

The research presented here was conducted in Project Management and Construction research group in the Department of Civil and Transport Engineering of the Norwegian University of Science and Technology. The research group focuses on project management in general and is currently involved in the Concept research programme on the front-end management of projects, funded by the Ministry of Finance. The Concept programme has established and maintains TrailBase, a database that as of 2008 held records of 100 major public investment projects in
To my knowledge, this is the first large collection of data from investment projects planned and executed under a common institutionalized framework for front-end project appraisal.

The principal aim of the research effort is to explore selected issues relevant to up-front assessment and quality assurance of major projects, particularly those conducted in Norway. A brief summary of the Norwegian Government quality assurance scheme set up in 2000 follows. A more detailed description of the project approval process, theoretical underpinnings, embedded principles and conduct in practice is set forth in Magnussen and Samset (2005) and Magnussen and Olsson (2006) included in Part 2 of this thesis.

The Quality Assurance 2 (QA2), applied in 2000 to 2005, involved a review of costs, analysis of management strategy, success factors and uncertainty, that resulted in recommendations concerning cost estimates, strategic framework and management before the project is authorized for execution by independent consultants assigned by the responsible ministry and the Ministry of Finance. In 2005, a new Quality Assurance 1 (QA1) process, was introduced to precede and supplement QA2; it requires independent review of different project concepts before an alternative is chosen and pre-planning takes place. Because QA1 is relatively recent, little experience has been gained from its application. Consequently, the focus of the empirical investigations of this research has been on the QA2 exercise.

The poor performance of many large public investment projects, especially in the late 1990s, was the reason why the quality assurance scheme was developed in 2000. In a government report, Berg et al. (1999), identified severe problems in major public projects. In a closer study of 11 projects presented in the report, six exhibited cost overrun, often combined with non-fulfilment of objectives, significant extensions of scope, etc. The report concluded that many of the problems encountered in implementation could be traced back to the early stages of planning. Quality assurance of major public projects was introduced to ensure that more effort was put in the early phases of large projects and that more realistic estimates could be made before a project is formally submitted to Parliament.

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^ TrailBase, for which the author of this thesis is responsible for maintaining, updating and entering data into, currently contains data of 81 on-going or recently completed public projects subjected to external review.

^ Approval process of large public projects (expected budget larger than NOK 500 million) before they are formally submitted to Parliament.
The projects analyzed in this research work were selected from among the large public investment projects conducted from 2000 to 2009 and subjected to the quality assurance scheme in Norway in transportation infrastructure, public building, defence procurement, and information technology. They may be described as projects under the conventional form of public ownership, with a Ministry typically owning a project that is included in public budgets (Flyvbjerg, Skamris Holm and Buhl 2004:13). These are projects exposed to meticulous examination, not only by the external experts appointed to carry out the formal review described above, but also by decision makers and to some extent the public. Of course, some projects have higher profiles than others, but a common characteristic is that information is available from a wide range of publicly available sources, as illustrated in Figure 3. The Figure also provides an example of the collection of essential information (estimates and actual costs to study responses to quality assurance and cost development) and shows how the information may be verified in various ways. The main findings and conclusions from the quality assurance exercises have been put forth in several reports that together comprise the main source of information about the quality assurance process. Government documents, such as proposals and reports to Parliament.
also are important sources. Other notable sources include documents released by subordinate agencies responsible for project planning and execution; reports on cost estimating processes, project specific reports from different stages of projects’ life cycles, and, in some cases, final reports summarizing the project organization’s main experiences after its completion. Moreover, while written sources are easily identified and accessed, the people involved in planning, review and execution of projects, some of whom have considerable experience from a wide range of projects, also are valuable sources of information.

The scenario of the analysis of a project is illustrated in Figure 4. The analysis starts with the identification, collection and review of the sources shown in Figure 3. In some cases, projects were contacted by telephone or e-mail to verify information taken from the written sources. Information was compiled in files, one for each project, and entered in a database according to pre-defined categories. The information then was analyzed (including the conversion of costs to the same level) and written up in research reports in the form of papers.

![Figure 4 Scenario of an analysis](image)

As discussed above, the key areas defined by the research questions are subject to empirical examination, including the collection and analysis of information from a selected approach to up-front assessment and quality assurance of projects. The approval process for large public projects in Norway offers an opportunity to look at an array of projects planned and executed under a common framework for project improvement.

Arguably, this affords a unique opportunity for learning and finding answers to the key questions. That said, the challenge is to ensure that the work provides reliable information and produces consistent results, and thereby contributes to development in the field.

### 2.5 Reliability and validity issues

The issue of validity in research concerns the extent to which the truth or value of a proposition may be demonstrated. Cooper and Schindler (2006) state that validity concerns the extent to which a valid measurement system is in place so that research measures what needs to be measured to solve the problem at hand. Reliability is associated with the accuracy and precision of the applied procedure for obtaining results and is closely related to the quality of measurement. It concerns the question of the degree to which research is free of random error. One way to ensure reliability is to carefully select large, representative samples of data.

The relationship between the validity and reliability is often explained by saying that reliability contributes to validity, but it cannot alone ensure validity. This is because validity concerns the extent to which the results of an observation or measurement are relevant in relation to the questions under study, and not just the precision and accuracy of the measurement tool.

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6 A list of government documents which have served as sources in this work is included after the reference list.
In line with Flyvbjerg (2006b), the value of the studies presented here depends on the validity claims that can be made for them and on the status these claims attain in concert with other relevant validity claims. In other words, the value of a research output is based on existing knowledge and depends on the reactions to the study by other researchers. As noted above, the support from existing research in validating results constitutes a challenge due to the lack of previous relevant studies in this particular area. This leads to the conundrum of how to assess the validity of the research if there are no opportunities for verification beyond what is presented in this thesis. In general, I contend that this work can by no means be described as the first and only instance of an attempt to break new ground. The validity of the results obtained by the research effort consequently cannot be judged by previous research achievements alone. A logical starting point is to assess reliability, which is a necessary contributor to validity. That said, it should be pointed out that the sets of samples of projects dealt with in the studies discussed in this thesis are too small to permit the use of statistical tests of consistency and co-variation of data. The question is then of the degrees to which sample representativeness and careful execution of data collection and analysis are satisfied. If the intent of this work was to seek generalizable patterns and draw distinct conclusions concerning the management of large projects, the findings would be biased by the selection of public projects planned and executed in Norway. However, as stated above, the purpose has been to explore the field of up-front assessment and quality assurance in a relatively broad manner. It is assumed that the choice of projects planned and executed under the same regulatory and construction regime are subjected to independent examination before they are authorized for execution, although individual projects and their contextual settings may be diverse.

Further, an assessment of validity requires reflections on the extent to which the research presented in this thesis is epistemologically robust and the extent to which the analysis and findings contribute to the understanding of projects and their management.

The chances that findings and interpretations will be found credible may be improved through triangulation, which is the hypothesis that greater confidence may be placed in a result if different sources, methods and approaches lead to it. It is, according to Denzin (1989:237): ”…varieties of data, investigators, and theories, as well as methodologies.” In other words, triangulation involves the combining data from many sources, studying phenomena from various aspects using differing theories and including several investigators and methods for data collection and analysis. This is brought out in Figure 3 that includes the possibilities for triangulating data. The data were collected by different method guided by different approaches, as summarized in Section 2.3.

The work presented here entails several samples. Hence, reference is made to the attached papers for detailed discussions of reliability. Such issues are highlighted where they occur. However, it may be said that the samples included all projects for which data were considered valid and reliable. The implication for studies that involve comparison of estimates is that data were accessed from the written reports of quality assurance exercises, were verified by government documents, and, if deemed necessary, were verified separately through project contact by the primary investigator.

The types and number of sources from which information is extracted also may elevate the quality of research output through triangulation. Clearly, this work has benefited from access to a

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7 However, in some studies, the question of sample size can be said to be irrelevant, because a case study approach is employed, meaning that looking at a small number of cases is a matter of choice of design.
8 Epistemological robustness is derived from epistemology, the theory of knowledge, and an assessment of such includes judgment of methods validity and scope.
variety of sources. Furthermore, the sources described above may be regarded to be primary, as they are original works of research or raw data with no interpretation. Primary sources are authoritative because the information in them has not been filtered or interpreted by second parties. Consequently, the authenticity of studies that rely on information from projects for which other researchers in other studies compiled the data is not an issue in this work. It is also worth noting that most of the sources from which information has been obtained are open to the public.

Thus far I have described issues that may aid assessment of the reliability of data collected, but the fundamental question remains as to whether the collected data is relevant to answering the identified questions. Clearly, there are fundamental challenges in describing or measuring how different approaches to improving projects may affect outcomes. Ideally, particularly because of the complex and interrelated issues involved in the assessment of project success, the entire spectrum of possible aspects of project planning and management should have been covered, but that is beyond the scope of a single thesis. While the validity of each sub-study may be questioned, the issues that emerged from the overall work came from a multi-year study of a selection of large public investment projects subjected to up-front assessment and quality assurance. The research problem has been studied from various angles using differing approaches. This comprehensive approach may help address the problems of validity.

The outputs of the research, the papers attached in Part 2 have been validated by peer review. Clearly, peer review is no guarantee that research is not flawed, as the responsibility for errors or deviation from professional norms or ethical standards lies solely with the researcher, but it ensures that some basic requirements have been met. However, it is equally clear that the analysis can be biased by the researcher’s values and beliefs. In general, beliefs usually are more unintentional than values, but their impacts on the value of the research are the same. This work has built upon readily available sources and papers reporting the research subjected to review by experts, and subsequently made publicly available, which affords opportunities to assess whether basic scientific requirements have been met, to verify results, to check data for accuracy, and to reveal potential omissions, misinterpretations or obvious factual errors.

To summarize, various theories and approaches have been employed in this work. Several available methods, including document studies, case studies and semi-structured interviews have been used to collect data, and in the empirical investigations it has been possible to weigh multiple sources of information. Hence, I believe that the work is based on an extensive approach that may enhance the credibility of the research output.

However, it is understood that the scientific requirements concerning reliability and validity are only partly resolved and that further research and more extensive studies are needed. Therefore, the work presented should be regarded as a partial and preliminary report from an evolving area of study. Despite these reservations, I believe that it will shed light on some key issues and answer some basic questions that in concert may benefit research and practice.
3 Concepts and constructs of the project management language

Some major challenges concerning the theoretical basis of project management and the ambiguous nature of some of the concepts involved were discussed in Chapter 2. The purpose of this chapter is to provide appropriate theoretical underpinnings. Therefore, it includes definitions of basic concepts important in exploring up-front assessment and quality assurance.

3.1 Project, project management, the project life cycle, uncertainty

The concept of “the project” is defined in various ways, depending on aspects such as uniqueness, task complexity and time-limitedness, as put forth by Samset (2003:222), Gareis (1989:243), Gido and Clements (1999:4) and PMI (2000:4)). I take the project to be as defined by Shenhar and Dvir 2007:94, “… a temporary organization and process set up to achieve a specified goal under the constraints of time, budget and other resources.” Projects are generally temporary and unique, with non-routine features, but that is not to say that all projects are completely different. Project management is “… the managerial activities needed to lead a project to a successful end.” (Shenhar and Dvir 2007:94)

The concept is paramount in understanding the nature of project work and how it is conducted. The project life cycle is here defined as a sequence of major phases through which the project evolves from beginning to end, a sequence in which each phase is separated by approval gates (Besner and Hobbs 2006:39). The life cycle of a project may be assumed to consist of three major phases. The project is conceived and formulated as a response to some need in a front-end phase. The front-end may consist of a stage where basic concepts and alternatives are defined (pre-study) and a stage owed to the shaping of a specific alternative (pre-planning). Project outputs are produced in the implementation or execution phase. The implementation phase ends when the newly-produced output is commissioned or brought into working condition and the operational phase of the project starts (in which an impact or effect is expected to be manifested) (Samset 2003). The sequence of phases from such a point of view is illustrated in Figure 5.

As previously mentioned, this work is constrained to focusing on the front-end, which may arise in many ways. In this thesis, the front-end is the phase in which the project is planned, and it
ends with the final decision to appropriate funds (Samset 2003). This means that the realization of the project outputs has not started, and in many cases the project manager and the project team have yet to be appointed. An important aspect of the front-end phase is its high level of uncertainty. First of all, as discussed above, projects are unique, complex undertakings, which means that they by definition are characterized by uncertainty. At its most basic level, uncertainty characterizes situations in which potential outcomes are not fully understood (Lessard and Miller 2000). In other words, uncertainty involves a lack of information. It is always present and cannot be totally eliminated because full knowledge of potential events isn’t possible. This poses a fundamental challenge for decision-making. Uncertainty is assumed to be present in the front-end of projects because at this early stage in the project life cycle, little is known about relevant alternatives and actual outcomes. At the same time, it is clear that the most significant decisions are made at this stage. The importance of decisions is greatest at the same time as the available information is scarce.

It is also clear that the work concentrates on major projects. The ambiguous, vague and even paradoxical issues surrounding the term “project” have already been discussed. The use of the term “major” does little to resolve this, but, as we shall see, there are many definitions of major projects in the literature. Morris and Hough (1987) suggest that a major project is particularly demanding due to its size, complexity, schedule urgency or demand on existing resources or know-how, it is “… a project which exceeds our experience, or which poses special problems of size or urgency, or which represents some other form of major difficulty.” (Morris and Hough 1987:14) The Major Projects Association contends that major projects:

“… are larger, more complex and offer greater risks and rewards, to society and to those involved in them. Major projects are particularly challenging to those tasked with initiating, planning, implementing and managing them, because they combine complexity and scale, finance and human resources, technology and time pressure.”

Eden, Ackermann and Williams (2005) draw the aspect of complexity to the forefront by denoting “complex” projects. However, there is little doubt that the projects “… in which project outcomes are difficult to predict, and even difficult to explain post hoc” (Eden, Ackermann and Williams 2005:16) would fit into the category of major projects.

Some of the uncertainty of major projects may well be caused by conflicting views of different project stakeholders. According to Samset (2003:11) “Project stakeholders are individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected by the project.” The key stakeholders include the financing party or the project owner, the operator or the implementing party, and the primary user or customer. The variety of interests of the project’s stakeholders may give rise to conflicts. The operator focuses on the implementation of the project according to specific requirements and is less likely to be concerned with long-term effects of the project, which is the main interest of the project owner. The primary user focuses on the results of the project, because he is responsible for the realisation of goals, not just the physical production of a product or a service of the project. Clearly, the interests of the key stakeholders must be maintained and balanced and built into the project’s design. This is a challenging task which takes place in the front-end. The differing perspectives of the project stakeholders leads to the question of what might be the perspective of a researcher concerned with projects. In this research work, it is clear from the questions pursued that the perspective is associated with that of the owner or the financing party. This is apparent from the approach of examining how an institutional framework for project improvement may affect outcomes in a selection of projects. It concentrates on the front-end, unlike the implementation focus offered
by most BOKs and textbooks in project management, and the empirical work aims to bring forth insights and possible explanations at a generic level, regardless of project type, industry, etc.

### 3.2 Project performance – perceptions and measures of project performance and success

The question was raised above as to what extent up-front assessment and quality assurance may be linked to more consistent achievement of project success. Hence, an explanation of how project performance and project success may be perceived and measured is germane.

Project management research frequently has sought the factors determining project success. This trend apparently is driven by a desire to provide guidelines or knowledge for project management relevant to most projects, most of the time. Such matters are beyond the scope of this thesis, though some works are worthy of mention. In a recent study of project success, Dvir, Sadeh and Malach-Pines (2006) assert that the operational mindset caused by a business aspect focus in project execution reflects the frequent use of time, budget and performance as the main indicators of project success. Frequent use, however, can not conceal the fact that any of these measures are incomplete, even when taken together. First of all, it is worth noting that new elements should be added to the assessment; or example, it is clear that a project, even if it meets time and budget constraints, should not be said to be successful if end user needs were not met. Second, project success assessments also may differ according to the assessor. In other words, the perspectives of different project stakeholders should be taken into account. Finally, timing is crucial to the assessment of project success. If, for example, the assessment is carried out soon after the output of the project work is completed, it may be justifiable to assess whether actual costs are in accordance with budgeted costs, but an approach which distinguishes between issues pertaining efficiency and effectiveness may be more difficult to address at this point in time.

In the IMEC study based on a sample of sixty large engineering projects where the aim was to undertake practical, grounded research to understand what leads to success or failure, and to identify the practices that, in project executives’ experiences, made a difference, reported in Miller and Lessard (2000), efficiency is regarded as “... an internally oriented method of evaluation, [which] focuses on costs, schedules, and technical performance; the project-management field measures success mainly through these criteria. (Miller and Lessard 2000:14) Project effectiveness is “... a composite measure, combining economic performance, technical functionality, social acceptability, environmental acceptability, political legitimacy, and economic development.” (Miller and Lessard 2000:15) In the IMEC study, project performance was measured by two sets of variables: ratings of the technical, economic, social, environmental, political, and developmental performance of projects (effectiveness), and, cost and schedule results (efficiency).

To summarize, it is clear that alone the cost of a project is of secondary importance in judging its feasibility and long-term effects. That said, this research is concerned with issues of efficiency. Yet, as mentioned in Section 1.1, the overall scope of this thesis is constrained to the front end. This brings in the dilemma that focus is on the front-end (which is mainly associated with strategic issues) but the aim includes exploring issues associated with a tactical perspective. On the other hand, it connotes that the work done here is a first step towards dealing with more fundamental issues.

A recapitulation of the central issues in this Chapter is pertinent. The definitions of “project” and “project management” deviate little from those of conventional project management. The “project” is a process undergoing continuous development and change and a way of organizing
set up to achieve a specified goal within certain specified constraints. “Project management” is the managerial input needed to lead the project successfully toward its goal. I am particularly interested in a plausible explanation of what constitutes “major” in speaking of projects. I assume that “major” projects are especially challenging, complex and uncertain, and in a sense extreme or critical. Moreover, I assume that the project evolves through a sequence of phases in a life cycle. The scope of the research conducted is constrained to the front-end phase in which crucial decision are made; it ends with the decision to finance and build. Consequently, this research does not deal with the various specific tools and techniques which may be associated with the planning and controlling of project execution. The decision making in the front end phase involves maintaining and balancing the potential conflicting interests of the project’s key stakeholders; the project owner, the implementing party, and the primary user. Finally, though the work is limited to the assessment of issues associated with direct outputs, it is clear that the perspective employed is that of the project owner. Selected projects are investigated and possible explanations and lessons are sought at a generic level.
4 Main topics covered by the research work

This thesis builds on 11 publications covering two main areas:

1) The importance of the front-end and how efforts to improve the initial design of projects may be set up, implemented and carried out in practice, including theoretical underpinnings, embedded principles and expected effects

2) Empirical indications from external assessments and reviews carried out in the front-end.

The topics are covered with a particular emphasis on Norwegian experience.

The aim of this Chapter is to summarize the main results from the research conducted to provide a cohesive overview of central issues that have emerged. Some basic background information is included for the sake of completeness and consistency. For a full description including methodology and data collection, reference is made to the papers listed on page 6 and attached in Part 2.

4.1 The importance of the front-end and characteristics of measures to improve the initial design of projects

In paper 1, Magnussen and Samset (2005) describe the background for and intended effects of the governance regime of large public investments put in place in Norway. They identify some of the key problems encountered in major projects and discuss how they may be addressed employing measures introduced in the initiative for quality at entry regime for large public investments in Norway. On the experience of some 50 projects and five years of the project approval process, they conclude that the independent examination introduced by the quality assurance may make budgets more reliable, but that more fundamental examination is needed earlier in the life cycle if significant improvements are to be made. The control and management of projects are factors determining project success in an operational perspective, but it is argued that a focus on the initial phases is even more important.

The importance of the front-end phase of projects usually is illustrated by saying that this is the stage at which crucial decisions are made yet also is the time at which the available information is least. Mikkelsen and Riis (2003) go so far as to label this a “fundamental dilemma in project planning”. In paper 4, Olsson and Magnussen (2007) pursue this question using experiences from major governmental investment projects to illustrate aspects of project flexibility, from both theoretical and empirical points of view. Many textbooks on project management have illustrations of the relative size of project attributes during the various project phases, including uncertainty, significance of decisions, freedom to manoeuvre, accumulated cost and available information. The derived models all have in common that the uncertainty, significance of decisions and the degree of freedom to manoeuvre are typically high in the beginning of the project, and low at its end. At the same time, variables such as the accumulated cost and available information begin at low levels and end up at a high level at the end of the project. However, the models put forth in the literature to date apparently serve as summaries and illustrations, and are to a lesser extent based directly on empirical evidence. Based on empirical data from 48 major projects, flexibility in different project phases is quantified for illustration. The authors suggest a structured approach to flexibility through using lists of potential reductions of scope that may be put into effect should unexpected problems arise. However, they conclude that the sole purpose
of the reduction lists is to keep the project within budget. This might be described as “negative”, or a constraint on the internal freedom to manoeuvre, which in turn implies that there is no intent to use the freedom to manoeuvre to increase effectiveness or benefits. In contrast, a “positive” or external freedom to manoeuvre would include options for increased user satisfaction with the projects.

In paper 3, Magnussen and Olsson (2007) argue that traditional project management has focused on the implementation of single projects. The traditional approach admits a high level of uncertainty, but there are no concepts that may fully capture the uncertainty and dynamics involved, especially in the front-end of projects. The authors challenge the conventional view of projects and draw attention upon how an industrial networks theory approach can be applied to analyze and manage the front-end of projects. The use of the approach is illustrated by an analysis of the front-end phase of a Norwegian public building project. It is concluded that in capturing the dynamics of the front-end, the approach is promising, though important questions concerning the description of activities and resources of the front-end need further clarification.

In paper 5, Olsson and Magnussen (2008) use experiences from up-front assessments of major governmental investment projects to illustrate aspects of project flexibility. From a flexibility perspective, project management as a discipline is compared to other managerial disciplines. Projects are described as trapped in their freedom. What is meant is that the potential freedom of projects as temporary organizations is so great that major emphasis in project management should be directed towards reducing and controlling their freedom, or flexibility. The authors go on to describe and discuss theoretical traditions in project management and build on this discussion to analyze one particular approach to up-front assessment of projects, the Norwegian Quality-at-entry regime for major governmental investments. They also state that this particular approach may be said to have its theoretical roots in the engineering tradition of project management. However, the early analysis of project alternatives also includes elements from the tradition of the social sciences. Hence, the quality assurance regime can be seen as an effort to combine optimal solutions from two different approaches at different stages of the project life cycle. Social science approaches are used when alternatives are assessed in the early stages of development, and engineering approaches are used when focus is set on the implementation of a chosen alternative.

Paper 6, Klakegg, Williams, Magnussen and Glasspool (2008)9, and paper 7, Williams, Klakegg, Magnussen and Glasspool (2008), describe the Norwegian framework and its use as a control measure. While examination and external assessments are key ideas, control was introduced in response to the historical need for offsetting the cost overruns of large public projects in the 1980s and 1990s. The first feature to be implemented, following a development driven by the Ministry of Finance was the QA2, a control measure prior to the decision to finance and build in which a realistic budget and a sound basis for project execution were the main targets. It was understood that the QA2 covered only a narrow perspective in the sense that only the chosen alternative was looked into. This led to the development of QA1, an external assessment to take place before the decision was made to enter preplanning. The QA1 focuses on the rationale of the project, the basic need that the project is meant to satisfy, and is performed at a stage where various alternatives are available. The Norwegian QA scheme consists of two mandatory gateways made up of good practices in the areas of social economy, planning and project management. It represents a tool for control from the top of the hierarchy, but aims in practice to work through expectation management. Paper 6 further states that “…expectations influence performance.” How this statement may be justified is the topic of the next section.

9 The paper was included in the programme of the PMI Research Conference 2008 and subsequently was published in the August 2008 special issue of Project Management Journal.
4.2 Empirical indications from external assessments and reviews carried out in the front-end

Clearly, there are fundamental challenges in describing or measuring how different approaches to improving projects may affect outcomes. The assessments made here entail more than merely evaluating different ways of directly measuring the suitability of any one particular approach to delivering successful projects. Instead, the examination has been of various traits, attributes or characteristics that may be linked to project success above the level of a single project. As stated by Venkataraman and Pinto (2008:6): “Among the factors that influence success is a reasonable and accurate system for estimating costs.” The importance of project cost estimation is due to estimates being used as standards against which future costs are compared. Although estimates become more accurate as decisions are made and uncertainties resolved, they serve as input in the assessment of project feasibility, in the sense that a comparison of cost estimates with estimates of revenues is crucial in determining whether the project is worth carrying out or not. In this research, it is acknowledged that costs play a limited part in the overall assessment of project success, but the important aspects associated with costs mentioned above may justify the particular emphasis placed on the development of estimates.

There are many before-and-after studies of cost in projects in the literature, most notably the well-known and thoroughly documented work by Flyvbjerg and colleagues (Flyvbjerg et al 2002; 2004; 2005, Flyvbjerg 2006a; 2008). But little research has been done on comprehensive practical responses in the front-end, such as in terms of institutional frameworks, to counteract cost overrun. In this research, early estimates are brought into the picture. Consequently, cost development can be traced from the earliest stages of project definition to actual outcome in projects subjected to external review. For the first time, this tracing permits assessing how measures in the front-end may affect cost estimation and planning processes.

In paper 2, Magnussen and Olsson (2006) analyze the development of cost estimates before the decision to finance and execute major public investment projects is taken. Cost estimation is a specific area of interest. The basic problem of underestimation of a project’s costs or overestimation of benefits has been addressed by a number of authors, for example the comprehensive work by Flyvbjerg, Holm and Buhl (2002) describing the effects of optimism bias and strategic underestimation. The study reported in paper 2 by Magnussen and Olsson (2006) is the first step in an attempt to investigate the degree to which ex ante quality control of cost estimates may counteract cost overrun. The consequences of the approach to the cost estimation process in terms of review or control of estimates are worthy of investigation, because they reveal practical steps that may be taken to reduce cost overruns. The study reported by the authors is based on investigations of 31 major public investment projects, of various categories and types, subjected to a mandatory ex ante quality control process initiated by the Norwegian Ministry of Finance in 2000. The authors address the question of how the scheme of third party quality assurance may influence the development of a project budget. However, the authors reach no conclusion on the effect of independent examination on the reliability of projects budgets, simply because none of the projects in their sample were completed and their final outcomes consequently unknown. Instead, two essential results are highlighted and discussed: The differences in the proposed cost estimates appear to have decreased systematically since the introduction of the quality assurance, and the project owners rely to a large extent directly upon the cost estimates from the quality assurance when the decision is made to execute the project.
In paper 10, Magnussen (2009b) presents results from further studies of cost estimates in major public projects through considering 61 transportation infrastructure, public building, defence procurement, and information technology projects subjected to an institutionalized framework for up-front assessment and quality assurance before the decision is made to build. The focus is on identifying explanations for differences in estimates by external experts. The causes of differences in the qualitative descriptions of why estimates differ are explored. In two-thirds of the cases analyzed, it was found that external experts recommend that budgets should be increased. The combined impact for project costs apparently remained low, as the average recommended budgetary increase was 3%. The explanations obtained were sorted into categories based on the association with specific issues (the assessment of uncertainty, methods, etc). It was found that methodical issues and assessments of the potential impact of risks play a major part in explaining differences.

The scope of this thesis is insufficient to provide a complete overview of the data involved in the study of estimates, though these data are available in the works referenced. Hence, transparency is preserved, because all research materials used in this thesis are available upon request. In the following I present an example that illustrates how costs are reported, how information was dealt with, compared and analyzed in one single case (the Klemetsrud-Assurtjern E6 Highway section), so that readers can conceptually follow what is done. Clearly, this one example cannot cover all details encountered in each of the individual projects, but it serves as a good illustration of an overall perspective of what was done.
### Budget proposed by the Norwegian Public Roads Administration


490 million (NOK, price level 2002), P50 estimate, based on 50 % subjective probability, the value at which the likelihood of staying within budget is 50 %

539 million (NOK, price level 2002), P85 estimate, based on 85 % subjective probability, the value at which the likelihood of staying within budget is 85 %

### Budget recommended by the quality assurance consultant


540 million (NOK, price level 2002), P50 estimate

570 million (NOK, price level 2002), P85 estimate

### Budget approved by Parliament


540 million (NOK, price level 2002), (based on P50 estimate, 50 % subjective probability, the value at which the likelihood of staying within budget is 50 %), **primary baseline for project execution**

570 million (NOK, price level 2002), P85 estimate, based on 85 % subjective probability, the value at which the likelihood of staying within budget is 85 %

### Actual cost


463 million (NOK, price level 2004), construction costs, construction started August 2002, completed September 2004

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Stage 1: Data collection and sources

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Stage 2: Data structuring and refinement, in which data were recorded into a database according to a pre-defined structure. For each project, there is one unique record in the database and a separate file with hard-copies of its documents. Data also are stored and displayed in a spreadsheet.

Stage 3: Data comparison and analysis

Data for each project were normalized to the same price level as was the actual cost (based on calculation by the NPRA and stated in the Annual report and in the Final Project Report). The calculation is verified by the sector index compiled by Statistics Norway.

Stage 4 comprises the presentation and display of data, of which Figure 6 is an example. The main output of the study of differences in estimates is shown in Figure 6, in which the difference between the estimate proposed by the project organization prior to external review and the estimate recommended by the external consultant is calculated in percent. The estimates are assumed to be comparable in the sense that cost data have been brought to the same price level and factors including price escalation, project changes, etc have been accounted for.
Figure 6 The difference between the project’s proposal and the revised estimate from the external consultant, N=61 (Magnussen 2009b)

Figure 6 essentially shows that the experts responsible for external review recommend budget increases in two-thirds of the cases analyzed. As shown, a significant part of the differences in relative terms suggest that for all practical purposes, the estimates are equal (the differences in estimates observed in 30 projects are within the ±5 % range). A few exceptions show that differences in estimates experienced in single projects may be significant, but the average difference is 3.4 %. It is assumed that the observed discrepancies in estimates are real. However, the quantitative evidence is insufficient to reveal any possible underlying causes.

In paper 9, Magnussen (2009a) analyzed the cost development from the early stages of definition to the actual outcome of 28 major transportation infrastructure projects subjected to an institutionalized framework for up-front assessment and quality assurance. He found that the development of costs in the early stages of a project has the most significant impact on total cost. This illustrates that a cost control measure introduced at the time of decision to build has little impact on project’s budgeted cost. Comparison of estimates with actual outcomes show that cost estimates may be more reliable, but that observed cost reductions are negligible, if costs at the early stages of definition are taken into account. A sub-sample of the 61 projects for which cost data are obtainable, namely 28 transportation infrastructure projects under the Norwegian Public Roads Administration (NPRA), is examined. In addition to the comparison of estimates made by the project organization and the external consultant prior to the decision to build, this paper also included estimates prepared at the early stages of definition. Due to extensive redrafts of project concepts, estimates in 14 projects that could be said to be related to comparable project alternatives, were used to trace the cost development from the earliest stages of definition to decision to build. Estimates were normalized to the same price level and comparisons of estimates were prepared by the NPRA, the budgets were recommended by the external analyst, and the budgets were set at the times that decisions to build were made. The early estimates most likely are inaccurate (typically a ±40 % accuracy level). Consequently, it might be argued that these early estimates cannot be compared with later ones. Deviations from the early estimates may be characterized as “tolerated inefficiencies”. Nonetheless, as frequently observed, estimates, despite their high levels of uncertainty, are used to prioritize between projects and even to finalize
agreements on the fractional distribution of actual costs between financing parties. Therefore, it is assumed that an investigation that involves comparison of early and later estimates is justified. This rests on the assumption illustrated in Figure 7 (Samset (2008)), in which illustrates a typical cost development in a project and underlines the importance of getting things right in the early stages. Cost overruns or cost savings defined by the difference between final budget and actual cost may often be negligible if early estimates are included in the analysis.

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**Figure 7 Cost development in projects**

The development of cost from the early stages of definition to decision to build, in the 14 projects in which estimates were obtainable, is shown in Figure 8. The cost figures are normalized to the 2007 level to facilitate comparison. It is shown that the total costs for the 14 projects increased by NOK 5.2 billion from the earliest estimates to the estimates proposed by the agency at the detailed planning level. All projects save one contributed to the cost increase.
The review by external experts at the detailed planning level adds another NOK 0.5 billion. The total budget of NOK 18.7 billion at the time of decision to build is slightly lower than the total budget recommended by the consultants, though it is NOK 5.5 billion above the costs associated with these projects at the early stages of definition. Though it’s easy to understand the potential consequences for public budgets of a NOK 5.5 billion increase in portfolio of 14 projects under the same agency, the numbers themselves may be said to be of secondary interest in this context. More important, as the results illustrate, a control measure introduced just prior to the decision to build is inadequate to significantly affect the development of costs in a project.

Thus far, the focus has been on the presentation of quantitative differences that may shed light on the affects of quality assurance. The complex and interrelated issues involved imply the importance of inquiries aimed to better capture context dependent information.

In paper 10 (Magnussen 2009b) reviewed the magnitudes of the differences between external consultants and project organizations in 61 projects and then identified explanations for the differences, that is, qualitative descriptions of why estimates differ. The areas associated with explanations for differences in estimates identified by the study are listed in Table 1.
Table 1 Areas associated with explanations for differences in estimates (Magnussen 2009b)

It is shown that differences in estimates mainly originate from different assessments of the impacts of internal factors. Explanations regarding the quality of cost estimation methods are identified in the largest number of cases (16). This is unsurprising in light of the focus of QA 2, in which revision of cost estimates and identifying major risks are important. How the cost estimation is performed and documented is seen as important, and the category attributed to these explanations accounts for 33 of the 70 identified explanations. Another interesting observation was (as suggested above) that the differences in estimates were reduced. However, no particular change was seen over time in the explanations for differences. They seem to be equally distributed along the time axis. This implies that it’s not the differences in estimates themselves, but how estimates are produced and documented that’s most important.

However, Magnussen’s most important conclusion was that projects displaying small differences in estimates are just as important to examine as those with large differences. Explanations were just as readily available and informative, even though the differences were small, and estimates for all practical purposes could be said to be equal.

In papers 6 and 7, Klakegg, Williams, Magnussen and Glasspool (2008), and Williams, Klakegg, Magnussen and Glasspool (2008) report results from a study supported by the PMI, the Concept Programme and Southampton University to analyze frameworks for front-end appraisal and governance of public investment projects.10 The aim was to see how the governance regimes for major investment projects in different countries affects project performance, as well as comparison of this with the frameworks’ intended effect. The focus was on cost and time management. Case studies that looked into specific elements and principles concerning cost and time were used. The author of this thesis was responsible for the data collection and analysis of Norwegian case studies. Although it was found that the potential effect of frameworks put in place in the front-end was large, the selected cases did not show the full potential. In fact, the impact of the QA2 was less significant in them. No significant changes in cost estimates or schedule were made. The project organization developed no new or specially adapted documents, though the QA2 analysis showed that the project was well planned, so a key benefit of the procedure was legitimating the project, which afforded reassurance for the project owner.

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10 It should be underlined that the papers did not aim to cover the wider considerations of the study. A complete coverage of the work performed in the study is offered by a full report, Klakegg, Williams, Magnussen and Glasspool (2009), published by the PMI.
In paper 9 (Magnussen 2009a) an analysis was made of the outcomes in 10 projects under the NPRA that had been through external review prior to the decision to build. In Figure 5 a comparison is made of actual costs, the NPRA estimate, the estimates recommended by external analysts and the budgeted costs in the completed projects.

![Figure 9 Comparison of actual outcomes with estimated and budgeted costs (Magnussen 2009a)](image)

As shown in Figure 9, seven projects were finished below the budgeted cost, the primary cost baseline for project execution, while three projects used contingency funds. Cost savings dominate in the sense that the mean deviation from budgeted cost is -7.6%. The total cost reduction for these 10 projects combined amounted to some NOK 600 million (out of an aggregate budget of NOK 8896 million, cut to NOK 8276 million).

Care is essential in interpreting the results of this comparison. First of all, 10 completed projects are a small sample. Also, bias may have been introduced, as the selected projects were those with the shortest execution times and the lowest expected costs. For each project, the actual costs were reconstructed shortly after the output of the project work was completed, but together the reconstructions addressed few issues other than cost performance. However, possible changes of scope or quality reductions were investigated. Such adjustments, which are frequently held to cause cost overruns, did not take place in these 10 projects. This implies that the reported underruns represent actual cost savings.

This Section has summarized the main results from the studies carried out as part of the research work. It has been shown that many approaches have been used to explore the field of up-front assessment and quality assurance. The work may be said to be mainly empirical. Empirical evidence from projects subjected to examination, particularly with respect to the Norwegian
experience, has been collected and analyzed. The next Chapter highlights important lessons that have emerged from the work.
5 Conclusions and directions for further research

The conclusion of this work comprises comments linking the results obtained to the issues initially identified.

The work reported in this thesis is an exploration of the up-front assessment and quality assurance of major investment projects. Traditional project management research is concerned with how planning and control of project execution affects actual outcomes. This work focuses on empirical investigation of improvement measures introduced in the front-end.

Both primary and secondary research questions were stated in Chapter 1. The primary questions addressed the essential features of effective up-front assessment and quality assurance as well as their impacts on projects. The secondary questions, explored in greater detail, concerned the major problem of cost overrun in projects. They included exploring the extent to which up-front assessment and quality assurance may guard against underestimation of cost, whether agreed boundaries for cost development are followed or not and how improved budgetary compliance may be encouraged.

In paper 1 (Magnussen and Samset (2005)) and paper 2 (Magnussen and Olsson (2006)), the questions have been explored through detailed descriptions of the project approval process, its theoretical underpinnings, its embedded principles, and how it is carried out in practice. It was shown that the introduction of quality assurance was triggered by the lack of success and repeated failures of major public projects in the 1990s. The first initiative addressing this drawback was Quality Assurance 2 (QA2), the mandatory quality assurance and uncertainty analysis of projects carried out by external consultants on behalf of the responsible ministry before a project is brought before Parliament to be authorized for execution. In paper 5, Magnussen and Olsson (2008), assert that this particular approach has its roots in the engineering tradition of project management, which means that focus is on the control aspect. It focuses on ensuring that projects can be carried out as planned and much effort is expended on the development of a realistic budget. It is presumed that the quality assurance affects projected costs simply because it exists. Arguably this is the case, because responsible agencies and project organizations are informed about an upcoming quality assurance, so adjustments to estimates may be made in advance of the external independent review. It is also shown that immediately after the introduction of the QA2, a more sophisticated procedure for monitoring project cost came in place. This may itself influence the control of costs during execution. In paper 4, Olsson and Magnussen (2007) illustrated how this might occur in practice, with an analysis of the use of reduction lists principally used to keep the project within budget.

Investigations of cost estimates to probe issues related to extent to which the process of up-front assessment and quality assurance could guard against underestimation in cost have revealed several important aspects. In paper 10 (Magnussen (2009b)) demonstrates that the impact of a review of costs done prior to the decision to build may result in significant changes in individual projects. However, the impact on costs for the projects seen as a whole remains low (an average difference of 3.4 % is observed and in nearly half of the projects the differences are within the ± 5 % range). In paper 9 (Magnussen (2009a)) tracks cost development from the earliest stages of definition to actual outcome. The paper illustrates that “inaccurate estimates” in the early stages of planning in 13 of 14 cases later turn out to be “too low estimates”. However, the most important aspect probably is that even more reliable estimates result from costs added by external
consultants prior to the decision to build, the cost reductions in actual outcomes are, as indicated in paper 8 (Magnussen (2009a)), negligible if the whole picture of the cost development is considered. This shows that the most crucial decisions take place early in the project life cycle. Consequently, a contribution of this work to practical planning is that it demonstrates that any response aimed at affecting the accuracy of estimates must be implemented at an early stage in the project life cycle.

However, the search for explanations of differences in estimates has shown that a quantitative comparison of estimates could turn out to be a misleading simplification in the examination of how up-front assessment and quality assurance may influence planning. The study, which aimed at making use of the ample contextual information available, illustrated that projects may be affected even if this is not reflected in changes to cost estimates. Important, though, was that an attempt was made to shed light on possible answers to the detailed level questions by using case studies. It was shown that the impact of the QA2 was less significant in the two analysed cases, described in greater detail in paper 7 by Williams, Klakegg, Magnussen and Glasspool (2008). However, one observation illustrated aspects of the issue. The process of QA2 gave reassurance that the project was well planned, so a key benefit of the procedure was legitimating the project, and reassuring the project owner.

The selected aim to influence more fundamental issues connected to the project is of increasing mounting concern at the introduction of a particular approach. In paper 1, Magnussen and Samset (2005) show that the Quality Assurance 1 (QA1) is established to achieve substantial improvements of project performance by analyzing project concepts, not just to be a specified alternative, as it is in the QA2. Its purpose is to identify the most adequate project based on relevant needs and priorities. In paper 4, Olsson and Magnussen (2007) assert that the QA1 clearly includes elements from the social science tradition. The quality assurance regime can be seen as an attempt to combine optimal solutions from two different approaches at different stages of the project life cycle. In the early stages of development, social science approaches are employed, and whenever the emphasis is on the implementation of a specified alternative, engineering approaches are used. It should be underlined that due to lack of data, inquiries specifically involving the QA1 were not addressed. This is an important area that requires more research.

This research represents a first, small step in an evolving area of study, so some thoughts on the way forward are appropriate. First, I argue, due to the diverse contextual backgrounds of the projects involved, further studies may benefit from segmentation of data. The segmentation might be based on a number of parameters, but the most amenable are perhaps project type, size, and complexity. In this way, factors not observable in the data presented in this thesis may emerge and shed light on important unanswered questions. Second, changes in the set-up of the methodologies applied may also be required, such as a more extensive use of methods such as in-depth interviews with actors involved to better capture essential contextual information. Another way of approaching may be to carefully look at more individual cases. In this manner, even more important questions might arise, and may persuade us to view issues from other perspectives. Finally, a shift of focus from efficiency to effectiveness issues is crucial, so that the influence of more principal aims of improvement measures related to feasibility and sustainability of projects may be examined.

Overall, I believe that the work presented in this thesis has provided some useful insights and lessons. In summary, I feel that the main contribution from this work is that a measure introduced in the front-end to reduce the problem of cost overrun has for the first time been studied empirically. The principal finding is that any action aimed at affecting the accuracy of
estimates must be implemented at an early stage in the project life cycle. This is the conclusion of empirical investigations of immediate outputs of the projects, which undoubtedly has implications for decision making regarding large public investments. At the more theoretical level, it should be underlined that the implications of this work go beyond what examinations of efficiency can provide. A detailed description of the project approval process, its theoretical underpinnings, embedded principles, and how it is carried out in practice also has been carried out. One of its conclusions is that it is necessary to understand how projects can be successfully aligned with the desired direction. The initial choice of project concept is of crucial importance. This represents the pivotal decision made during the lifetime of a project, which is likely to have the largest impact on long-term success or failure. This can be said to be the main theoretical contribution of the work.

Hopefully, in this research, I have arrived at answers that may prove useful in the management of large projects. Yet, inevitably, due to the complex and interrelated issues involved in the research about projects and their management, the interpretation of many facts is still going to remain highly uncertain. The researcher, obviously unable to offer definitive answers, should do little more than probe previous assumptions and to push forward the boundaries of knowledge.
References


Magnussen, Ole M. 2009b. Explaining cost estimate differences in up-front assessments and quality assurance of large projects. Trondheim, Norway: Norwegian University of Science and Technology.


List of government documents


\(^{11}\) Name of government body and document titles appear in Norwegian because the documents themselves are available in Norwegian only. Please cf notes for English translation.

\(^{12}\) The Ministry of Finance

\(^{13}\) Proposition to Parliament no.

\(^{14}\) The Ministry of Government Administration and Reform

\(^{15}\) The Ministry of Defence

\(^{16}\) The Ministry of Justice and the Police

\(^{17}\) The Ministry of Culture and Church Affairs

\(^{18}\) The Ministry of Transport and Communication

\(^{19}\) Report to Parliament no.


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20 The Ministry of Health and Care Services
21 The Ministry of Education and Research
Part 2 – Papers


Part 2 Research papers
Successful Megaprojects: Ensuring Quality at Entry

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Abstract

Cost overruns and delays are common in projects of all sizes. The potential savings from improving implementation may be considerable. However, the choice of strategy and fundamental design is more essential, and the potential rewards for improving quality at entry might be considerably higher. This paper focuses on experiences gained in Norway to improve major public investment projects. This includes problems such as inadequate needs assessments, initial poor designs, tactical budgeting by local authorities, inadequate cost estimation and risk assessment, etc. The paper discusses consequences of such problems, and possible means to avoid major flaws in the initial conceptual design of mega-projects. An intriguing aspect is that such up-front investments in quality improvements tend to pay back to an exceptional degree in terms of cost reduction, increased utility and economic benefits. Based on experiences from some 50 Norwegian megaprojects, an initiative for handling challenges in the initial phases is discussed.

Keywords

Quality Assurance, Megaprojects, Project Design

Introduction

The paper describes lessons learned and provides some advice on how to improve the effects of major public projects. The increased use of projects as a way to organize and perform various tasks, not only in the business or industry environment but in all sectors of society, is challenged by a current focus on problems associated with the major projects. Despite the emphasis placed on improved methods to analyze and manage projects, the track record of projects reveal fundamental problems, and many projects are assessed as failures. Efforts to improve the initial and fundamental design and to avoid some of the common problems related to the implementation of projects represent a potential for considerable savings and added value. In this paper attention is directed to the early phases of projects as it discusses experiences from front-end assessment and quality assurance of 50 major public projects in Norway. It is argued that the traditional focus on the actual implementation of projects is too narrow when the ambition is to improve the viability and economic benefits of a project.

Cost efficiency considerations: right price

Several studies of major projects show that cost overruns are common. Morris and Hough (1991) found that cost overruns in a large sample of projects were typically between 40 and 200 per cent. A government white paper (Kaasen et al. 1999) on Norwegian offshore oil and gas activities 1994-1998 (35 projects) reported a total cost overrun of NOK 26 billion, or about 13 per cent on average. The report states that compliance with the initial budget is not an essential success criterion, since the initial estimate should not be an obstacle for flexibility, new business opportunities or technology, etc. A study of large transportation infrastructure projects by Flyvbjerg, Skamris Holm and Buhl (2002) found that 9 out of 10 projects fall victim to cost escalation, actual costs being on average 28 per cent higher than estimated costs. Berg, Kilde and Rolstadås (2003) discuss some lessons from five large Norwegian public infrastructure projects. They reported overruns between 10 and 222 per cent, partly explained by change processes being unclear and difficult to control at a late stage in the projects and insufficient risk management. It was noted that some of the projects were considered profitable despite cost overrun.

Odeck (2004) reports from a study of 620 public road projects in Norway completed during 1992-1995 that in more than half of the projects the total cost exceeded the budget. The average cost escalation was close to eight per cent. It should be noted that the majority of projects were relatively small, and that the more restricted sample of large projects came out with costs within budgets. For the projects as a whole, however, cost overrun amounted to more than NOK 500 million (≈EUR 60 million).

The media’s current interest in the issue of cost overrun is associated with the cost-efficiency issue: Cost overruns imply wastage of public resources that could otherwise have been used for productive purposes.
elsewhere. Another issue is of course that if the initial cost estimation of major projects with large cost overrun had been accurate and realistic, they might not have been implemented and more viable projects could have got priority.

The causes of cost overrun in projects are varied, some are not only hard to predict but also difficult to manage. Morris and Hough (1991) conclude that in many cases overruns are caused by circumstances outside the project's area of control, such as price escalation, government action, strikes and so on.

Kaasen et al. (1999) asserts that the estimates investigated in their study were unrealistic due to exaggerated optimism and limited understanding of uncertainties involved. The study concluded that projects were approved on an insufficient basis and recommended that this needs to be improved in the future. It concluded that the risk of cost overrun could be reduced through investments in the early stages of the projects and that the remaining risks need to be understood and managed.

Flyvbjerg, Skamris Holm and Buhl (2004) offer several explanations of the causes of cost overrun in projects. They found that cost escalation strongly depended on the length of the implementation phase. Delays and long implementation phases tend to increase the risk of substantial cost escalations. They observed a tendency that projects grow larger over time, and for some project types, larger projects have higher percentage cost escalation. Also, they found that the risk of substantial cost escalation is high for all project sizes and types. Since the same percentage cost escalation would typically cause more problems in budgetary, fiscal, administrative and political terms in a large project than in a small one, they conclude that an increase in project size translates into a need for improved planning processes.

The study of Odeck (2004) highlights the considerable focus on budget compliance of large projects in the Norwegian road sector in the 1990s. The observed compliance and cost underruns among the largest projects in his sample leads him to assert that this may indicate that the larger projects have been under better management. Since cost overruns dominate the picture he suggests that a deeper understanding of why they occur, improved methods for estimating costs and a control mechanism that ensures sober estimates are necessary.

Cost estimation, which is closely related to the project organization, has received some attention among authors in this field of research. Flyvbjerg et al. (2002) deliver an interesting contribution on this issue. Their study focuses on transportation infrastructure projects, in a broad sample of projects from different parts of the world and a time period from 1910 to 1998. They study the differences between actual and estimated cost and argue that “[…] the cost estimates used to decide whether such projects should be built are highly and systematically misleading.” (Flyvbjerg et al. 2002:279) They found a systematic underestimation that could best be explained as strategic misrepresentation. Olsson, Austeng, Samset and Lädre (2004) suggest that "strategic budgeting" is a commonly used technique in major public projects. This technique includes using a budget that only visualizes part of the total cost in order to initiate the project, and then exploit the fundamental logic that a project, when defined and planned, is less likely to be reversed or terminated. Nijkamp and Übbels (1998) offer a similar explanation when investigating how reliable cost estimates are at the time of the decision to build in infrastructure projects1.

“One may safely assume that the costs of the project at that stage are as low as possible to ensure that the project will be executed. This suggests that the cost may be somewhat underestimated at the beginning of a project.”

(Nijkamp and Übbels 1998:3)

This issue is a problematic one because empirical evidence of such a practice is hard to establish. Moreover, it involves assumptions of not only the intentions but also the integrity of actors.

Nijkamp and Übbels (1998) conclude that, since large changes during implementation is a major cause of cost escalation, it is necessary to stress the importance of the initial planning phases.

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1 It should be noted that in the study which is based on only eight projects, they consider this cause of underestimation as less important.
Cost effectiveness considerations: Right project

The potential for reducing costs in major projects during implementation may be considerable. Improved cost efficiency will remain a focus in media. However, in many projects cost overrun in absolute terms may be considerable, but measured against operating costs after the project has been completed is insignificant. In one Norwegian hospital project a 10 per cent increase in construction costs was equivalent to only months of operating costs. In an airport train shuttle project a 30 per cent cost overrun was insignificant seen in relation to long-term cost and revenue because the investment cost were completely out of proportion of the potential revenue from the restricted number of passengers using the airport. What this suggests, is that in relative terms, cost increases may be even less significant if seen against life-cycle costs and revenues in a cost-effectiveness perspective. In most projects the choice of strategy and fundamental design is more essential than compliance with construction budgets. The potential rewards for improving quality at entry might be correspondingly higher.

More authors in the field of project management now seem to agree on the importance of a better design process in order to create successful projects. The focus is opened to include both factors associated with the implementation process and the long-term effects and fulfillment of overall objectives. In a study by the World Bank (1996) of more than 1000 projects, where the quality and extent of the front-end processes were rated against project success, it was concluded that some 80 per cent of the projects that could be characterized by an adequate front-end phase were performing well. Projects that were implemented after an insufficient front-end phase showed a success rate of some 35 per cent.

Miller and Lessard (2000) report results from a study of 60 large projects world-wide. In their study the measure of project success relies on a variety of factors not only restricted to the implementation phase. It shows that nearly 40 per cent of the projects in their sample perform very badly in terms of non-fulfillment of objectives, non-compliance to budget, time constraints, etc. Projects characterized by a long front-end phase, numerous iterations and late lock-in of concept are, according to the study, more successful. A key issue is the management of uncertainty that characterizes the early stages of the project since so little information is provided at this stage. On the basis of these results Miller and Lessard (2000) emphasize the importance of the front-end phase.

A trend in existing literature in the field of project management is a growing understanding of the need to focus on the front-end phase in order to address the fundamental problems and achieve more successful and cost-effective projects. Below are some lessons from an initiative by the Norwegian government to improve quality at entry of public megaprojects.

Improving Quality at Entry

In order to meet the demand for better management and control of major public investment projects, the Norwegian government established mandatory external quality assurance of all public investment projects with an expected budget above NOK 500 million (≈EUR 60 million). The so-called Quality-at-entry Regime became operative year 2000 under the Ministry of Finance. It aimed to avoid cost overruns and strengthen the projects’ decision basis.

The regime involved quality assurance of the basis for decision and management, including revision of cost estimates and uncertainty analysis for the chosen project by the end of the pre-planning phase. It provided the responsible ministries with independent analyses before final appropriation of funds by Parliament. By the end of 2004 about 50 projects had been subjected to external quality assurance. On the basis of these cases some key experiences can now be extracted.

A study of 31 of the 50 projects conducted by the authors, shows that the external consultants recommend higher budget than the technical ministries in 74 per cent of the projects, in some cases up to 15 per cent or more. The figures are comparable in the sense that data have been deflated and factors like price escalations, project changes, etc have been accounted for. The data shows considerable discrepancies between the estimates proposed by the responsible ministry/agency and the external reviewers. Whether
these adjustments make budgets more realistic remains to be seen, since none of the projects have yet been completed. However, an early attempt to study the effects of the regime (Olsson et al. 2004) suggest that representatives of the ministries and agencies are generally satisfied with the analyses as they represent a “second opinion” and leads to an improved decision basis before the project is submitted to Parliament.

Quality assurance was introduced to ensure that a realistic budget is established before the large projects are formally submitted to Parliament. Now there is a binding budget for the projects as a point of reference for monitoring budget compliance. This was not always the case before the regime, and there are examples of disagreements about what was included in the initial estimates. In some cases initial estimates did not appear in formal documents until the projects had been nearly completed (The Office of the Auditor General 2002). Another aspect of the quality assurance scheme is that it has strengthened the cost estimation process. If key cost elements are not included or omitted by intention or mistake, quality assurance is designed to intervene. It is also a tool to promote new methods and techniques and to develop the knowledge base, especially in the government agencies involved. Moreover, since the control aspect is prevalent, it is expected that the regime could have a disciplinary effect to establish a realistic budget both in the administrative and the political process. It is likely that the Quality-at-Entry Regime could have a favorable impact on tactical budgeting; assuming that such practice actually has taken place. The usefulness of the revised estimates seen from the ministries’ perspective is confirmed by the present study. When the project budget is sanctioned by Parliament, the decision is directly based on the revised estimate in most of the projects (58 per cent).

Another essential finding is that the difference between the estimates made by the relevant government agencies and the external reviewers appear to have decreased systematically since the regime was introduced. The evidence is not sufficient to explain the reason for this. The differences could just as well be explained by initial overestimation from the external reviewers as underestimation by the responsible agency. Another possible interpretation could be that an adjustment to the demands of governmental institutions has taken place, either by the external reviewers, the agency, or both.

The quality assurance scheme has been controversial. Some have claimed that it instead of contributing to improvements has lead to enhanced costs and delays. Clearly, the quality assurance exercise itself has a cost, but usually not more than one per mille of the project estimate, often much less. Also, in some cases projects have been delayed or temporarily halted as a result of the quality assurance process. Others have argued that the focus in media and frequent public criticism of cost overrun in large public projects could explain the initial tendency by the external reviewers to increase cost estimates. Could their fear of being exposed negatively in the case of severe cost overrun result in a cost estimation bias? Olsson et al. (2004) note that in some cases there have been distinct disagreements regarding the size of the cost estimate between the responsible agency and the external reviewers. This is understandable with the importance attached to establishing a realistic budget by the public and the politicians.

In the wake of this type of narrow discussion regarding the effect of the quality assurance scheme, more fundamental issues were raised. A one-sided focus on costs may divert attention away from issues far more important. Why is a five per cent deviation in expected cost of a project so carefully discussed when the issue whether the project is needed is neglected? Take the construction of a shore-based torpedo battery as an example: Four years after the project was formally approved by Parliament, at the same day when the new facility was tested in operation for the first time, the Parliament decided to close down the NOK 250 million (≈ EUR 30 million) torpedo battery along with eight similar installations, or ‘put it in the moth bag’. The reason was that such capabilities no longer were useful in the long-term strategy of Norwegian defence. The project was a total failure. Not only did it fail to comply with the budget, it also proved to be in conflict with the strategic needs of the end user. In hindsight, it is easy to point out that the project should not have been initiated. The fundamental issue here is what could have been done in this particular project to reach that conclusion before it was submitted to Parliament. Maybe it could not have been foreseen during the earliest stages of planning. It is however clear from the Government’s white paper on defence long before the project was completed that such installations were outdated. This

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2 The project was completed with considerable cost overrun.
demonstrates another fundamental issue: a general lack of ability to terminate unviable public projects in the process and minimize losses.

What this example basically underlines is that the cost of a project may be of secondary importance when it comes to judging its feasibility and long-term effects. Careful monitoring of costs could not have saved it. In the end, the total loss amounted not only to the cost overrun but the entire investment. In a recent study of concept development and evaluation in large public investment projects in Norway (Solheim et al. 2004) it was found that needs assessments and approaches to satisfy needs are of varying quality in defence projects. They are often focused on specific solutions instead of analyzing alternatives adequate to solve the specified needs, and there is a comparably stronger emphasis on investment cost. This indicates a potential for improved procedures and practice.

In terms of the quality assurance regime and the way it was implemented from the start, it is evident that its effect would essentially be restricted within the cost-efficiency perspective. One lesson, to which there also was awareness at the outset, was that the arrangement is inadequate to deal with fundamental issues related to long-term feasibility and profitability of major public projects, simply because it takes place too late in the process. It is useful in order to control the basis for decisions during the implementation phase in terms of costs, progress and quality, but since the project alternative is already chosen, the possibilities to have an impact on the project’s effect are small. The key to more successful projects lies in the choice of concept and fundamental design. Thus, the quality improvement processes must aim to start at a point in the process where these issues are resolved.

**Front-end assessment of major projects**

Based on the lessons discussed above, a revised and expanded quality assurance scheme was introduced from 2005 onwards. This is subsequently expected to result in more successful projects and better use of the public funds, not only reduced implementation cost. As earlier, quality assurance is performed by external consultants under a framework contract with the Ministry of Finance. The scheme is now extended to include external quality assurance also at an earlier stage in the project cycle, and will include two separate analyses:

- Quality assurance of the choice of concept (QA1)
- Quality assurance of the basis for control and management, including cost estimates and uncertainty analysis for the chosen project alternative (QA2)

QA1 is the new feature, and will be performed by the end of the pre-study phase, just prior to Government’s decision whether or not to start pre-planning, see Figure 1. The purpose of QA1 is to assist the Ministry in making sure that the choice of concept has been subjected to a political process of fair and rational choice. Ultimately of course, the choice of concept is the result of a political process, in which external reviewers have no role. Their role is restricted to control the professional quality of underlying documents constituting the basis for decision. The quality assurance scheme is in other words a tool for evaluating the quality of information and for providing additional information as required, on which basis decision makers can judge the project.

It will involve quality assurance of the following documents:

- Needs analysis
- Overall strategy document
- Overall requirements specification
- Analysis of alternatives
This includes performing a complete economic assessment of alternatives, according to guidelines from the Ministry of Finance. A fundamental requirement is that at least two viable alternative concepts should be presented for review, in addition to the so-called zero-alternative (no project).

The external reviewers should present their findings in a report containing their assessment and advice regarding:

- Uncertainties likely to affect the project
- Anticipated socio-economic benefits versus costs
- Anticipated relevance, efficiency of implementation and sustainability
- Ranking of alternatives
- Management strategy

QA2 is essentially the same type of quality assurance that was performed during 2000 – 2004. It will be undertaken by the end of the pre-planning phase, before formal submission to the Parliament. The purpose of QA2 is to provide the Ministry with an independent review of the project before the budget is appropriated by Parliament. Focus is on the control aspect. This is partly a final control to make sure that the basis for decision on appropriation of funds is acceptable in terms of scope and quality. Partly it is a forward looking exercise to identify the managerial challenges ahead. The analysis should help substantiate the final decision regarding the funding of the project, and should be used during implementation as a basis for control on behalf of the Ministry.

It should be documented in a report containing the consultant’s advice on:

- The cost frame, including necessary contingency to make sure the budget is realistic
- How the project should be managed to make sure the cost frame will hold

The Ministry of Finance monitors and guides developments within the quality assurance scheme through a forum, which includes representatives from ministries, agencies, external consultants, as well as the Concept research program, which has been designated to follow up on and help improve quality assurance in public projects.

The fundamental rationale of projects in general is their ability to satisfy certain needs. As stated above, the quality assurance scheme 2000 – 2004 was considered inadequate to deal with this fundamental issue. The main problem was the late introduction in the project life cycle.
Figure 1 The Extended Quality Assurance Scheme of the Norwegian Government

Isolated, QA2 is merely an instrument to secure that a project performs adequately within the borders of time and resource constraints rather than addressing the question whether this fundamentally is the best answer to the needs that the project is supposed to satisfy. Whether the revised scheme as illustrated in Figure 1 will perform as anticipated remains to be seen.

Up-front project evaluation in a broad perspective

It is generally agreed that effective management will require a broad perspective on a project, taking into account not only the strategy, but also its impact and coherence with needs and priorities of users and affected parties. In project evaluation, five analytical criteria are commonly used to provide a comprehensive yet simple picture of the status of a project. They constitute the key analytical elements in the definitions of the term ‘evaluation’ adopted by OECD and the European Commission. These are efficiency, effectiveness, impact, relevance, and sustainability. Taken together, and applied analytically on a project or process, they are meant to provide decision-makers with the essential information and clues to establish a precise diagnosis and make the right decision.

Projects can be viewed in different perspectives. Success in an operational perspective is measured in terms of efficiency. In a tactical perspective it is measured in terms of effectiveness. And the strategic perspective is explored in terms of the project’s impact, relevance and sustainability. In combination, the five evaluation criteria cover all three perspectives.

As discussed above, the ultimate choice of project alternative under the Norwegian quality assurance scheme is based on a ranking of alternatives on the basis of an early assessment of the anticipated project’s efficiency, effectiveness, relevance, and sustainability.
The key performance measures used in projects are cost, time and quality. These are used to measure project delivery in an *operational* perspective. However, they are inadequate as measures of success, it requires that not only the operational but also the tactical and strategic perspectives are taken into consideration. A comparison of the same type of projects undertaken under comparable conditions and in similar contexts could possibly be restricted to the operational perspective. However, projects are unique undertakings performing under different conditions so this is not feasible. What seems to be a successful project in the operational perspective may be a disaster seen in a tactical or strategic perspective.

As an example, consider a sub-sea road tunnel project linking an island with the mainland. The project turned out to be a complete success in an operational perspective, completed ahead of time and within budgets. The *tactical* objective is to improve access for residents to the mainland by dramatically reducing the access time. However, the project fails entirely in this respect simply because the construction and operational costs were too high compared with the limited size of the user population on the island and their willingness to pay user fees. People therefore preferred to travel by boat, and since the ferry had closed down, traffic with mainland went down. The tunnel project was a potential disaster in financial terms, as measured for instance in terms of its internal rate of return.

However, measuring effectiveness is also too restricted, it provides only a narrow part of the picture, namely the extent to which the *formally agreed* tactical objective has been achieved. In other words, the project's anticipated positive effect.

To make a fair statement of success or failure seen in a *strategic* perspective requires a broader assessment also of the relevance and sustainability. In other words, to what extent the objective of the project corresponds with important priorities in society and the needs of the users. Consider the example above: the goal was to improve access to the mainland and reduce access time. The economic basis for the island’s residents was basically fishing, tourism and some agriculture. Improved access would promote tourism to the island. For the resident population, however, most of the transport was by boat. Their needs in terms of infrastructure were more in terms of improved harbour facilities than an access road. It was therefore highly questionable whether the project was relevant. Rehabilitation and extensions of harbour facilities would also have been far less expensive. In a sense, relevance expresses the extent to which formal objectives are in agreement with society’s needs. To some extent, relevance is a key test of the feasibility of the initial project design. It is also an important indication of success during implementation.

In the strategic perspective, also the long-term *sustainability* needs to be taken into account. In other words to what extent the positive effects of the project persist in the years after the project has been completed. This is a combined measure which has to take into account all changes brought about by the project in society. In the example of the tunnel project, the long term strategic objective was to increase economic activities and develop the economic potentials of the island. The opposite seemed to be the result. Residents moved to the mainland and settled there, employment in the fisheries went down, and their houses were taken over by tourists. The sustainability of the total project was thereby reduced. While tourists might be more willing than residents to pay high user fees, they would use the access tunnel only during the short summer months. The rest of the year their resorts would be locked up and the island more and more deserted. The economic basis for the project was therefore even worse than anticipated and a large part of the project had to be financed by the public, not by the users as planned.

Was this project a success or a failure? There is not one simple answer to the question. An early assessment in an *operational* perspective would conclude that it was a success. In a *tactical* perspective the project was not very successful, since its formal objective was attained only for those who could accept the high user fees. And finally, in a *strategic* perspective the project’s relevance as well as its sustainability appears to be a disaster: the tunnel is an economic burden to society and a main cause of disintegration of a community of islanders.

Most projects consider success only under the constructor’s perspective. In order to improve quality at entry at an early stage the perspective will have to been widened, as discussed above. In that sense, the Norwegian quality assurance scheme is firmly rooted in a strong internationally approved evaluation tradition.
Expected effects of the revised quality assurance scheme

The quality assurance scheme is an initiative to enforce a qualitative change in government practice and improve quality at entry of major investments. It does not interfere with current procedures, but merely aim to improve on existing documents that are an essential basis in the political decision process. However, the fact that the Government itself will now have to approve a go-ahead before preplanning certainly centralizes decision to some extent.

The most fundamental aspect of the quality assurance scheme is probably the new requirement that at least three alternatives should be considered - not only one - and it should be done at an early stage when options are still open. The alternatives should have the same degree of specification, and since QA1 is performed prior to the pre-project stage, no alternative is, by definition, better defined or planned than another. This would help making fair assessments of alternatives.

This, and the emphasis on socio-economic analysis, might prove significant in the aim to select the most viable project alternative, see Table 1. Also, identifying and assessing uncertainty is a key feature at this stage when a great deal about the perceived project in its context is unknown. The uncertainty analysis implies that decision-makers are informed at an early stage about possible risks involved, and will be better equipped to be able to decide not to proceed, or to proceed in a different way. It is well known that once a large public project has been defined and planned it is not likely to be reversed or terminated.

In financial terms, QA1 requires that a realistic preliminary cost estimate is established to be verified by external reviewers. This might not be essential as a means to reduce the problem of cost overrun during implementation since this will require an updated estimate after the project has been planned in more detail. However, it is likely to help reduce the problem of tactical cost under-estimation in local projects submitted for funding at national level.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Quality assurance 1</th>
<th>Quality assurance 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost overruns</td>
<td>Independent preliminary estimate before choice of concept</td>
<td>External ‘audit’ before decision to finance project</td>
</tr>
<tr>
<td>Tactical budgeting</td>
<td>Realistic and independent cost estimates established early</td>
<td>External follow-up ‘audit’ of final budget proposal</td>
</tr>
<tr>
<td>Narrow planning perspective</td>
<td>Systematic early assessment of needs and effects</td>
<td></td>
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<tr>
<td>The wrong choice of concept</td>
<td>Assessment of at least three alternatives</td>
<td></td>
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<tr>
<td>Adverse effects of uncertainties</td>
<td>Uncertainties analysis prior to selection of project concept</td>
<td>Updated analysis before decision to finance project</td>
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</table>

Table 1 Some key problems in major projects, and corresponding features of the quality assurance scheme that might help reduce these problems

Another feature is the comprehensive needs analysis and a complete economic assessment of alternatives. This is a key to strategic planning and is meant to secure that the focus is on intended and possible effects of alternatives instead of only one specific technical solution which is so often the case. This was identified by Kaasen et. al. (1999) as an area for improvement. A thorough analysis of needs is essential to
establish relevant objectives. Relevance is a prerequisite for sustainability, as the example above illustrates – willingness to pay is strongly linked to the extent that benefits exceed costs for the users.

Table 1 highlights some of the key problems encountered in major projects and measures introduced by the quality assurance regime to address these problems. It can be seen that the QA1 is designed to cover the aspects that contribute to project success in an overall perspective, while QA2 is a control mechanism of the basic assumptions underlying the project before the final appropriation.

In this paper we have shown that research reveals fundamental problems connected to projects, especially the large and complex ones. Much effort has been on the occurrence and causes of cost overrun. This is natural seen in the perspective that cost overruns represent a waste of resources that is directly and immediately linked to the project. The traditional response has been to use considerable resources to better control and management of the implementation phase.

The control and management of projects are of course factors determining project success in an operational perspective, but we argue that a focus on the initial phases is even more important.

Guided by an example we demonstrate compliance to schedule, budget, and technical requirements are of secondary importance if the project does not perform well in terms of feasibility and long-term effects. These overall issues are determined in the initial phases of the project where focus should be put on the needs it is meant to satisfy and the different approaches to fulfill those needs. This was the background for introducing a quality assurance scheme to secure sound choice of concept. It is a supplement performed by external project management specialists to the political decision process and is supposed to bring independent analyses of the different alternatives and ultimately an advice on what alternative is best to achieve the given objectives. Some experiences have been gained but there are many questions that need to be answered to get a picture of the effect of this initiative on long-term feasibility and profitability of public projects.
References


Comparative analysis of cost estimates of major public investment projects

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Abstract

This paper reports findings from a study of cost estimates of 31 major public investment projects in Norway. It is aimed at analysing the development of cost estimates before the decision to execute the projects and in what way the scheme of mandatory quality assurance influences this process. Two important results are highlighted and discussed: The differences in the proposed cost estimates appear to have decreased systematically since the introduction of the quality assurance and the project owners rely to a large extent directly upon the cost estimates from the quality assurance when the decision to execute the project is taken.

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1. Introduction

To meet the demand for better management and control of major public investment projects, an arrangement for external Quality-at-entry analyses of all public investments in Norway with an expected budget larger than NOK 500 million (≈EUR 60 million)2 has been established. This so-called Quality-at-entry Regime became operative from year 2000 and was the result of an initiative from the Norwegian Ministry of Finance. The main factors leading to the establishment of a mandatory external assessment of public multi-million projects were the poor performance of many such projects especially in terms of cost. The introduction of the Regime was, among other factors, an attempt to avoid and control cost overruns [1].

This paper is the first attempt to analyse the development of cost estimates in the early stages of the quality assured projects. Very few of the projects have yet reached completion, which explains why studies of actual costs do not constitute a part of the present research. The objective is to develop an understanding of the current Quality-at-entry Regime and to point out its relevance and impact on the cost estimation process and how it could contribute to more realistic budgets. The paper is thus concerned with impacts of quality assurance concerning the efficiency issue, i.e., focus on the cost criterion. In a broader perspective, however, it also concerns the more substantial issues of project viability and long term effects since the end result of inaccurate estimates could be that nonviable projects are prioritized (a central perspective in [2,3] for example).

2. The scope of the paper

The scope of this paper is to consider the relevance and significance of the current Quality-at-entry Regime on cost estimation in major public projects. Our preconception is
that studying the development of the cost estimates from different actors through the stage of quality assurance can tell us something about how this affects the decision. In studying the divergence we are in effect studying the extent to which estimates may be biased.

3. Cost overrun and its causes

Nijkamp and Ubbels [4] point out the need for better insight into cost estimation. It is because cost estimation play a major role in the decision-making process of the government.

Studies of major projects show that cost overruns are not uncommon. Morris and Hough [5] suggest that cost overruns in large projects are typically between 40% and 200%. The study of large transportation infrastructure projects reported in Flyvbjerg et al. [6] shows that 9 out of 10 projects fall victim to cost escalation, actual costs are on average 28% higher than estimated costs, and it appears to be a global phenomenon observed over a long period of time. Kolltveit and Grönhaug [7] include an example of costs in Norwegian large-scale projects varying from 6% saving to 160% overrun.3

The causes of the observed tendency seem to be connected to factors not only hard to predict but also difficult to manage. Morris and Hough [5] point out that overruns are caused by circumstances outside the project’s area of control. According to them, many projects overrun because of factors like price escalation, government action, strikes and so on. A big issue is then related to the ability to predict such factors and their potential impact.

Flyvbjerg et al. [8] attempt to explain the causes of cost overrun in projects. They found that cost escalation was strongly dependent on the length of the implementation phase. Delays and long implementation phases translate into risks of substantial cost escalations. They also observe that projects grow larger over time, and for some project types, larger projects have larger percentage cost escalation. That bigger projects having a larger risk of cost escalation than smaller ones (for all project types) is not supported by their data, but they emphasize that the risk of substantial cost escalation is high for all project sizes and types. Since the same percentage cost escalation would typically cause more problems in terms of budgetary, fiscal, administrative and political dilemmas in a large project than in a small one, they conclude that an increase in project size translates into a need for improved planning processes.

Nijkamp and Ubbels [4] found on the basis of their study that the influence of inflation was clearly large in the projects they studied. Because of the length of planning and construction, price rises played a major role. What they call incompleteness of the estimations, the practice that some elements of costs are omitted or not included, are also important. They argue that project changes also is an important cause of underestimation, which lead to a conclusion that the estimates in their sample were rather reliable.

The cost estimation process, which can be viewed as a factor more closely related to the project organization, has also received some attention among authors in this field of research. Flyvbjerg et al. [6] deliver an interesting contribution on this issue. First of all, it must be noted that their study focuses on a certain category of projects, so-called transportation infrastructure projects, and secondly, the data comes from projects all around the world from a period of time stretching from 1910 to 1998. They study the differences between actual and estimated cost and argue that “the cost estimates used to decide whether such projects should be built are highly and systematically misleading.” [6, p. 279] This underestimation could, according to Flyvbjerg et al. [6], best be explained by strategic misrepresentation. Olsson et al. [9] suggest that “strategic budgeting” is a commonly used technique in major public projects. This technique includes using a budget that only visualises part of the total cost in order to initiate the project, and then exploit the fundamental logic that a project, when defined and planned, is less likely to be reversed or terminated. Nijkamp and Ubbels [4] discuss a similar explanation when investigating the reliability of cost estimates in infrastructure projects.4 They state that at the time of the decision to build:

“One may safely assume that the costs of the project at that stage are as low as possible to ensure that the project will be executed. This suggests that the cost may be somewhat underestimated at the beginning of a project.” [4, p. 3]

They further state that there is some space for negotiations in the cost estimation process since estimators tend to take the demands of governmental institutions into account.

Nijkamp and Ubbels [4] conclude that, since large changes is a major cause of cost escalation, it is necessary to increase the importance of the first planning phases. In recent years more authors seem to agree on the importance of a better design process in order to create more successful projects [10–12].

4 It must be noted that the study in Nijkamp and Ubbels [4] includes a total of only 8 projects and that they describe this cause of underestimation as less important.

4. Ensuring Quality-at-entry

The initiative to investigate the need for better management and control of major public investment projects in Norway was based on the understanding that a number of large projects did not accomplish according to the requirements vital for the decision to execute the project. Additionally, large cost overruns and change of scope during implementation were observed. After a closer study of

3 The example included only 5 projects and was used to illustrate the challenges of the construction and building industry.
11 projects, where 6 of them showed cost overrun, a government committee concluded that failures in the initial phases of the projects were the main cause of the cost escalation during implementation [1].

4.1. Description of the current Quality-at-entry Regime

The Quality-at-entry Regime is in this paper a label for the formal requirements that public investment projects must meet before the preparation of proposal for the Parliament. The basic exercise connected to the present Regime is mandatory quality assurance and uncertainty analysis of the project carried out by external consultants on behalf of the responsible ministry, the so-called quality assurance 2 (QA2). In this paper the term “quality assurance” is used shorthand instead of referring to the “exercise under the present Quality-at-entry Regime”. The aim of the Regime so far has been to evaluate the quality of the foundation for the chosen alternative. The more particular focus regarding revision of cost estimates and identifying major risks must be seen in light of the specific goal for the quality assurance. It is a tool for evaluating the quality of information and for providing new information on the basis of which the decision makers can judge the project.

4.2. The quality assurance – when and how

The quality assurance, which typically takes place at the pre-planning stage, and the cost estimates provide an opportunity to track how three main stakeholders; the project organisation, the external consultant, and the Parliament, view the project cost at this stage.

An illustration of the process and how the cost estimates relate to a certain stakeholder and point in time is given in Fig. 1.

The duration between the steps in the process varies from project to project, and it is not uncommon to observe a time-span from several months up to a year between 1 and 3 in the figure. A suitable question here is: As some elements of the project may change in the course of its development, how is it possible to compare the cost estimates connected to the different points in the process? The question is a fundamental one, and a brief explanation is appropriate. First of all, the formal requirement is that the project does not proceed beyond the pre-planning stage until it is approved by the Parliament. Secondly, the quality assurance does not take place until updated project documentation exists, and the cost estimate is a central part of this information. This pertains to the situation between 1 and 2 in the figure. Information concerning the expected budget of a project is crucial when deciding to go ahead with the project. In this way it is safe to assume that the recommended budget from the external consultant and the approved budget fundamentally refer to the same project, unless it would be explicitly stated. This pertains to the situation between 2 and 3 in the figure.

The cost estimate connected to 1 in the figure stems from the uncertainty analysis conducted by the project organisation. This is an expression of the project organisation’s view concerning the project cost. The consultants deliver an external evaluation of the project and give their recommendation of a budget for the project based on an independent uncertainty analysis (2 in the figure). The end of the pre-planning stage is the parliamentary approval of a budget and permission to implement the project (3 in the figure).

4.3. The estimates and how they are prepared

The prevailing method among project organisations and consultants in the projects studied here is the stochastic uncertainty analysis regarding the project cost. The estima-
4.4. The new approach to project costs

Olsson et al. [9] describe the situation that, as a consequence of the Quality-at-entry Regime, a more sophisticated overview of the project cost is presented. The external consultant recommends a total budget that is expected to cover the consequences of the identified uncertainties. The reserves are, however, not expected to be used, and specific rules for the management of reserves have been established. The budget allocated to the executing government agency is the basic budget plus expected extra costs (based on 50% subjective probability), which also was the typical standard before the Quality-at-entry Regime was established. Use of the reserves must be approved by the responsible ministry. This implies that there is a binding subjective probability, i.e., there is a 50% expected probability that the project will be completed within this cost. The recommendation from the external consultant consists of the expected cost and total budget, most often based on 50% and 85% probability, respectively. The uncertainty analyses performed by the project organisation and the external consultant represent the basis when the project owner decides upon the estimates that are to be presented in the national budget or in a separate project-specific Government white paper. Formally, the Parliament reaches whatever conclusion on the matter it would find appropriate. In practice, however, the estimates presented in the national budget or the project-specific white papers are sanctioned by Parliament without changes.

5. Data collection and refinement

The quality assurance report, which is a compilation of the results from quality assurance, represents the fundamental data source in our research. From the quality assurance report it is possible to obtain cost estimates prepared by the project organisation/the executing government agency and of course the recommendation from the external consultant. The project budget approved by the Parliament is obtainable from the national budget or project-specific Government white paper presented by the responsible ministry. When it was deemed to be necessary to ensure the quality of the data, projects were contacted separately via e-mail.

To compare the cost estimates presented at the specific points in the process (cf. Fig. 1), cost data had to be corrected for inflation. This basically means that cost data in each individual project are brought to the same price level as the approved budget, either with the aid of specific methods for the single project, or by appropriate indices for discounting.

Before a presentation of the important findings from analyses done on the existing material, it should be noted that the aim of this paper is not to present a final evaluation of the effects of the quality assurance scheme, since most of the projects are still in the planning stages or in the early stages of implementation.

6. Presentation of important findings

The collected data are stored in a research database. Proper storage and the possibilities for fast retrieval of large quantities of data seem to be the most important characteristics of a database [13]. Fifty-two projects have been through the quality assurance procedure between 2000 and 2004. On the basis of these projects a sample of 31 projects representing a broad range of project types was established (cf. Table 1).
Table 1
The sample

<table>
<thead>
<tr>
<th>Type of project</th>
<th>Number of projects</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation infrastructure</td>
<td>12</td>
<td>39</td>
</tr>
<tr>
<td>Building</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Defence procurement</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Information technology</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100</td>
</tr>
</tbody>
</table>

Project reserves in major public projects is a fundamentally new approach in Norway [9].

Table 2 describes the size of the project reserves recommended by the external consultant with respect to project type (upper part of the table) and size (lower part of the table). Since the reserves are not expected to be used, they are here presented as a mark-up above the 50% probability budget.

The fundamental information provided by Table 2 is that the size of the typical project reserve lies in the area between 8% and 11%. The average reserve in this sample is a 9% mark-up. An analysis based on a categorisation with respect to project type (transportation infrastructure, building, defence procurement, and IT) shows that the sub-category mean values deviate little from the overall mean.

Table 2 also shows that there is no obvious connection between the project size and the size of the reserve expressed in per cent. The three sub-categories including projects from NOK 300–750 million, NOK 750–1500 million and projects larger than NOK 1500 million all show mean values close to the overall mean value. One might expect that it would be more difficult to predict all aspects that could have an impact on costs in large projects. The intention with the allocated reserve is to mitigate project risks that can not be fully predicted [14]. Seen in relation to the literature referred to above, where it was stated that major projects often suffer from cost overrun, one might expect that large projects would call for larger reserves. This is contradicted by the unsubstantiated notion that in major projects there exist more alternative courses of action, i.e., there are more opportunities to influence costs.

The results here are nevertheless not surprising. The recommended reserves basically reflect the uncertainty in the performed calculations. As described above, the size of the reserve in most cases is the difference between the 50% and the 85% subjective probability, which roughly equals one standard deviation. The robustness of the result from the uncertainty analysis depends on the ability to predict possible factors and their influence on project cost. Table 2 indicates that there is a rather typical reserve percentage, independent of project size or type. Building and information technology projects display a somewhat higher mean reserve and standard deviation than transportation infrastructure and defence procurement projects, but the existing material does not allow us to draw sharp conclusions whether there is a pattern here. The results from analyzing projects categorized by size, show even smaller differences between the sub-categories.

One of the major concerns has been the possibility that actual costs will be higher with the new approach, where reserves are allocated, compared to the old procedure. The point here is that it is questionable to assume anything about actual costs as long as the projects have not been completed yet, and adequate measures to obtain more realistic budgets have been established. Many authors emphasize the importance of better planning in the early stages of large projects to increase the potential for project success and reduce the occurrence of cost overrun.

6.2. The difference between the proposed estimate from the project organisation and the recommendation from the external consultant

The main issue here is related to the significance of quality assurance on the cost estimation process. This is the background for the attention paid to the comparison between the initial estimate and the revised estimate.

When comparing the estimates, fixed prices are used, and the numbers describe the “same project”, which means that it has been controlled whether fundamental elements of the project have been changed between the proposed estimate and the recommended estimate (cf. the discussion above concerning that a project could be subject to modifications over time). This is an important prerequisite, because when the cost focus and control aspect is dominating, one must not only consider the different answers, i.e., the numbers from the uncertainty analyses. One must also ask whether they are answers to the same question.

To present an aggregate view of the data, the differences have been calculated in percent and divided into categories based on the size of the difference.

Table 3 shows that the recommendation from the external consultant is lower or equal to the projects’ proposal in 8 out of 31 projects (26%). For the majority of the projects (74%), the external consultants recommend higher budget limits, in some cases up to 15% or more. On average the
external consultants recommended 5% higher budgets. Some might argue that the observed differences are rather small. Why should we deal with differences that in an analytical sense equal the uncertainty in the results? First of all, even a 5% difference in projects of this scale could, expressed in money, be substantial. Secondly, it must be kept in mind that studies of initial estimates and actual costs that show deviations up to several hundred percent could include large distortions for instance with respect to inflationary backgrounds. This study is different, obviously because initial estimates from two different actors rather than initial estimates and actual costs are compared, but also because price escalations, project changes and other factors are not an issue or have been accounted for. The compared figures are indeed “answers to the same question from two different actors”. With this in mind, one question immediately arises: What could explain the observed result? An exact explanation must be left open for the moment, but a closer look into the sources can be a basis for discussion. It could be that the external consultants apply a broader view and include more elements assumed to have an impact on the cost of the project.

The project organisation’s major concern is the implementation of the project according to specific requirements. The external consultants must also consider the potential impact of factors that to the project organisation may appear to be of a more unpredictable and unmanageable character. These could be factors connected to the market, financing, and changes imposed by the government.

It must also be recognized that the prevailing methods to calculate the estimates rely on subjective assessments. As described by Olsson et al. [9], in some cases different estimates have been a source of discussion between the project organisation and the external consultant. In cases where there are fundamentally different subjective views concerning central uncertainty elements, this will clearly be manifested in the results. Still, this does not explain why the external consultants present a higher estimate in so many cases.

Some may claim that this indicates an exaggeration of the estimates from the external consultants. Since they do not have any responsibility for the actual budget compliance and it is claimed that nobody wants the label that they underestimate costs, this could lead to a situation where extra costs are included just to be sure. It would be hard to establish data that could describe this issue, because this fundamentally is an assumption about the intentions of actors. It must otherwise not be forgotten that the foundation for the external consultants’ recommendations are explained in the reports from the quality assurance exercises. In this way the underlying premises for the recommended estimate can be verified.

The major question in this paper is the Quality-at-entry Regime’s influence on the initial decisions connected to the projects. Does it lead to different practices and other methods? In this perspective an analysis that maintains the time dimension is presented.

The difference between the proposal from the project and the revised estimate is calculated in percent. A plot of the differences for all the projects in the sample against the month of presented report and the result is shown in Fig. 2.

Visual inspection indicates that the largest differences occurred when the quality assurance scheme was new, and interestingly, no revised estimate substantially lower than the initial estimate is observed before late 2002. Another indication from Fig. 2 is the clear decrease in the differences from the first quarter of 2002.

What explanations are there? A number of possible factors spring to mind. One possibility might be that the focus on more realistic cost frames launched by the Regime has led to an increase in the use of relevant methods by the project organisations to identify the uncertainties in the early stages of the projects. Observations made during the collection of the data suggest that more equal estimates coincided with a more consistent use of the most commonly used terms. At the same time, the Ministry of Transport and Communications, which accounts for a large number of the projects in the sample (cf. Table 1), specified how the results from the quality assurance of projects in their area of responsibility should be employed. This indicates that a change in practice and learning has taken place.

The literature referred to above suggest that so-called “strategic budgeting” could be a cause of underestimation in public projects. This is based on the assumption that projects that appear to be inexpensive have a greater chance of being prioritized. It is easy to predict that the Quality-at-entry Regime could have a rather direct impact on strategic budgeting; assuming that such practice actually has taken place. It is, however, impossible to answer this question on the basis of this study. The differences observed here could just as much be explained by overestimation from the external consultant as underestimation from the project organisation, and a possible interpretation of the development towards more equal estimates could also be that an adjustment to the demands of governmental institutions has taken place, either by external consultants, project organisations, or both.

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6 Flyvbjerg et al. [6, p. 289], face the same problem when trying to answer the question whether project forecasts are intentionally biased.
6.3. The difference between the recommended budget from the external consultant and the final budget decided by the Parliament

The formal approval and resolution on budget limits for each single project is dealt with by the Parliament. In practice, however, the Parliament accepts the Government’s proposal without changes. The project presented to the Parliament is prepared by the responsible ministry based on the information from the subordinate agency responsible for the day-to-day activities in the project.

Table 4 shows that in 58% of the projects, the upper financial level decided for the project equals the total budget recommended by the external consultant. This means that in most cases, the project owners directly use the recommendation from the external consultant when submitting the proposal. At least there is a strong tendency toward this as reflected by the table. The table also clarifies that the recommendation can be disregarded. It must also be noted that in many cases new estimates are prepared from the project as a response to quality assurance. To give a closer illustration of how the recommendation is applied by the project owner, i.e., the direct response to the results from quality assurance, descriptions from some of the projects included in the sample are presented:

“External quality assurance has taken place which gives an estimate of NOK 738 million with 50% probability for budget compliance, and NOK 788 Million with 85% probability. Based on the quality assurance the Norwegian Public Roads Administration has reviewed the project and presented a revised estimate of NOK 718 million.” ([15, p. 117], author’s translation)

Another example describes a case where the difference was rather small:

“The quality assurance shows recommended budget numbers marginally lower than those proposed by the Norwegian Public Roads Administration. In the Ministry of Transport and Communications’ opinion the quality assurance confirms that the Norwegian Public Roads Administration’s estimate is on an appropriate level.” ([16, p. 4], author’s translation)

The examples illustrate how the external consultant’s recommendation is used by the project owner to verify the numbers proposed by the project organisation and that the quality assurance could result in updated cost estimations from the project organisation. It is shown that there is no rule of thumb whether the final decision is based upon the project organisation’s or the external consultant’s estimate. Each project is considered on an individual basis by the responsible ministry and the project organisation.

An explanation to the observations made here can be connected to some of the results from Olsson et al. [9] where it was concluded that the project owner particularly finds the quality assurance useful. The study reported in Olsson et al. [9] was based on fewer projects and did not include analyses of the cost estimates. The study in this paper is a quantitative one, but it supports the results in Olsson et al. [9] because it clearly states that the external recommendation, at least concerning the project cost, is followed up by the project owner. An important conclusion, drawn from the analysis presented here, is that the involved ministries, being the project owners, actively use the information provided by the external analysis in the preparation of the project. The cost estimates are a central part of this information, and the fact that the project owners in so many cases directly build upon the calculations from the external consultants, is a strong indication concerning the significance of this contribution.

<table>
<thead>
<tr>
<th>Sanctioned budget</th>
<th>Number of projects</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower than the revised estimate</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Equal to the revised estimate</td>
<td>18</td>
<td>58</td>
</tr>
<tr>
<td>Higher than the revised estimate</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100</td>
</tr>
</tbody>
</table>

Fig. 2. The difference between the project’s proposal and the revised estimate from the external consultant.
7. Concluding discussion

The performed analyses show that the recommended project reserves on average are 9%. It is furthermore observed that no matter the scale of the project, the size of the reserves measured in per cent appear to be rather typical, which is rather surprising, when it is kept in mind that existing studies report overrun up to several hundred per cent.

A discussion concerning the potential cost effect of the stochastic cost estimation and budgeting in public projects is conducted. It is concluded that a final evaluation of the cost development must be done when the actual costs are available. Compliance to the approved budget rely to a large extent on the management of the reserves and it is also argued that it is questionable to judge projects not yet completed against past experience, which indicates that projects use at least their allocated budget, when adequate measures to reach realistic estimates at an early stage have been established.

It is possible to conclude from the present study that there is a difference between the numbers proposed by the project organisation and the revised estimates from the external consultant. This is based on the observation that the revised estimates were higher than the initial estimate in 74% of the projects studied here. This is a rather strong indication since the estimates compared here are answers to the same question. The study also shows that the differences were higher in the early stages of the Regime. The observed differences have decreased systematically since quality assurance was initiated in 2000. Some suggestions based on empirical observations, the prevailing methods and different views upon the analysed project are discussed, but the most important result here is the revealed tendency in the existing material.

The study further shows that for many projects in the sample, the parliamentary decision directly rely on the estimates provided by the external consultant. This supports the claim that the involved ministries, i.e., the project owners, benefit from the external assessment of the project, and actively use the provided information when preparing the decision proposal for the Parliament.

The observations here lead to the identification of important issues that need to be addressed in further research. Are the differences in the estimates systematic and statistically significant? Are the differences observed when the scheme was new cost underestimation by the projects or overestimation by the consultants? Does the systematic decrease imply a learning curve, or does it indicate an adjustment to external demands? A closer look at the historical records will help to cast light on these issues.

This paper is a report from the first analyses of cost estimates in major public investment projects after the initiation of the Quality-at-entry Regime. Some experiences have been gained, but there are many questions that need to be answered to get a picture of the effect of this initiative not only in terms of reduction of cost overrun but also long-term feasibility and profitability of public projects.

References

MANAGING THE FRONT-END OF PROJECTS: AN INDUSTRIAL NETWORKS THEORY APPROACH

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MANAGING THE FRONT-END OF PROJECTS: AN INDUSTRIAL NETWORKS
THEORY APPROACH

ABSTRACT

Traditional project management has focused on the implementation of singular projects. The high level of uncertainty has been acknowledged in the traditional approach, but there is a general lack of concepts that could fully capture the uncertainty and dynamics involved, especially in the front-end of projects. In this paper attention is drawn upon the description of how an approach from industrial networks theory can be applied to analyse and manage the front-end of projects. The use of the approach is exemplified by an analysis of the early phase of a Norwegian public building project. It is concluded that in capturing the dynamics of the front-end the approach is promising, but some important questions concerning the description of activities and resources of the front-end needs to be further elaborated.

KEYWORDS

Front-end Project Management; Industrial Networks Theory; Project Networks

INTRODUCTION

This paper is concerned with the front-end of projects. Traditionally, the implementation phase of projects has received greatest attention both in the academic and the professional communities. A trend in existing literature in the field of project management, however, is a
growing understanding of the need to focus on the front-end phase in order to address the fundamental problems and achieve more successful and cost-effective projects. A major issue is connected to the uncertainty and dynamic aspects involved in the design and implementation of projects. This paper addresses these issues by arguing that the existing approaches have acknowledged the high uncertainty, but have, because of the static view of projects and their environment, failed to truly encounter the real challenges of project management. In this paper, a new approach to describe and manage the front-end of projects is presented. It starts with a presentation of concepts and definitions concerning the front-end of projects, followed by a discussion of existing approaches in project management. It continues with a presentation of the concepts of the so-called network approach. An important model of the network approach is presented and examples of use in a project setting are discussed. The usefulness of the model is tested by applying it to describe a case project. It ends with the discussion of results, some implications for management, and indication of further research.

Characteristics of the front-end phase

While past research on projects has emphasized the implementation phase of projects, this paper deals with the part of the project life cycle labelled the front-end. The front-end of a project is conceived in multiple ways. In this paper, however, the front-end is the phase where the project is being planned, and it ends with the final decision to appropriate funds for the purpose (Samset, 2003). This means that the realisation of the project outputs has not started, and in many cases the project manager and the complete project team has not been appointed. It is obvious that the activities carried out in the front-end differ from those faced when actual production starts.
Olsson, Samset, Austeng and Lädre (2004:38) point to three main aspects of front-end project management. They pertain to the basic concept of the project, because the three main aspects are described as definitions of different project concepts, development of concepts and evaluation of the concepts. The perspective on front-end management presented by Olsson et al. (2004) highlights that the front-end involves more than narrow task planning. They claim that the most important activities in the front-end concern the identification of different alternatives and the basic design of the project. Results arising from the comprehensive IMEC-study of large engineering projects underlines the importance of the front-end phase:

“Conditional on the degree of task complexity and institutional development, we found that a project’s capability of success depended on the extent to which it was characterised by a front-end process with sufficient time and resources to shape the project and its context. A project is never foreordained, but early choices point early toward success or failure.” (Miller and Olleros (2000:101))

They also call attention to that even if thorough and time consuming processes in the front-end often involves high costs, they are necessary to explore unknown events and to adapt to a changing environment.

Another important feature of the front-end phase is the high level of uncertainty. First of all, projects are unique, complex undertakings, which mean that they by definition are characterised by uncertainty. In addition, at this stage in the project life cycle, little is known about relevant alternatives and actual outcomes. It follows that a lot of effort is spent on generating relevant information to reduce uncertainty. The gathering of new information, however, has its limitations. First of all the collection and processing of information has a cost, and secondly, it is in itself impossible to gain perfect knowledge about any possible
future outcomes. In practice, it is often relied upon the ability to identify potential events and predict future courses of action, and assessment of the identified events’ impact on the purpose of the project if they should occur.

Another source of uncertainty in the early phases of projects is that the project could be more or less well defined, and there would normally be a number of different actors struggling for the incorporation of their individual interests in the basic design of the project.

**Traditional view of the project and its environment**

Traditional project management has been focused on the management of individual projects (Söderlund, 2002; 2004). The dominating elements of what has been labelled ‘the project’ seem to be uniqueness, task complexity and time-limitedness (see for example Samset (2003:222); Gareis (1989:243); Gido and Clements (1999:4); PMI (2000:4)). The common characteristic of the different definitions of a project is that they tend to view the project as a single independent entity, defined by the specific task it is meant to achieve and made up of the personnel allocated to execute it. This could explain the search for a universal theory in managing projects, based on the critical factors of project success. The classic definitions of projects in themselves assume that there is one best way of organizing.

Söderlund (2004) states that there exist two main theoretical traditions in project management research, one rooted in engineering science and mathematics, and the other in the social sciences. They differ somewhat in their basic approach to project management, since the first is described as primarily interested in planning techniques and methods, and the latter especially concerned about the organizational and behavioural aspects of project organisations. Researchers from the social science tradition in project management have launched the metaphor of projects as “temporary organizations” (Lundin and Söderholm,
1995; Packendorff, 1995), mainly criticizing that mainstream organization theory is based upon the assumption that organizations are or should be permanent. Engwall (2003) addresses the importance of analyzing the interior processes of a project in relation to its environment. The project’s environment is its historical and organizational context. Despite the call for what he labels an ontological change, “instead of lonely and closed systems, projects have to be conceptualized as contextually-embedded open systems, open in time as well in “space”.” (Engwall, 2003:790), the basic theoretical approach to describe and analyse projects is the same. The project itself is viewed as a static, well-defined entity in relation to a highly dynamic and shifting environment.

Kreiner (1995) points to that the term “project” commonly refers to empirically distinct entities, labelled and studied as projects. He argues that he is not concerned with the specific entities themselves, but models the project, without specifically characterising any actual projects, as an island that needs to co-evolve with a drifting environment. This is done to describe the situation that normally projects are created to perform a specific task seen as the operationalisation of the needs of some interested parties. A major challenge occurs when the project has been established as a tool to achieve specified targets, and when the needs of the interested parties change the premises of which the project was originally designed and planned. The project then has to respond to the changes in its environment, or risk that the outputs of the project become less relevant to the interested parties. The contribution from Kreiner (1995) is interesting in many ways. He argues that current project definitions are problematic because the applied models are less useful to describe empirical project phenomena. He omits this obvious dilemma by not making general assertions of actual projects, but instead focusing on their contextual relations. By doing so, he shows that the source of the problem that a project risks becoming less relevant to its environment lies in the
static view of projects. A project formulated and designed to perform a specified task will have to change as the originally prevailing needs alter.

Miller and Hobbs (2005) face the same problem when trying to develop a framework for building governance regimes for large complex projects: “The literature tends to treat governance issues as being static, but project development processes and environments are dynamic.” (Miller and Hobbs, 2005:42) Their solution to the problem is to view project governance regimes as “time-dependent and self-organizing. They involve a network of actors in a process through which the project concept, the sponsoring coalition, and the institutional framework co-evolve.” (Miller and Hobbs, 2005:49) It is clear that the subjects of matter in Kreiner (1995) and Miller and Hobbs (2005) are totally different, the first examining project strategies for how to cope with that originally outcomes not necessarily will remain relevant over time, and the other outlining a framework for governance regimes for large public projects. It can, however, be argued that the problems they point to are basically caused by the same error: a rationalistic and static view of something that is highly complex and dynamic.

It can be concluded that projects, and especially the early phases of them, are uncertain undertakings. Traditional project management has acknowledged the high level of uncertainty, but there seems to be a lack of concepts that could fully capture the uncertainty and dynamics involved.

The aim of this paper is to develop an understanding of how a project can be seen as made up of the surrounding network and how the project relates to it. That there exists a project is undeniable, but the focus of attention in this paper is on the description of the network that constitutes it and how the description of the nature of important relationships could contribute
to a better way of managing the front-end of projects. To do so, we will draw knowledge from a theoretical perspective, industrial networks theory, which so far has received little attention in this line of research.

**Industrial networks theory**

As described above, the aim of this paper is to show how an approach based on the industrial network model can be applied to manage the early stages of large projects. Here it is aimed to bring a description of the theory in general and earlier examples of contributions, and then discuss in more detail how this approach can be utilized in a project context.

**Industrial networks theory – theoretical underpinnings and basic concepts**

Johanson and Mattsson (1987) describe (in an article comparing the network approach and the transaction-cost approach) the theoretical foundation of the network approach in this way:

“In the network approach, the benchmark models of markets and organizations are not used: the “markets” are characterized by interaction in systems of connected relationships, among suppliers, customers and other actors, in which the parties have some control over each other and the organizations are not “pure” hierarchies. [...] the boundaries of individual organizations are unclear. [...] the network approach views firms as social units and is closer to social exchange theory.” (Johanson and Mattsson (1987:43))

The problem orientation is, according to the authors, on description and analysis of dynamic aspects in industrial systems. The functional activities related to exchange and adaptation processes in the individual firm are also of particular interest. The theoretical background and basic assumptions of the approach are also presented in a book section, Håkansson and Snehota (2000). They state that the network approach, the Industrial Marketing and Purchasing (IMP) perspective in their terms, is rooted in marketing, but underlines that the
scope of the conceptual development involves the market process and its overall impact on business organisations.

A basic assumption in the network approach is, according to Johanson and Mattsson (1987), that the firm is dependent on resources controlled by other firms and that the access to these external resources depends on the positions in the network.

*Trust* is another important concept in the network approach (Johanson and Mattson, 1987; Håkansson and Snehota, 2000) and is an important assumption of a basic characteristic of the actors. Håkansson and Snehota (2000) link the concept of trust to another prevailing condition, *uncertainty*. Uncertainty is viewed as lack of information and it stems from the relationships in the network. It is argued that it can not be reduced through the collection of new information. Since uncertainty is rooted in the exchange situation, the parties have to develop trust to each other.

In the industrial networks theory the main assumption is that firms in a business environment are interdependent. Since the situation of a single firm can not be understood without taking these interdependencies into consideration, the focus is on the network the firm is part of.

**The industrial network model**

Kavanagh and Kelly (2002) describe the industrial network model (or the ‘Activities-Resources-Actors model’) as the dominant model in the industrial networks tradition. The model was outlined in Håkansson and Johanson (1992). The main aim of the model was to arrange for an integrated analysis of stability and development in industry and to establish a basis for studies of actors and sets of actors from an industrial development perspective. The basic elements of the model are the variables actors, activities and resources.
Figure 1 Basic structure of the industrial network model (Håkansson and Johanson, 1992:146)

The variables are related to each other in an overall structure of networks (cf Figure 1), which basically is a matter of definition.

Important characteristics of actors, according to Håkansson and Johanson (1992), are the control over resources or activities or both. They can be individuals or groups of individuals, typically as parts of firms, firms themselves, or even groups of firms. Furthermore, it is important to acknowledge the notion of the goal oriented actors. This means that it is assumed that the general goal of actors is to increase their control over the network. This implies that there is a power struggle present in the network described in the words of Håkansson and Johanson (1992:146):

“[…] in a network, there are a number of conflicting and common interests as well as efforts to provide for those interests. In this struggle the actors use their knowledge of the network as well as their relationships with other actors in order to increase their control. Furthermore, as the actors are at different organisational levels this struggle takes place not only between actors but also within actors.”

First of all, the text cited above underlines that the term actor does not label firms or organisations but can also represent individuals or departments. Secondly, the anticipation of a power struggle does not necessarily concern only the total network, but also the actors
themselves, since it is assumed to take place within actors as well. One important aspect of the model is thus that it is voluntaristic, which means that the actors are assumed to have a free will to act in the network, although this freedom is limited by the nature of the existing relations.

An activity is defined as the combination, development, exchange, or creation of resources by the utilisation of other resources. According to Håkansson and Johanson (1992) there are two main kinds of activities. These are transformation activities and transfer activities. Resources are changed through transformation activities, whereas transfer activities involve the transfer of control over a resource from one actor to another. The activities in the network are related to each other, as it is assumed for all the basic variables.

Resources have, according to Håkansson and Johanson (1992), a wide definition. They are heterogeneous, have attributes in an unlimited number of dimensions, and can be combined with other resources. The assumption that the less available a resource is, the more important it is to gain control over it, corresponds with what could be expected. That an actor indirectly can control a resource through a relationship with the actor who directly controls the resource, is a basic assumption which can be said to separate it from other theories in this field of inquiry. This is not further elaborated in Håkansson and Johanson (1992). It is, however, consistent with the view in Johanson and Mattsson (1987) that access to resources does not depend upon resource ownership in classical terms, but network position.

It is then assumed that each of the elements constitutes a network structure. The three networks of actors, activities and resources are also combined in an overall network (cf Figure 1). It should be noted that Håkansson and Snehota (2000) point to that an important finding
from empirical investigations has been the existence of relationships. Single relationships
seen in isolation from a wider context is hard to understand, and empirical observations
seemed to suggest that it was impossible to understand a relationship disconnected from
others. In this way it can be asserted that it is possible to experience the network as an
empirical phenomenon.

**Industrial networks theory in a project context**

Above we have seen that the network approach is rooted in industrial marketing and it has for
the most part been used to analyse industrial systems with an emphasis on relations between
firms engaged in industrial production. In this paper, a central model from the network
approach will be used to analyse a project. Thereby, it must be examined how adequate the
model is in a project setting. First of all it should be noted that although the most commonly
used terms in the network approach refers to “firms”, “business organisations”, “companies”,
etc, it is clear that this stems from the implicit assumption that it is mainly used to describe
relations between organisations in industrial systems. It is clear that focus is on organisations
and the relationships between them. What these organisations are labelled is less important. In
the basic descriptions of the approach we have not been able to identify specific discussions
concerning projects. Håkansson and Snehota (2000), however, describe how the interaction
between parties in industrial markets can take place as “[...] part of “larger” constellations
or projects.” Håkansson and Snehota, 2000:77) It is thus evident that projects are viewed as
an important ingredient in the relationship between two parties. In other words; it could be
said to represent one way of how actors can choose to organise their interaction. The fact that
the term “project” itself is not more thoroughly discussed, could apparently originate from the
basic assumption in the network approach that the boundaries of individual organisations are
rather unclear. There is, however, no evidence that it is generally assumed in the network
approach that projects do not exist as entities.
Another aspect of the network approach, which can turn out to be fruitful in a project context, is the dynamical nature of the approach, underlined by the description in Johanson and Mattsson (1987:36):

“To get established in a new market, that is, in a network new to it, the firm has to build relationships that are new to it and to its counterparts. Sometimes this is done by breaking old, existing relationships, and sometimes by adding a relationship to already existing ones.”

It is clear that these authors express themselves in terms of a firm-specific setting, which also is explicitly stated in the text cited above. This could, however, in many aspects be seen as close to the process a project organisation has to go through in the early stages of a project.

Three examples\(^1\) where the project network is emphasized have been identified and are briefly described and compared below.

The article by Hellgren and Stjernberg (1995) proposes a project network approach for describing the design and implementation processes in major investments. They see the major force behind the transformation of an economy as made up of project networks that are created and recreated for different purposes. The purpose of their article is to elaborate a conceptual framework useful for understanding and analyzing inter-organisational relations in designing and implementing major investments. Their focus is on patterns of interactions

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\(^1\) It should be noted that we are hereby not suggesting that the contributions discussed here are the only examples. They do however meet the criteria that they (1) are explicitly concerned with project networks, and (2) have been published in high-ranked journals.
among organizations, not individuals and processes within organizations. When they use the word actors, they refer to organizations. In their terminology a project network is defined

“as (1) a set of relations, where no single actor may act as legitimate authority for the network as a whole, (2) where the network is open in the sense that there are no definite criteria by which the boundary of the network may be identified and controlled, and (3) where the network is temporally limited, dynamically changing and (partially) reconstructed from one project to the next.” (Hellgren and Stjernberg, 1995:379)

They argue that their framework is a reaction against the too limited view of treating the project as a rational undertaking suitable for different formal planning techniques. By applying a network perspective a project is seen as not only a tool to fulfil an obvious predefined task, but also as means for actors trying to maintain their position in a wider economic environment. This approach thus opens for a wider understanding of projects and how they evolve.

Vaaland (2002) describes the project in terms of a set of actors, actor bonds, and structures. The basic element of this view is that actors control activities or resources and develop actor bonds with the persons or institutions they interact. The bonds web the actors into actor structures, referred to as networks. In other words, the project is embedded in a structure of actors where it is one actor among several others. At the same time, the project is constituted by the very same network it is part of. This approach opens, according to Vaaland (2002), first of all for the opportunity to get access to valuable resources, resources that otherwise would be seen as outside the projects’ range. Secondly, and not less important, he claims that the role
of project management has to change from ruling suppliers and external resources to coaching the project network. The internal resources in a project are only a minor part of the total resource constellation, which means that access to the resources in the surrounding network provides the project with capabilities beyond what is possible in for example the hierarchically integrated firm.

Manning (2005:410) identifies project networks as “dynamic sets of project-based inter-organizational and inter-personal relationships which sustain beyond particular projects.” In a similar way as we have seen above, he assumes that project networks allow for the external pooling of resources, which means that new resources and capabilities can be shared across the network.

It is evident that the approach in Manning (2005) is somewhat different from the two other described above. Hellgren and Stjernberg (1995) and Vaaland (2002) analyse the network which surrounds (and constitutes) the project. The network is analysed assuming that there is a focal project embedded in the structure of actors. Hellgren and Stjernberg (1995) focus on how understanding and analyzing the network can be used to maintain the position in the network. It is consistent with the view that the network is highly dynamic and changing, and because of its indeterministic character it cannot be predicted, only tentatively understood.

Vaaland (2002) models what he calls the focal project in the centre of the network. The borders of the focal project are, of course, not explicitly defined, as it according to the applied theory is assumed borderless. Manning (2005), however, analyses what he calls external pools of certain creative and technical professionals. These pools are embedded in project networks which consist of longer-term relationships of actors. Through the collaboration between the
actors, the relationships are reproduced. The network is seen as a resource pool which sustain beyond the single projects. In this way, a focal project is not in the centre of the analysis. The focus is on the relationships between the actors and how they collaborate in different projects. Even if projects have been completed and cease to exist, the relationships between the actors, i.e. the network, continue. It is observed that the contributions discussed above do not share a common definition of the term project network, and only two of them clearly state that they have the network approach or the IMP Perspective as a point of departure, either by referring to central articles made by scholars representing it, or by explicitly discussing important concepts of the approach. What is important, however, is that they all discuss the network surrounding a project rather than focusing on the project itself, and they all acknowledge the highly dynamical nature of the project network.

The most important aspect which can be extracted from the contributions reviewed above is that they point to that a network approach can help the project to detect and access valuable resources otherwise assumed to be out of reach. The traditional view in project management has implicitly treated the project as an independent organisation focusing only on the resources directly controlled by it. It is also clear that the network theory represents a step away from the classical assumption that an organisation’s adjustment to its environment or a market can be predicted without taking into account important counterparts.

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2 This is above all evident in Figure 2 in Manning (2005:412). The figure shows the actors and the relationships between them. The projects are only indirectly part of the illustration as the thickness of the lines between the actors indicates the number of projects they have collaborated in.
OUTLINING THE MODEL (THAT WILL BE USED IN THIS PAPER TO ANALYSE THE EXAMPLE PROJECT)

In this section focus is set on outlining central elements of the model applied in this paper based on the literature above. The model is used to analyse a single case, but it is assumed that it would be applicable in a wider range of projects.

Perspective

As mentioned above, actors in industrial networks can be individuals, groups of individuals, organisations or groups of organisations. The analysis presented here will focus on the organisational level. It has also been shown that a network in this specific context is assumed to have no borders and no centre. The network analysed here will, however, be illustrated with the focal project in the centre. This is done from pure illustrative purposes. The focus is on the network that constitutes the project and how the project organises its interaction with it.

Definitions

*The focal project – actors – activities – resources*

The project is seen as “an externally provided capacity reservoir allocated for a limited period of time.” (Vaaland, 2002:34), which is consistent with the aim to see the project as made up of the surrounding network. One important aspect of the project analysed here is that it is a public project. When Håkansson and Snehota (2000) described the project as one way of organising the interaction between actors, this was done from an industrial market’s perspective. Vaaland (2002) also applies the theory in an industrial project setting. It is, however, assumed that it is not vital whether the approach is used to analyse pure business organisations or organisations in the public domain. In a similar way, it could be argued that
the network approach has been used to describe continuous and ongoing processes in a business environment, whereas the project represents a time limited process which after its conclusion ceases to exist. First of all, the discussion above shows that there are examples of use of the network approach in project specific contexts. Secondly, the explanatory power of the network approach in a project setting is its dynamic characteristics. We are not saying that all aspects of the model fit to describe processes and actors involved in a project, but some parts of it does. That the network model here will be used in the phase of the project life cycle labelled the front-end, which is the phase where the project is less defined and there is a lot of uncertainty involved, stems exactly from the need to analyse the forces and processes that constitutes the project.

The terms actors, activities and resources, as they are used in Håkansson and Johanson (1992), are assumed to be transferable to the context of this project. The perspective is on the level of organisations, which means that the identification of relevant actors will be rather straight-forward. It must otherwise not be forgotten that the main issue is to establish a description that involves the two other variables in the model, activities and resources. The main challenge lies in describing accurately what the activities and resources of the front-end are. This is because, as pointed to earlier, that the project exists only in conceptual terms and that the actual production of outputs has not started. However, Hellgren and Stjernberg (1995:383) illustrate actors’ roles and relations during design and implementation and describe some design activities and relational characteristics that could be helpful to describe the case project.

Above some basic characteristics of the front-end were discussed. It was shown that activities linked to the basic design of the project were considered to be crucial. The front-end could of
course be described in more detail by identifying a number of important activities assumed to take place before the project is locked in and production starts. Some activities are, however, assumed to be more important than other. This implies that in this paper it is not intended to bring closer descriptions of all front-end activities that can be identified in the case project. Focus is put on the activities related to the basic design of the project.

EMPIRICAL SETTING

Data collection and methods

To exemplify the use of the approach, data from a case study originally gathered to study how the industrial network model could be applied to describe the network and manage uncertainty is analysed. The data has later been supplemented merely by access to written sources of project information.

In the terminology of Yin (2003), this is a single case study. Separate sets of research material have been used, particularly a combination of personal qualitative experience and quantitative decision support information. The data reported here primarily stem from personal meetings and interviews, telephone interviews, review of project documents and reports from project management consultants and government. The data collection was mainly done between September 2002 and May 2003, and later supplemented between May 2004 and December 2005. Since focus was put on the project’s network, also sources of information outside the project were used. This means that the focal project’s identity in the network could be

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3 The results from that study are presented and discussed in more detail in Magnussen and Råstad (2003).
established based on the views of its main counterparts and the nature of the relationships were described by individuals outside the focal project.

The focal project – Central characteristics

The project used as an example here is a (major) public building project. It includes the construction and renovation of a total of 18 500 square metres office building aimed to house the Norwegian Ministry of Defence. The current total investment cost is NOK 573 million⁴.

The project is a result of a central government decision to implement a top level reform of Norway’s defence organisation⁵ as part of a far-reaching and essential restructuring of the Norwegian Defence. The building project, referred to as the ISL-project⁶, initiated from the need to relocate the new organisation in joint facilities. Responsible for the planning and implementation of the project is the Norwegian Defence Estates Agency (NDEA) on behalf of the Norwegian Ministry of Defence. The location of the new building is on the outer edge of the Akershus Fortress area in the capital of Norway, Oslo.

Although the roots of the projects can be said to stretch further back, the direct need for the project arose with the central government decision to establish an integrated strategic leadership structure for the Norwegian Defence. This took place in June 2001 and represents the start of the front-end phase of the building project. The final decision to finance and

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⁴ Approximately EUR 72 million.
⁵ The establishing of an integrated strategic leadership structure for the Norwegian Defence where the Chief of Defence and his military/strategic functions are integrated within the Ministry of Defence.
⁶ The name of the project is an abbreviation formed from the initial letters of integrated strategic leadership, which was seen as the overall goal of the restructuring project.
execute the building project was taken in December 2003, which from the terminology applied here represents the closure of the front-end. In this paper, as previously explicitly stated, focus is limited to describing the early phases of the case project.

The network of actors, activities and resources

The network of actors

In this section the case project will be described with the aid of the outlined model. The description will start with the identification of the network of actors and will narrow in on the actors involved in activities related to the basic design of the project.
In Figure 2, the actor network of the ISL-project has been illustrated. The circles represent actors and are dashed to illustrate that boundaries are unclear. The lines between the identified actors (A-M) represent the relationships. The thickness of the lines indicates the importance or the substance of the relationship.

The focal project has, as mentioned above, been placed at the centre of the network for illustrative purposes. Actors with whom the focal project has no direct interaction have been
shaded. The most important relationships and features of the network are discussed in more detail below.

First, a closer look is taken at actors and relationships identified in the actor network of the ISL-project. As Figure 2 shows, 13 actors have been identified in the project network. It should be noted that the illustration represents a snap shot of the network as it appeared early in the year 2003\(^7\). This represented a point in time crucial for the design and planning of the new building. The most important actors identified in the network at this time in addition to the focal project itself (labelled A in Figure 2) are the Ministry of Defence (labelled K in Figure 2) which from a project terminology can be seen as the project owner. The Norwegian Defence Estates Agency (NDEA, labelled G in Figure 2) is an administrative agency responsible to the Ministry of Defence. The NDEA’s main tasks include planning, development, administration, leasing and sale of defence properties. In this context the NDEA is responsible for the planning and execution of the building project and represents, in classical project terms, the executing party. The project organisation was staffed merely by personnel from the NDEA. The project manager and his core team was already assigned on a full time basis to the project. It was stated above that the perspective would be on the organisational level. A short description of the features of the actor described as the focal project would, however, be practical. The project manager of the focal project was responsible to a project steering committee made up by representatives assigned by the base organisation, the NDEA. The project manager administered a staff mostly consisting of technical professionals (technical consultants, architects, safety and quality engineers, etc) involved in the design of the project and the identification and coordination of end user needs. The focal project also consisted of an information department consisting of personnel from

\(^7\) It is not meant to describe the network through the whole front-end, which above was indicated to occur between June 2001 and December 2003.
the NDEA. The communication strategy of the project suggested that the NDEA should manage issues connected to the public, but the high level of public scrutiny the project was subjected to made project exclusive resources in this area necessary.

It could perhaps come as a surprise that there is assumed to be no direct interaction between the focal project and its owner in classical terms (cf Figure 2). The empirical investigations, however, showed that the Ministry of Defence coordinated its activities with the project mainly through the NDEA and the End User Committee, which explains why it has been labelled as a separate actor B in Figure 2.

The End User Committee was made up of representatives from the Ministry of Defence, which in classical terms means that it would be seen as a distinct part of the organisation it stemmed from. Here, however, the resources controlled by, and the activities performed by the End User Committee is consistent with the view that it represents an actor among other actors in the network. First of all, the end users have a formal right to be consulted, which means that their impact on the design of the project could be substantial. Secondly, it was observed that the communication with the end users took place with the End User Committee as the main and coordinating link between the focal project and the Ministry of Defence.

The new building’s planned location on the historical ground of the Akershus Fortress area⁸, implicated that the collaboration with cultural heritage authorities was deemed to be important in order to get the necessary permits to even be allowed to build on the chosen location. Although the planned location of the building was in a “corner” on the outer limits of the Akershus Fortress area, the cultural heritage authorities both on the central and the local level

⁸ The history of the fortress stretches back to the thirteenth century and it represents one of Norway’s most important cultural-historical landmarks.
of government (identified as the actors E and L in Figure 2) were initially opposing the plans to build on the premises. The Ministry of Defence’s proposal to locate the new building on the Akershus Fortress area had previously been supported by a parliamentary decision where it was explicitly stated that the design and planning should be carried out in close cooperation with cultural heritage authorities. The consequences of opposition from the cultural heritage authorities to the plans were anticipated to be considerable delays and even relocation of the building.

The focal project chose to coordinate the communication and cooperation with the cultural heritage authorities through an external constellation, the Cultural Heritage Seminars (labelled D in Figure 2). The Cultural Heritage Seminars were initiated by the focal project as a direct response to negative feedback from cultural heritage authorities both on the central and local level of government on a sketch project presented in the summer of 2002. It was signalled that from a cultural heritage perspective the presented project could not stand. The main aim of the seminars was thus to facilitate a meeting place where cultural heritage authorities, project planners and independent expertise on architecture and cultural heritage issues\(^9\) could come together and share their ideas about the design and shape of the new building. The purpose with the seminars was to bring possible cross-interests forward and promote a design of the building that would not cross any of the involved actors’ views.

The most important actors\(^{10}\) identified as participants in the interaction through the Cultural Heritage Seminars were the End users (B), the Ministry of the Environment (C), and the

\(^9\) As a matter of fact, three professors of architecture from three different institutions were appointed to take part in the seminars. They were participants in the seminars but can not be identified from Figure 2. They have not been identified as actors because their contribution to the design of the project can only be viewed in terms of their participation in the seminars, not as individual actors with power to significantly influence the project.

\(^{10}\) The label used to identify the actor in Figure 2 in parenthesis.
Directorate for Cultural Heritage (E). The only actor involved in the seminars, which it was assumed that the focal project did not have any direct relationship with, is the Ministry of the Environment. The Ministry of the Environment was mainly represented because of expertise in the field of cultural heritage. Otherwise there exists a direct relationship, as can be seen in Figure 2, between the Directorate and the Ministry as a result of a formal relationship. The Directorate for Cultural Heritage is responsible for the management of cultural heritage and is the Ministry of the Environment’s advisory and executive body for the management of architectural and archaeological monuments.

It is important to address some features of the Cultural Heritage Seminars. First of all, they could be described as temporary arrangements. There were held a total of four meetings between the summer of 2002 and the summer of 2003 when the pre-project was presented and the activity of basic design of the project had reached its conclusion. Secondly, there was no formal authority to support decisions or outcomes of the meetings. The project manager later described the seminars and the processes involved as a success. Although the seminars did not represent any formal arena for decision making, many of the issues discussed and resolved there were made part of the actual design chosen for the building. Also representatives for the cultural heritage authorities expressed that they were satisfied with the arrangement. It was stated that the seminars advanced quality improvements in the design and facilitated for an open discussion of important issues early in the design process. It was expressed by the involved parties that the Cultural Heritage Seminars was an important arena for sharing knowledge and learning from each other. The Cultural Heritage Seminar network of actors has been highlighted in Figure 3. In the description of activities and resources we will take this sub-network of actors as a point of departure.
The analysis is concerned with a point in the life cycle where the project existed only in conceptual terms. The basic need of the project, the need of joint facilities for the new, integrated leadership of the Norwegian defence, was communicated and had lead to the establishing of a project organisation responsible for the planning and execution of the building project. The activities observed in the network at the time were related to the basic design of the building, which explains why the analysis of activities and resources has narrowed in on a part of the actor network (cf Figure 3) where these activities were prominent.

An activity involves the combination of resources, which means that a starting point could be to describe the resources observed in the network. It is obvious that since the physical production not yet has started, the resources would also be of a more intangible nature. The most important resources in the network at this stage were the knowledge and experience of the involved individuals and organisations and the available information about the design of
the project. The basic activity was the identification and coordination of needs and demands connected to the project, which then had to be transformed into a model of the project. The applied theory distinguishes between transformation and transfer activities, where transformation activities involve that resources are changed, transfer activities that the control over a resource is transferred from one actor to another. It is evident that these concepts fit better to describe activities in an industrial process, where it could be assumed that the resources are more tangible assets or inputs in a production process (raw materials, etc), rather than to describe the activities in the early stages of a project, where the resources best could be described as knowledge and experience and the output is a conceptual model (an abstraction of the needs of some interested parties). Nevertheless, it is clear that in the case described here, there are resources, the resources are heterogeneous (which means that the knowledge or the expertise of the different aspects of the building project is not shared equally among the actors) and they are combined with other resources in the activity that involves shaping the project. Figure 4 is an attempt to illustrate the network of actors, activities and resources observed in a specific setting of the case project. While Figure 2 and 3 only illustrate the actor network and the relationships between them, Figure 4 is an attempt to show the most important resources and activities in the network as well. The aim is to illustrate that the resources of the different actors are combined in the Cultural Heritage Seminars to perform the basic activity of shaping the project.
DISCUSSION AND ANALYSIS

Above, the network of a public building project in the front-end was described with the industrial network model. The model was proposed because it has characteristics that could be useful in the early phases of project. Data from a case study has been analysed to illustrate the use of the model and to elaborate whether the approach could advance improvements in the way the front-end of projects are managed, compared to the traditional approach.

The description of the case project started with the identification of important actors and relationships. Figure 2 is an illustration of the network of actors and their relationships. It was specified that the perspective would be on organisations. Therefore, it could be criticized that Figure 2 represents nothing more than a static overview of stakeholders. However, what also was specified was that in the description of resources and activities, some activities are...
assumed to be more important than others. In Figure 3 it has therefore been narrowed in on one specific part of the network where important design activities were performed. Figure 3 highlights this part of the network. Important resources in the network were identified as knowledge and experience of different aspects of the building project and the identified activity pertained to the basic design of the project. Although the identified resources and activities here can not be said to be incompatible with the terms defined in the industrial network model, it must be noted that the concepts of the industrial network model have some limitations when it comes to describing resources and activities in the front-end of a project. This could of course stem from the fact that the network model was created to analyse stability and development in an industrial environment, which typically would involve firms engaged in a production process. Despite these difficulties, the description results in Figure 4, where it is attempted to combine the three variables actors, resources and activities. The discussion here will be centred on the specific part of the network presented in Figure 4.

An important feature of the Cultural Heritage Seminars is that it both characterises the interaction between the actors involved in it, at the same time as it itself represents an actor in the network (although it does not necessarily fulfil the conditions to be described as an organisation). This is meaningful from a network approach, first of all because it can be said that it is an entity that controls resources. Secondly, it is also evident that the Cultural Heritage Seminars represent an activity because of the fact that resources were combined to perform a task and the outcome was crucial in the design of the project. It was stated by the project manager, that the Cultural Heritage Seminars was an important arena for sharing knowledge and learning from each other. This opens for the interpretation that resources were shared and combined, which means that it is consistent with the definition of an activity in the perspective of the industrial network model.
The observation here is interesting in many ways. First of all, it is clear that the focal project in this setting does not itself choose who it should develop relationships with (in this case close cooperation was explicitly demanded by central authorities), but on the other hand, the nature of the relationship or how the interaction should be organised is to a great extent left up to the involved actors to decide. Here, the focal project established an arena for cooperation and mutual discussions, and even if there was complete lack of formal instruments to support it, it was rated as a success by the most important counterparts in the network.

The establishing of the Cultural Heritage Seminars could be interpreted in terms of the basic concept of trust in the network approach. The only possible way to reduce uncertainty in a relationship is to develop trust. In this specific context the uncertainty was connected to the final design of the new building and its appropriateness in terms of cultural heritage requirements. The uncertainty was reduced through close cooperation and the establishing of informal arenas for discussions and negotiations.

From a resource perspective, the Cultural Heritage Seminars represent one way in which the focal project can get access to resources otherwise described as outside the project’s range. Figure 4 illustrates that there are resources that can be said to be uniquely connected to the different actors. In this case it is shown that these resources were shared and combined in the Cultural Heritage Seminars, and resulted in quality improvements in the design of the project. This illustrates that resources can be seen as shared across the network. It is also important to point to that through the Cultural Heritage Seminars resources were combined in ways that otherwise might not would have been identified.
Another interesting observation was that although many of the individuals we interviewed expressed that they highly appreciated the establishment of the seminars, and saw them as significant tools for the incorporation of important points of views early in the design process, most of them could not in definite terms describe what the Cultural Heritage Seminars represented. It could of course be said that it was an informal arena for discussions and negotiations, but our observations indicate that it was one of the most important events in the process of shaping the project. This could of course indicate that by applying traditional project management theory there is a lack of theoretical concepts to describe the Cultural Heritage Seminars. It does not bear the common traditional characteristics used to describe an organisation and it has no formal authority. Our study shows that the Cultural Heritage Seminars were important in the design process. Trying to describe the Cultural Heritage Seminars by a traditional approach could thus result in a situation where the most important aspects of the arrangement would not have been fully acknowledged.

**IMPLICATIONS**

In this paper it has been shown that an approach based on industrial networks theory can be applied to describe the front-end of a project. The model was proposed because the paper argues that there are flaws in the traditional approach when it comes to considering the uncertainty and dynamics of projects, especially in the front-end where less is known about actual outcomes and crucial decisions regarding the design of the project are made. The model, which is assumed to be applicable to the context of other projects, was tested on an actual ongoing project, a large public building project. The project was at this stage subjected to a high level of public scrutiny and a lot of stakeholders were involved, which means that there was a lot of uncertainty and complexity. The model has in this respect shown its
usefulness. Instead of analysing the project organisation and the stakeholders in the project’s environment as independent entities, focus is drawn to actors, activities and resources that constitute the project and the interdependence between them. Resource ownership in classical terms can be substituted by the view that resources in the network are accessible and can be shared across the network. In the setting of the case project this was clearly demonstrated by the Cultural Heritage Seminars. The focal project could not disregard the views of other important actors in the network and organised its interaction with important counterparts through the Cultural Heritage Seminars. In this way, the resources of the different actors were combined and went into the activity of designing the project.

The performed analysis results in a description of the network that merely represents a snapshot of the network connected to a limited period of time in the project’s life cycle. The inherent dynamic characteristics of the model open for an analysis where changes over time in the network can be described. The analysis done here can be said to represent a starting point for further analyses. The power struggles that often take place within actors themselves have not been closer investigated since the focus has been on the organisational level. Further analyses could focus on identifying power struggles within actors and how this could affect the design process. It is also clear that the concepts of activities and resources pose some challenges, mainly because they are difficult to describe in a phase where physical production has not started and the network approach has traditionally been used to describe processes in an industrial setting. It can be concluded that the proposed theory in some areas has shown its advantages compared to existing ones, but it must be tested in more empirical project settings, and at the same time some of the basic concepts of the model needs to be clarified.
REFERENCES


Flexibility at Different Stages in the Life Cycle of Projects: An Empirical Illustration of the “Freedom to Maneuver”

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ABSTRACT

Many textbooks on project management present illustrations concerning the relative size of project attributes during different project phases. The derived models all have attributes in common, such as uncertainty, significance of decisions, and degree of freedom to maneuver, that are typically high in the beginning of the project and low in the end. At the same time, variables such as the accumulated cost and available information begin at low levels and end up at a high level at the end of the project. Based on empirical data from projects, this paper illustrates and quantifies one of these attributes, the freedom to maneuver, in different project phases.

KEYWORDS: project attributes; project flexibility; scope reductions

INTRODUCTION

The paper is an attempt to provide empirical results on some project management issues related to project flexibility. Project flexibility is discussed and models for illustration of project flexibility are presented. The paper presents quantifications of one aspect in the presented project flexibility models.

Flexibility and Project Management

Flexibility is one approach to prepare projects for the effects of uncertainty. Terms like adaptability and robustness are often used when discussing issues related to what this paper calls flexibility. Flexibility may also be described as a way of making irreversible decisions more reversible or postponing irreversible decisions until more information is available.

The uncertainty of a project decision can be described by the gap between the information needed to make a decision that is entirely consistent with the actual outcome and the information available at the moment of decision making (Galbraith, 2001). Mikkelsen and Riis (2003) identified a fundamental dilemma in project planning—the importance of decisions is at the highest at the same time as the available information is at its lowest. A common way of reducing this dilemma is to increase the available knowledge about the project. One key idea in project flexibility is to postpone irreversible decisions in the front-end phase of projects, in addition to (or instead of) gathering more information.

Flexible projects are generally not described as desirable in project management literature. A wide range of studies (including Hall, 1980; Miller & Lessard, 2000; Morris & Hough, 1991) indicated that a clear project definition is a critical success factor for projects. On the other hand, a number of scholars, including Kreiner (1995), argued that flexibility is necessary to face the changes and uncertainty in the business environment. There is a desire of project owners and users to have “room to maneuver” to be able to adjust projects as they gain knowledge about their needs and changes in the project context (Christensen & Kreiner, 1991; Eikeland, 2001; Kreiner, 1995; Midler, 1995). As pointed out by Garel and Midler (2001), the approach to flexibility held by the different stakeholders is closely related to the incentives open to the stakeholders. Flexible projects have a value for those who can align a project to their priorities, but flexibility represents a cost for those who have to adapt (Mahmoud-Jouini, Midler, & Garel, 2004).
Flexibility at Different Stages in the Life Cycle of Projects

The approach to flexibility can be depending on the unit of analysis. Adaptability is frequently seen as a key success factor for organizations (Bahrami & Evans, 2005). Projects, on the other hand, are established to be targeted, focused instruments for execution of defined tasks. However, as the Western world is getting "projectified" (Lundin & Söderholm, 1995), management by projects (Gareis, 1989) means that the traditional distinction between an organization and its projects becomes less apparent. A strategic perspective on project management means to emphasize the link between projects and strategic objectives of an organization, as highlighted by Srivannaboon and Milosevic (2006) and Shenhar and Stefanovic (2006). A growing emphasis on strategic aspects of projects is likely to generate a growing interest in project flexibility. The substantial and well-documented drawbacks of project flexibility on project efficiency—primarily cost and time—are a major argument against flexibility. Kreiner (1995) pointed out that the traditional focus on stability in project management becomes challenged under uncertainty, which creates what he calls "drifting environments." Winch (2004) and Jaafari, Doloi, and Gunaratnam (2004) pointed out a major limitation in the predominant theory in project management during the last decades is that it assumes that the scope of a project can be completely known in advance.

Project flexibility can be seen as both a blessing and a curse to project management. On one hand, projects need stability and control to be executed efficiently, typically measured by time, cost, and meeting specifications. From this point of view, flexibility should be minimized. On the other hand, important decisions in projects must be taken based on limited information in an unpredictable world, creating a need for flexibility.

Flexibility is used in a rather wide meaning in this paper, based on the definition of Husby, Kilde, Klakegg, Torp, Berntsen, and Samset (1999): flexibility is "the capability to adjust the project to prospective consequences of uncertain circumstances within the context of the project."

Visualizing Project Flexibility

Lundin and Söderholm (1998) described how a project moves from relative openness in the beginning of the project to relative closeness in the execution phase. In the execution phase, the predetermined action is supposed to be carried out according to the plans, in a "planned isolation." The concept of project flexibility in the execution phase disturbs this planned isolation. Midler (1995) described a management strategy for modern concurrent engineering projects. First, prevent early commitment while at the same time trying to gather as much information as possible on the project. In the second phase, the project is locked as precisely as possible. Finally, at the end of the project, speed is given maximum priority in order to solve the remaining technical obstacles. In a similar way, Mahmoud-Jouini et al. (2004) characterized project management by the speed of three project phases: preparation, freezing, and implementation.

Many textbooks on project management present illustrations concerning the relative size of project attributes during different project phases. The attributes include uncertainty, significance of decisions, freedom to maneuver, accumulated cost, and available information. Figure 1 is an attempt to summarize some of the main elements from the different models. The figure is based on Christensen & Kreiner (1991, p. 40), Mikkelsen & Riis (2003, p. 47), Midler (1995, p. 369), and Samset (2001, p. 32). Even though the shapes of the curves vary between different authors, the models show that uncertainty, significance of decisions, and degree of freedom to maneuver are typically high in the beginning of the project and low in the end. At the same time, variables such as the accumulated cost and available information begin at low levels and end at a high level at project closing. Although the type of shapes shown in Figure 1 appears to be logical, the models appear to primarily serve as summaries and illustrations. They seem to a lesser extent to be based directly on

![Figure 1: Summary of the main attributes of the project life-cycle models.](image)
empirical evidence. There are obvious challenges in quantifying and measuring the different variables. Miller and Lessard (2000, p. 34) showed that for one particular project, regulatory, political, and financial risks were at the highest during the middle of the project.

The "high to low" curve may have different direct meaning, but the underlying message is similar. Christensen and Kreiner (1991, p. 40) used Galbraith's (1977) definition of uncertainty as the difference between the needed and the available information. As the available information increases, the uncertainty decreases throughout the project. Samset (2001) used a similar definition of uncertainty. Eikeland (2001), on the other hand, equalizes "room for maneuvering" with the internal uncertainty of the project, related to internal decisions that will be, but are not yet, taken. A decision is within the room for maneuvering if it does not violate the consequences of previous decisions. Midler (1995) related the decreasing degree of freedom to maneuver with a rising degree of irreversibility in project decisions. Mahmoud-Jouini et al. (2004, p. 361) described the descending curve as "possibilities of action in the project." Mikkelsen and Riis (2003, p. 47) let the "high to low" curve represent importance of decisions.

The "low to high" curve usually represents either accumulated cost (Eikeland, 2001) or the relative amount of information or knowledge available related to the project (Mahmoud-Jouini et al., 2004; Midler, 1995; Mikkelsen & Riis, 2003; Samset, 2001).

Project flexibility is part of a fundamental dilemma in project management. On one hand, projects need stability and control to be executed efficiently, typically measured by time, cost, and meeting specifications. From this point of view, flexibility should be minimized. On the other hand, important decisions in projects must be taken based on limited information in an unpredictable world, creating a need for flexibility.

Method and Material

The data utilized in this paper is based on 48 quality-at-entry assessments of major governmental Norwegian projects carried out between 2000 and 2004. These assessments are made by consultants prior to the parliament's appropriation of the projects. Information from the quality assurance reports has been entered into a database. The information is relatively detailed, but limited to the situation at the time of approval of the project investments in parliament. These assessments were carried out as a part of the quality-at-entry regime of Norwegian governmental investments. The quality-at-entry regime is described in more detail in Magnussen and Samset (2005). As a part of the Norwegian quality-at-entry regime, a forum was established consisting of the involved consultants and ministries. A key issue in this forum was to ensure a uniform structure and terminology of the quality-at-entry reports. As a consequence, the research data used in this study have a uniform and quality assured structure. The data have been codified and entered into a research database, facilitating proper storage and retrieval of data (see Table 1).

Reduction Lists

It is a part of the consultant's assignment in the quality-at-entry regime to assess the possibility for potential scope reductions. These are scope reductions that can be carried out if other parts of the project turn out to be more costly than planned. These possible reductions are summarized as reduction lists. It is assumed that the elements in the reduction list can be extracted from the planned project activities without threatening the fundamental functionality of the delivery. As a part of the quality assurance assessments, it is required that possible scope reductions be identified and described, the cost reduction arising from the change of scope defined, and a list prioritizing the possible reductions made. Prerequisites and expected consequences of the proposed reduction are also to be described. Although it was not a formal requirement, many of the consultants chose to add due dates for the scope reductions, to indicate when decisions have to be made to realize any cost saving from the reductions.

Information on reduction lists was possible to obtain from 42 of the studied projects. As shown in Table 2, Projects under the quality-at-entry regime (QA2)

<table>
<thead>
<tr>
<th>Data set</th>
<th>Projects under the quality-at-entry regime (QA2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of projects (N)</td>
<td>48</td>
</tr>
<tr>
<td>Time of project initiation</td>
<td>2000-Consultant reports</td>
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<tr>
<td>Data source</td>
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</tr>
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<table>
<thead>
<tr>
<th>Project type</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Transportation infrastructure</td>
<td>25</td>
<td>52%</td>
</tr>
<tr>
<td>Defense</td>
<td>16</td>
<td>33%</td>
</tr>
<tr>
<td>Public buildings</td>
<td>6</td>
<td>13%</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project size (final or last known)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15 mill USD (100 mill NOK)</td>
</tr>
<tr>
<td>15–60 mill USD (100–500 mill NOK)</td>
</tr>
<tr>
<td>60–250 mill USD (500–2,000 mill NOK)</td>
</tr>
<tr>
<td>&gt;250 mill USD (2 mrd NOK)</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Table 1: An overview of the data set.
flexibility at different stages in the life cycle of projects

<table>
<thead>
<tr>
<th>Projects with reduction lists</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>33</td>
<td>70%</td>
</tr>
<tr>
<td>Projects that subtracted reductions in the recommended budget</td>
<td>18</td>
<td>38%</td>
</tr>
<tr>
<td>Projects with due dates in the reduction list</td>
<td>24</td>
<td>51%</td>
</tr>
</tbody>
</table>

Table 2: Occurrence of reduction lists (N = 47).

<table>
<thead>
<tr>
<th>Type of Reduction</th>
<th>Total observations</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Mill. NOK</td>
</tr>
<tr>
<td>Preparations for alternative use</td>
<td>9</td>
<td>5%</td>
<td>70</td>
</tr>
<tr>
<td>Quality, functionality</td>
<td>71</td>
<td>42%</td>
<td>804</td>
</tr>
<tr>
<td>Visual impression</td>
<td>22</td>
<td>13%</td>
<td>239</td>
</tr>
<tr>
<td>Volume</td>
<td>48</td>
<td>28%</td>
<td>864</td>
</tr>
<tr>
<td>Dependencies between projects</td>
<td>4</td>
<td>2%</td>
<td>41</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>9%</td>
<td>221</td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
<td>100%</td>
<td>2,239</td>
</tr>
</tbody>
</table>

*Based on data from 37 projects.

Table 3: Reductions by type, frequency, and size.

Reduction lists were used in 30 of these projects. For 24 of the projects, the reduction lists also included due dates to define when the window of opportunity closed for each item on the reduction list. The total value of all identified possible reductions was 7% if only the projects with reduction lists were used as basis for percentage calculation, and 5% if all projects are included—that is, also the projects without reduction lists.

Table 3 shows a categorization of the reductions, their frequency, and total amount. Preparations for alternative use refer to the final product of the projects. It was observed that reductions in quality or functionality lowered the quality, but the volume remained the same as planned. A common type of reduction for roads was related to planned actions on existing roads in connection to the new construction. We have registered these cases as reductions in quality. Adjustments of ambitions related to the aesthetic quality of the project deliveries were common. Examples of this category include planting fewer trees, establishing smaller lawns, and reducing the aesthetic quality of concrete walls. Due to its frequency in transportation infrastructure projects in particular, reduction of aesthetic qualities is presented as a separate category. Reductions in volume are related to number of items delivered, fewer kilometers of road, etc. The dependencies between different projects were typically that “if another project includes this particular delivery in their scope, we can take it out of our scope.” Finally, any type of reduction that did not match the identified categories is listed as “other.” As can be seen in Table 3, quality and volume issues were most frequent and represented the largest monetary value.

Several concerns regarding the scope reductions can be raised. One issue is related to cost sharing between stakeholders in the projects (for example, between the governmental Public Roads Administration and the local counties). Some type of scope reductions may only represent a relocation of the cost.

A similar discussion related to weighing investments versus maintenance cost is also present for many projects. In some cases, it is commented that future maintenance cost becomes neglected by the use of a fairly high discount rate in cost/benefit calculations.

In many cases, reductions are claimed only to be possible by reducing the volume of the projects (for example, in terms of highway meters or defense equipment units). Commonly noted is that by reducing the volume, the unit cost will increase in projects because of fixed costs. There is also a tendency for frustration because the projects have been through several rounds of reductions to focus the scope prior to the external quality-at-entry analysis, where a new round of reductions is asked for.

The need for fast decisions regarding possible reductions is very common. According to one consultant, reductions in system architecture and quality standards have to be made early in projects. Reductions in volume are possible to be made at later stages depending on the contract structure. Also noted is that the potential savings from the reductions are so small that it is not justified to set up a system to manage reductions.

The purpose of the reduction lists is to have possibilities to reduce the scope in response to cost overruns. A major challenge is that the due dates for the reductions typically occur before one can expect that the project manager has updated cost estimates that may indicate potential overruns.
Calculating the Remaining Flexibility of Projects
Based on the reduction lists and due dates, it was possible to illustrate how the due dates of the items on the reduction list expire on a time scale. Quality assurance reports were typically delivered a few months prior to the final decision in parliament to go ahead with the projects. We modeled the time span of the projects from the date of the delivered quality assurance report to the planned delivery date of the final project result. To perform the calculations, we divided the time span of each project into quarters of years. For each quarter, the value of the still-open items on the reduction list was calculated as a percentage of the total project budget. Remaining flexibility of the project decreases each time a due date for an item on the reduction list passes. This value can be seen as an indication of the remaining room to maneuver. It was possible to perform such calculations for 19 of the projects. The shortest of these projects had a duration of one year, the longest 10 years. The average duration was 4.1 years. Only one project had a duration over seven years. The average remaining flexibility shows a pronounced drop during the first year of the projects, from almost 6 to less than 2%. After six years, none of the projects had any remaining items on their reduction lists. Only three projects had such a long duration.

To achieve a uniform presentation of the projects, regardless of their duration, the time scale was then converted to percentages of time span, as shown in Table 4. Thus, all projects begin at 0% on the time scale. At this point, the initial remaining flexibility is represented by a full reduction list (on average 5.9%). The projects were completed at the 100% mark on the time scale. At 50%, all projects were halfway between the delivery of the quality assurance report and their planned date of completion. At this stage, the average project had open items on the reduction list equivalent to 0.8% (and 3.4% at the most) of the total budget. Table 4 shows remaining flexibility presented as average, maximum, minimum, and standard deviation on the uniform time scale.

Reserves
It is also a part of the consultants’ assignment to recommend a budget for the project. Projects are typically assigned a budget that consists of the expected cost including expected extras. In addition, reserves are allocated to the investments in order to avoid the need for additional funding. The intention with the allocated reserves is to mitigate project risks that could not be fully predicted.

As Figure 2 illustrates, the external consultant recommends a total budget that is expected to cover the consequences of the identified uncertainties. The allocated budget should represent the cost that has an 85% probability of being met (referred to as “P85”), minus the identified potential for reductions. The reserves are, however, not expected to be used, and specific rules for the management of reserves have been established. The budget allocated to the projects, or the executing government agency, is usually the most probable final cost (P50). The reserves were not managed by the project manager, and usually not even by the executing government agency. Use of the reserves must be approved by the responsible ministry. It should be noted that reserves are not intended for expanding project scope, but solely to cover unexpected expenses.

The size of the reserves recommended by the external consultants could be established for 45 of the projects. On average, the external consultants recommended a 9% reserve (interpreted as a mark-up above the expected cost). Viewed as a share of the total allocated budget the recommended reserve is 8% on average. In 30 of the projects the external consultants directly recommended a budget managed by the subordinate agency, and in 20 projects a project manager cost target was recommended.

A closer look at the recommendation on how the reserves should be managed reveals that the subordinate agency on average is pointed out as responsible for 94% of the total allocated budget. The recommended expected cost is on average 92% of the total budget, which means that the subordinate

<table>
<thead>
<tr>
<th>Percent of Project on Time Scale</th>
<th>Size of Remaining Items on Reduction Lists</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
</tr>
<tr>
<td>0%</td>
<td>5.9%</td>
</tr>
<tr>
<td>10%</td>
<td>5.2%</td>
</tr>
<tr>
<td>20%</td>
<td>2.9%</td>
</tr>
<tr>
<td>30%</td>
<td>1.7%</td>
</tr>
<tr>
<td>40%</td>
<td>1.5%</td>
</tr>
<tr>
<td>50%</td>
<td>0.8%</td>
</tr>
<tr>
<td>60%</td>
<td>0.4%</td>
</tr>
<tr>
<td>70%</td>
<td>0.3%</td>
</tr>
<tr>
<td>80%</td>
<td>0.2%</td>
</tr>
<tr>
<td>90%</td>
<td>0.1%</td>
</tr>
<tr>
<td>100%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Table 4: The size of the reduction lists at different phases of the projects (N = 19).
Flexibility at Different Stages in the Life Cycle of Projects

This paper contributes empirical data on some of the issues related to project flexibility. By using the results presented in Table 4, part of the curve for the freedom to maneuver in Figure 1 can be redrawn based on the empirical data presented. The relative size of the remaining open reductions can be seen as an empirical illustration of the "room for maneuvering." Figure 3 shows a curve generated from the reduction lists where the calculated room for maneuvering is shown with respect to the life span of the projects. The gray area in the figure represents the average plus one standard deviation of the relative remaining amount of the reduction lists.

In Figure 3, the curve related to reduction lists is placed in an overall time project time axis. To do this, it was noted that the first publicly available cost estimate for these projects on average was dated 3.4 years before the final approval. This means that the initial work in the early phase of these projects started even earlier. The average duration of the studied projects was 4.1 years. The decision to finance the projects is therefore located in the middle of the project time scale in Figure 3.

Figure 2: Project budget and reserves.

Figure 3: The relative size of the reduction lists as a percentage of the total budget at different phases of the projects (N = 19).

agency is granted somewhat more than the expected cost. In the 20 projects where a project manager cost target was recommended, the analysis showed that the project manager managed less than the expected cost (85% on average). This is supported by the observation that in many cases a specific project manager cost target was not explicitly recommended. Instead, it was frequently mentioned that a reasonable level would be in the P45–P50 area. This was expected to launch a cost focus that ultimately would result in more cost-efficient projects.

Discussion

We see the use of reduction lists in the projects studied here as an introduction of a structured approach to flexibility. We saw, however, that the sole purpose of the reduction list is to keep the project within budget. This might be described as a "negative" or internal freedom to maneuver. This means that there is no intention to use the freedom to maneuver to increase effectiveness, or the benefit side, of the projects. In contrast, a "positive" or external freedom to maneuver would include options for increased user satisfaction with the projects.
knowing that the relative location on the time scale is an approximation.

The size and shape of the gray area indicated in Figure 3 have similar features as the model presented in Figure 1, which means that these quantitative results support the illustrative models used in many textbooks.

Another way of quantifying the remaining flexibility at the time for final approval of projects is to see the reduction lists and allocated reserves in combination. On average, the reduction lists amounted to 6% of the total project budget. At the same time, an average of 8% of the project budgets was allocated as reserves to cover unexpected expenses. Adding these two types of flexibility gives an approximate total remaining flexibility of 14% of total budget at the time of parliamentary approval. This number can be used as an approximation. Figure 2 shows that when calculating the recommended budget, 13 out of 42 projects subtracted the reduction list value before the recommended budget was set. These numbers indicate that a remaining flexibility ranging between 9% and 14% of the total budget appears manageable at the time of final project approval, measured by the relative size of reduction lists and allocated reserves.

Conclusion
Models for illustration of project flexibility in a time perspective were presented. An attempt was also made to quantify one dimension in project flexibility models based on empirical data. Remaining flexibility has been quantified during the life cycle of projects, and the result is a curve similar to the illustrative models used in many textbooks on project management. Around the time for final approval, the project management consultants saw it manageable to have an average of 6% of the total project budget still open, with a standard deviation of 5%, maximum 18%, and minimum 0.2%. These numbers are based on the 19 projects that used reduction lists with due dates.

Another representation of the remaining flexibility at the time of final approval is the fact that 8% of the project budgets was allocated as reserves to cover unexpected expenses. An approximation of the average manageable total remaining flexibility at the time of parliamentary approval is therefore estimated to be in the range between 6% and 14% of total budgets.

References

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Flexibility at Different Stages in the Life Cycle of Projects

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PROJECTS TRAPPED IN THEIR FREEDOM: ANALYZING FLEXIBILITY ASPECTS OF PROJECTS BASED ON RESULTS FROM FRONT-END QUALITY ASSURANCE

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1. Introduction

The purpose of this paper is to use experiences from the Norwegian Quality-at-Entry Regime for major governmental investments to illustrate aspects on project flexibility. The paper is also an attempt to contribute with empirical results on some project management issues related to project flexibility.

To begin with, theoretical traditions in project management are discussed. Some models for illustration of project flexibility are also presented. Secondly, the nature of the Norwegian quality-at-entry regime for major governmental investments is analyzed in general. Project flexibility is chosen as a perspective to illustrate some aspects of the regime in more depth.

1.1 Project management

Söderlund (2004) discusses two main theoretical traditions in project management research. The first tradition has its intellectual roots in engineering science. Planning techniques and methods of project management, including the recent emphasis on uncertainty quantification and risk management, have been the major focus. This is in accordance with Pankendorf (1995), who claims that a number of writers trace the intellectual roots of project management research and knowledge to various types of planning techniques, such as Program (or Project) Evaluation and Review Technique (PERT) and Critical Path Method (CPM). The other tradition has its intellectual roots in the social sciences and is especially interested in the organizational and behavioral aspects of projects. Söderlund (2004) terms these “the engineering tradition” and “the social science tradition,” respectively. In a similar distinction between project management traditions, Crawford and Pollack (2004) uses the terms “hard” and “soft”. Crawford and Pollack (2004) relate “hard” project management approaches to objectivist, scientific approaches and has parallels to Söderlund’s (2004) engineering tradition. The “soft” project management approaches of Crawford and Pollack (2004) stem from an interpretivist and constructivist schools of thought, and share similarities with Söderlund’s (2004) social science tradition.

According to Engwall (2003), research on project management has been dominated by what he calls “the lonely project” perspective, with little emphasis on project context and organizational history. Engwall (2003) and Jugdev (2004) point out that current project management knowledge is a practitioner-driven theory focusing on supporting advices to the project manager, apparently referring to the engineering tradition.

1.2 Flexibility and project management

Flexibility is used in a rather wide meaning in this paper, based on the definition of Husby, Kilde, Klakegg, Torp, Berntsen, and Samset. (1999): flexibility is “the capability to adjust the project to prospective consequences of uncertain circumstances within the context of the project.” Flexibility is one approach to prepare projects for the effects of uncertainty. Flexibility could be conceived in numerous ways. We treat flexibility as a project characteristic or property. Terms like adaptability and robustness are often used when discussing characteristics that
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described in this paper calls flexibility. Flexibility can also be seen as availability of options that make irreversible decision more reversible or postponing irreversible decisions until more information is available (Brennan & Trigeorgis, 2000).

The definition above clearly defines uncertainty as an important element of flexibility, which calls for a discussion of the concept of uncertainty. The uncertainty of a decision in a project can be described by the gap between the information needed to make a decision that is entirely consistent with the actual outcome, and the information available at the moment of decision making (Galbraith, 2001). Mikkelsen and Riis (2003) identify a fundamental dilemma in project planning: that the importance of decisions is at the highest at the same time as the available information is at its lowest. A common way of reducing this dilemma is to increase the available knowledge about the project. One key idea in project flexibility is to postpone irreversible decisions in the front-end phase of projects, in addition to (or instead of) gathering more information.

The engineering tradition of project management, referred to by Söderlund (2004) and Crawford and Pollack (2004) is focused on stability for the project, particularly in the later phases of a project. The social science tradition has a greater understanding of the needs for flexibility and adaptability. Kreiner (1995) points out that the traditional focus on stability becomes challenged under uncertainty, which creates what he calls “drifting environments.” The drifting environments (or “context,” as termed by Engwall, 2003) of a project are not necessarily caused by actual changes in the project context, but may also be the result when the project owners and users stakeholders get a better understanding of, and ability to express, their actual needs. According to Samset (2003), contextual uncertainty is associated with the surroundings or context of a project and usually considered beyond the scope and authority of the project. The project has limited opportunity to influence the contextual uncertainty. Olson (2004) indicates that flexibility is generally not desirable when the unit of analysis is limited to the project itself, but it can be rational when a wider context is included in the analysis.

Projects are traditionally seen as temporary organizations designed for unique tasks (Cleland, 2004), often in contrast to the mass producing core activities of organizations. At present, projects are initiated to solve tasks of almost any type (Engwall, 2003) to the extent that the Western society seems to be heading towards a “projectified society” (Garic, 2004; Lundin & Söderhölm, 1995). A major benefit of organizing a task as a project is the freedom to create an organization more or less from scratch. While uniqueness is the competitive advantage of projects as a way of organizing, changes and lack of predictability are commonly seen as the major pitfalls of projects. Successful projects are characterized by control and governance (Hall, 1980; Morris & Hough, 1991; Miller & Lessard, 2000).

The work of permanent organizations, on the other hand, is traditionally seen as repetitive tasks, suitable for permanent organizations (Taylor, 1912). Focus in manufacturing and supply chains has moved from mass production, via lean to agile production, (Asbjörnslett, 2003). As a part of this development, the emphasis on flexibility has increased, to the extent that “changeability” is listed on equal terms as effectiveness and efficiency when establishing performance measurement systems (Andersen, Fagerhaug, & Rolstad, 1998).

2. The quality-at-entry regime

The largest public investment projects in Norway amount to about US$3 billion per year totally, mainly channeled through the Ministries of Labor and Government Administration, Finance, Defense, and Transport and Communications (Proposition to Parliament no. 1 (2001-2002)). In 1998, the Norwegian ministry of finance initiated an analysis of a number of major governmental investments. Effective from 2000, the Norwegian Ministry of Finance initiated mandatory up-front quality assurance and uncertainty analysis of all governmental investments in Norway exceeding NOK 500 millions (US$60 million), the so-called Quality-at-Entry Regime. The regime was introduced in response to a situation with large overruns (Berg et al., 1999).

As a consequence, the responsible ministries are required to undertake assessments prior to the parliament’s appropriation of the projects, with a particular aim to review cost estimates and major risks that might affect the projects when implemented. Such analyses are given the short name Quality Assurance 2 (QA2). The aim is to establish realistic cost and time frames for the projects. Four consulting groups, experts in project management, were commissioned to undertake the assessments. Seen from a project life cycle perspective, the quality-at-entry analyses are made in the end of the front-end phase.

Important elements in the QA2 Quality-at-Entry assessments are (Proposition to Parliament no. 1 (1999-2000):

- Verify the cost estimates in order to achieve commitment for realistic project budgets
- Establish a list that specifies how the cost can be reduced if the set budget cannot be met-- the reduction list

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- Advise on budget reserves that can cover unforeseen costs. The reserves should serve as a realistic tool to ensure that the projects could be carried out based on the allocated funds and, if need be, by also using the reduction list.
- Advise on how the budget reserves should be managed, specifically who would have the authorization to use the funds.

The quality-at-entry assessments shall also address issues such as important prerequisites, contract management, and project organization.

The purpose of the QA2 assessments was to give the ministry of finance and other involved ministries an independent analysis of the project before approval in parliament. In the consultant’s mandates, it is clear that the controlling aspect is the main focus. Based on the chosen content of the Quality-at-Entry Regime, the assessments appear to have their roots in the engineering tradition of project management. Main attention is paid on securing that he projects can be carried out as planned, with a particular emphasis on the budget. An important part of the QA2 assessments has been stochastic calculations of the expected cost. Dedicated software tools are used for such calculations. Even though organizational aspects of the projects are included in the quality-at-entry assessments, this is done from a controlling perspective: how do we secure that the projects can be carried out as planned? The reasons for such a perspective, documented in the preparations for the regime, were cost overruns and varying treatment of uncertainty in project estimates were identified as major challenges.

Experiences from the Quality-at-Entry QA2 regime have indicated a need to focus on the basic rationale of projects as to satisfy needs. The Quality-at-Entry Regime has been revised and extended to include an external assessment of different project concepts. This new part of the regime is called Quality Assurance 1 (QA1).

4.6 QA1 - societal and stakeholder perspectives

After presenting empirical results related to the preparations and execution of the Quality-at-Entry Regime, we now continue to a brief analysis of a new aspect of the regime. After the first round of four years, the Quality-at-Entry Regime has been revised and new consultant contracts were awarded in June 2005. In the revision of the regime, a new part has been added that includes an external assessment of different project concepts, termed Quality Assurance 1 (QA1). Five years of trailing research served as input to the revision of the Quality-at-Entry Regime. According to Magnusen and Samset (2005), QA1 is established based on a belief that in order to achieve substantial improvements of project performance, the basic concepts of projects shall be analyzed, not only the final proposal, as is done in QA2.

QA1 includes an analysis of the prerequisites for a proposed project, a needs analysis, analyses of the documented strategy and requirements, and finally, a comparison of alternative concepts. An important element of QA1 is that at least three alternatives shall be analyzed, including a reference alternative which only includes maintenance and other actions needed to continue to use existing resources. QA1 has a wide perspective and focuses on end users and society as a whole. The purpose is to identify the most adequate project based on relevant needs and priorities. The societal effects and the interest of different stakeholders are key criteria in the comparison of project alternatives to be carried out in QA1.

3. Method and material

Two data sets have been used. Table 1 gives an overview of some characteristics of the two data sets. The first data set describes the background for the Quality-at-Entry Regime. This material includes 14 projects initiated between 1986 and 1998. The prime source is reports written as a preparation for the Quality-at-Entry Regime. These analyses are well documented and submitted to public inquiry before a summary of the results were included in a parliamentary bill. In addition, public evaluation reports of governmental projects that have been submitted to the parliament have been used. Both types of reports are comprehensive and quality-assured analyses of the projects.

The second source of information consists of reports from quality assurance assignments carried out between 2000 and 2004. As a part of the Norwegian Quality-at-Entry Regime, a forum was established consisting of the involved consultants and ministries. A key issue if this forum was to ensure a uniform structure and terminology of the Quality-at-Entry reports. As a consequence, the research data used in this study has a uniform and quality assured structure. Both these data sets have been codified and entered into a research database. The purpose of the database was to provide proper storage of all relevant data regarding the projects.

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Table 1. An overview of the two used datasets.

<table>
<thead>
<tr>
<th>Data set</th>
<th>Background for the Quality-at-Entry regime</th>
<th>Projects under the Quality-at-Entry regime (QA2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of projects (N)</td>
<td>14</td>
<td>48</td>
</tr>
<tr>
<td>Time if project initiation</td>
<td>1986-1998</td>
<td>2000</td>
</tr>
<tr>
<td>Data source</td>
<td>Evaluation reports</td>
<td>Consultant reports</td>
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</table>

<table>
<thead>
<tr>
<th>Project type</th>
<th>Number</th>
<th>Per cent</th>
<th>Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>2</td>
<td>14 %</td>
<td>1</td>
<td>2 %</td>
</tr>
<tr>
<td>Transportation infrastructure</td>
<td>6</td>
<td>43 %</td>
<td>25</td>
<td>52 %</td>
</tr>
<tr>
<td>Defense</td>
<td>3</td>
<td>21 %</td>
<td>16</td>
<td>33 %</td>
</tr>
<tr>
<td>Public buildings</td>
<td>3</td>
<td>21 %</td>
<td>6</td>
<td>13 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project size (final or last known)</th>
<th>Number</th>
<th>Per cent</th>
<th>Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;US$15 million (NOK 100 million)</td>
<td>2</td>
<td>14 %</td>
<td>0</td>
<td>0 %</td>
</tr>
<tr>
<td>US$15 - 60 million (NOK 100-500 million)</td>
<td>4</td>
<td>29 %</td>
<td>5</td>
<td>10 %</td>
</tr>
<tr>
<td>US$60 - 250 million (NOK 500-2000 million)</td>
<td>4</td>
<td>29 %</td>
<td>34</td>
<td>71 %</td>
</tr>
<tr>
<td>&gt;US$250 million (NOK 2000 million)</td>
<td>4</td>
<td>29 %</td>
<td>9</td>
<td>19 %</td>
</tr>
</tbody>
</table>

As Table 1 shows, the material related to the preparations for the Quality-at-Entry Regime is of a retrospective type. The data related to projects that were subject to analysis under the Quality-at-Entry Regime is of a prospective type. A research program, CONCEPT, was established to do research on the effects of the new regime and to follow the projects that were subject to analysis. The projects to be studied were therefore defined before the data collection took place. The variables to be studied were also defined prior to the data collection based on the format of the Quality-at-Entry analyses.

In addition to the written material, structured interviews were carried out with key stakeholders in many of the projects, including the ministries, government agencies and project organizations. The ministries and project organizations in eight of the first 20 projects were interviewed. Further interviews of agencies and project managers in the Defense Ministry, the Public Roads Administration and the Directorate of Public Construction and Property were carried out.

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4. Results

In the following, the empirical data are presented. To begin with, we present results from a re-analysis of the material that served as a decision basis when the Quality-at-Entry Regime was established. Secondly, there are results based on performed Quality-at-Entry analyses. Finally, there is a brief presentation of the next steps in the development of the regime.

4.1 Background for the quality assurance regime re-analyzed

Based on the available reports from the analysis that was done as a preparation for the Quality-at-Entry Regime, we have reanalyzed the projects in a flexibility perspective. The type of projects in this part of the study is shown in Table 1. The analyzed projects were been initiated between 1986 and 1998.

The types of flexibility that was observed in the projects have been analyzed, and is summarized in Table 2. A distinction is made between scope changes, iteration and no observed use of flexibility. Iterations indicate strategic re-configurations of the projects, while scope changes indicate adjustments with less strategic implication. Scope changes were common, particularly during the planning phase. Only one project could be executed as planned. This means that in the sample of projects related to the period before the Quality-at-Entry Regime, projects were subject to adjustments of both the basic project concepts (manifested by iterations), as well as changes within the defined concepts (generating scope changes).

The original analysis (Berg et al., 1999) claimed that unsatisfactory project results, mostly cost overruns, often came as a consequence of poor preparations of the projects before they were presented to the parliament for final approval. In a flexibility perspective, this reanalysis indicates that the analyzed projects were subject to project flexibility, particularly in the planning and execution phases. The background for the Quality-at-Entry Regime, therefore, indirectly points to project flexibility as a major problem in governmental investments.

<table>
<thead>
<tr>
<th></th>
<th>Front-end</th>
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<th>Execution</th>
<th>No phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope changes</td>
<td>0</td>
<td>7</td>
<td>2</td>
<td>N/A</td>
</tr>
<tr>
<td>Iterations</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>No flexibility</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

4.2 Results from quality-at-entry reports seen in a flexibility perspective

Mandatory quality-at-entry analyses of governmental investments were carried out by external consultants on behalf of the responsible ministry. The consultants present a report that compiles the results from the quality assurance. By the time of cutoff for data going into this paper, 54 projects had been subject to quality-at-entry analysis. General information was obtainable for 48 of these projects. Table 1 shows a summary of the type and size of the projects.

Flexibility is, with some exceptions, not directly addressed as a term by its own in the QA2 analyses. However, several issues discussed previously in this paper as different aspects of flexibility are to be found. The QA2 reports include an overview of critical success factors and pitfalls. Table 3 shows a summary of how frequent three aspects of flexibility were mentioned in the summaries of the quality-at-entry reports. The aspects were change management, structured approach to flexibility and finally predictable funding. Issues related to scope change management are summarized in the columns for change management in Table 3. Iterative decision processes and flexibility in the technical solutions are summarized in the columns labeled structured approach to flexibility. This was the only area where the term "flexibility" was explicitly used in the quality-at-entry reports. Finally, management of uncertain funding is covered in the columns labeled predictable funding. Table 3 shows a summary of how frequently these aspects of flexibility were mentioned as one of the top issues in the project analyses. The
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overview only covers occurrences in the summaries of the reports, meaning that a prioritization among the aspects has been made.

Table 3. Key project aspects related to project flexibility as mentioned in the summaries of the quality-at-entry reports (QA2). N=48

<table>
<thead>
<tr>
<th></th>
<th>Change management</th>
<th>Structured approach to flexibility</th>
<th>Predictable funding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent</td>
<td>No.</td>
<td>Percent</td>
</tr>
<tr>
<td>Pitfall</td>
<td>33 %</td>
<td>16</td>
<td>4 %</td>
</tr>
<tr>
<td>Key success factor</td>
<td>25 %</td>
<td>13</td>
<td>6 %</td>
</tr>
<tr>
<td>Pitfall or key success factor</td>
<td>50 %</td>
<td>24</td>
<td>10 %</td>
</tr>
</tbody>
</table>

Management of changes was the most frequent issue in the quality-at-entry reports related to flexibility. It was mentioned as a top issue in 24 (50 %) of the projects. In most cases, the purpose of change management was to establish a structured management of scope changes in order to minimize the amount and the size of the changes. In five projects, change management was mentioned as both success factor and pitfall, usually addressing the same issue, in essence an emphasis of the importance of change management. The apparent “double counting” in five projects means that the total number of projects addressing change management are not equal to the sum of each issue individually in Table 3. Flexibility in the product or decision process was mentioned in 10% of the projects. The availability of predictable funding was frequently mentioned in the text of the reports. However, it was only listed among the top pitfalls or key success factors in three projects.

Table 2 indicated that flexibility was a frequent problem in the studied projects from the time before the Quality-at-Entry Regime. For later projects, after the Quality-at-Entry Regime, the results in table 3 indicate that flexibility management, typically flexibility minimization, was a common success factor in the quality-at-entry reports (or that the lack of flexibility management was mentioned as a pitfall).

5. Discussion

The analysis indicates that flexibility was seen as one of the major problems in governmental projects prior to the introduction of the Quality-at-Entry Regime. As discussed in the introduction section, the engineering tradition in project management theory then proposes a stronger emphasis on the front-end phase in order to adequately prepare the projects. In this perspective, one of the objectives of the Quality-at-Entry Regime was to reduce the flexibility of the projects. The purpose was to make sure that the project is well defined, both in terms of project scope and organization.

The strong emphasis on scope change management in the QA2 reports indicates that changes and flexibility primarily are treated as something to be minimized, or at least to have a strict regime for. Use of reduction lists can be seen as a structured approach to flexibility. However, the sole purpose of the reduction lists is to keep the project within budget. This might be described as a "negative" aspect of project flexibility. There is no intention to use the freedom to maneuver to increase the effectiveness, or the benefit side of the projects. In contrast, a "positive" or external freedom to maneuver would include options for increased user satisfaction with the projects. This can be explained by the background to the Quality-at-Entry Regime, where the observed flexibility of the projects often was aimed at increasing the benefit from the projects for the involved stakeholders. This frequently resulted in cost increases. A key purpose of the Quality-at-Entry Regime was to stop this development.
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We noted that the possibility to establish a more or less customized organization for a unique task is one of the main reasons that projects are set up. As a contrast, control is a key issue in the Quality-at-Entry Regime. Once established to have freedom and adaptability, project management, or at least the engineering tradition of project management, is focused on reducing or controlling this freedom of the projects. Projects thus appear to be trapped in their freedom. The potential freedom of projects is so large that major management emphasis is directed towards reducing and controlling flexibility. Permanent organizations have a different perspective. Repetitive tasks are traditionally organized in ways that utilize economies of scale and to utilize the learning curve. This has usually meant rigid processes and high investment. Coming from a tradition of repetitive tasks, successful permanent organizations are characterized by adaptability (Mintzberg, 1994).

Table 4. Flexibility is a success criterion of permanent organizations and a strength of projects.

<table>
<thead>
<tr>
<th>Strength</th>
<th>Permanent organization</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Repeatability</td>
<td>Flexibility</td>
</tr>
<tr>
<td>Success criteria</td>
<td>Flexibility</td>
<td>Focus</td>
</tr>
</tbody>
</table>

Table 4 illustrates, with the lack of nuances that comes with such matrices, that flexibility is not the inherent strength, but a success criteria of permanent organizations. As a contrast, flexibility is the inherent strength of projects or temporary organizations, and controlling this flexibility by focus is a key success criterion of this type of organizations. The lack of nuances in Table 4 includes the fact pointed to by Engwall (2003) that many organizations are neither purely projects nor permanent. Reality is therefore more like a continuum of gray scales, where the degree of "permanent" or "project" character of organizations varies. The discussion above then relates to organizations with a high degree of repetitive tasks or "permanent," and similar for "projects."

It is claimed that QA2 aims to reduce flexibility, at least in the planning and execution phases of projects. Seen in isolation, this means a reduction of flexibility. However, the introduction of QA1 means a stronger emphasis on analyzing alternatives in the front-end phase than has previously been required in this manner. By seeing QA2 and QA1 in combination, the Quality-at-Entry Regime is an opportunity to reduce flexibility options in the planning and execution phases, and to increase and structure these options in the front-end phase.

Some authors on project management, including Söderlund (2004), argue that the engineering and social science tradition are incompatible from a theoretical standpoint. The discussion about QA1 and QA2 indicates that the two perspectives might be practically compatible when analyzing one particular project, but with a displacement in time. The Norwegian Quality-at-Entry Regime strives to utilize the best of the two perspectives, drawing on the social science perspective in the early phase (represented by QA1), and then switching focus to the engineering perspective in the execution phase (represented by QA2). The fact that these traditions co-exist in the minds of different actors involved in a project does not contradict Söderlund’s (2004) notion about the mutual incompatibility from a theoretical standpoint.

In accordance with the engineering tradition in project management, the Quality-at-Entry Regime strives to provide the project owner and project management control over the environments related to the project, or a type of "framing" of the projects. To achieve a high efficiency in the projects, the stakeholders appear to strive for control of the prerequisites for their tasks. It is in accordance with the engineering tradition, with its roots in project planning, that project management shall strive for control of the environments related to the project. In the QA2 reports, this is represented by the high priority given to change management, as shown in table 3. As shown by the use of project reserves and reduction lists, stakeholders also strive for freedom to maneuver within the defined prerequisites. The QA2 aims at defining the projects as precisely as possible, but still provide project management with the freedom to decide how the specifications shall be met, work carried out and budgets to be held. In a similar way, Turner (2004) claims that one of four necessary conditions for project success is that the project manager is empowered. The project owner should give guidance on how the project can be best achieved, but allow the project manager flexibility to handle unforeseen circumstances as they chose.

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6. Conclusion

The purpose of this paper was to use experiences from the Norwegian Quality-at-Entry regime for major governmental investments to illustrate aspects on project flexibility. From a flexibility perspective, project management as a discipline was compared to other managerial disciplines. Projects are described as trapped in their freedom. The potential freedom of projects as temporary organizations is so large that major emphasis in project management must be directed towards reducing and controlling the freedom, or flexibility, of projects.

Theoretical traditions in project management were discussed. The analysis of the Norwegian Quality-at-Entry Regime for major governmental investments indicated that the regime has its theoretical roots in the engineering tradition of project management. However, the extension to include an early analysis on project alternatives appears to have more in common with the social science tradition than the engineering one. This means that the quality assurance regime, including both QA1 and QA2, is an attempt to use the best of the two worlds divided by the time scale; use social science "glasses" when analyzing the alternatives, then switch to engineering "glasses" to execute the project.

References


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Governance Frameworks for Public Project Development and Estimation

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**ABSTRACT**

This paper investigates how the interface between governance and project management works for public projects. It describes governance frameworks, analyzes embedded governance principles, and discusses the consequences. Based on an initial literature study giving theoretical underpinning, a characterization of frameworks is developed and used to investigate three public-investment-project governance frameworks in Norway and the United Kingdom. This gives a systematic comparison of framework scope, structure, and embedded principles, and shows the differences between the frameworks and elements, despite the stated purposes being the same: increasing value for money and better use of public spending. The analysis shows the frameworks have to be politically and administratively well anchored. A case study particularly looking into cost and time illustrates how the framework influences the project through scrutiny. The analysis shows the governance frameworks are important in securing transparency and control and clarifies the role of sponsor. This work will be useful in establishing frameworks in other contexts and should be helpful in working with governance of major public projects.

**INTRODUCTION**

The governance framework, including government roles, policies, regulations, and so on, is documented to have vital importance to the planning and management of projects (Association for Project Management [APM], 2002; Berg et al., 1999; Flyvbjerg, Bruzelius, & Rothengatter, 2003; Miller & Lessard, 2000; Morris & Hough, 1987). Several developed countries have started a development process to strengthen the ability to manage and control major public investment projects. Two examples focused on in this article are Norway and the United Kingdom. The Norwegian Ministry of Finance has established a mandatory Quality Assurance Scheme for all large public investment projects (Magnussen & Samset, 2005). This scheme is compared with its equivalents in the United Kingdom: a framework developed over time by the Office of Government Commerce (OGC) and the new framework implemented by the Ministry of Defence (MoD, 2007). The frameworks approach the problems of major public investment projects in very different ways. The consequences of the framework approaches to the cost estimation and planning processes in terms of review or control are important targets for investigation, because they reveal examples of practical steps to reduce cost overruns. This article sums up some findings of a research project sponsored by the Project Management Institute Research Program and the Concept Research Program. The study was not completed at the time of writing this article, but at the time of presentation to the PMI Research Conference 2008, the project is expected to be completed and the full report available.

**Governance**

Governance is a term with many meanings. Its rise to prominence stems from the difficulties of hierarchical coordination by firms or the state (Miller & Lessard, 2000). It covers the complex process of steering multiple coupled firms and agencies. Classical means of governance are regulations (proscriptions/injunctions or prescriptions/orders), economic means (sanctions or incentives) and information (advice or warnings) (Bemelmans-Videc, Rist, & Vedung, 1998). Governance can be defined on many levels. International governance has several institutions established to settle matters where several states are involved, such as the United Nations, World Bank, Organisation for Economic Co-operation and Development (OECD), World Trade Organization (WTO), and the European Union. This reminds us that
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Generally, the governing party of public investment projects is not the top of the pyramid; there is a superior purpose above the project. Abbott and Snidal (2001) discuss the use of standards as a mechanism of international governance and show how they can play different roles in different circumstances. They look at different government arrangements, varying combinations of private and public governance, and varying levels of governance (national, regional, and global). Flyvbjerg et al. (2003), investigating several international mega-projects, observe the same: governance is relative—the same formula will not work everywhere. North (1990) notes, “The institutionalist approach aims to identify the various governance modes that enable coordination of major actors in society.” Each society seems to develop its own architecture, and optimal solutions are hard to identify. Among many definitions for governance, we have chosen this one as the best for our purpose (given uncited in Wikipedia):

the use of institutions, structures of authority and even collaboration to allocate resources and coordinate or control activity in society or the economy.

For public investment projects on the national level, the focus is public governance, which has two parallel subsystems: the political (making decisions and giving priority, not discussed further here) and the administrative. Different authors define (public) governance differently. Traditionally the area in mind is called public administration (PA). New public management (NPM) has taken over the arena over the last two decades. NPM has introduced many of the same ways of thinking and designing systems in the public sector as traditionally used in the private sector in Europe (Pollitt & Bouckaert, 2000) and Scandinavia (Bush, Johnsen, Klausen, & Vanebo, 2005). Critical literature (Christensen & Lægreid, 2001; see Klausen in Bush et al., 2005) points out that NPM does not fully take into consideration the specific public-sector context. The public sector is increasingly organized through independent public entities, strategic leadership, and contracts; this also increases the importance of projects in the public sector. Because of the NPM reforms’ shortcomings, several post-NPM reforms have been introduced to reinstate a more central political/administrative control (Christensen, 2007). Governance frameworks like the ones discussed in this article are examples of such post-NPM reforms.

**Public governance** is defined by the OECD (2005) as follows:

“Governance” refers to the formal and informal arrangements that determine how public decisions are made and how public actions are carried out, from the perspective of maintaining a country’s constitutional values in the face of changing problems, actors and environments.

The most common governance field is corporate governance; “a system (that) shapes who makes investment decisions in corporations, what types of investments they make, and how returns from investments are distributed” (O’Sullivan, 2003, p. 24) or “the laws and practices by which managers are held accountable to those who have a legitimate stake in the corporation” (Jacoby, 2005, p. 69). Corporate governance systems are composed of three areas: internal governance processes (structure, composition, and authority of the board; the relationship between board and management; and internal financial and auditing controls), the quality of the independent auditing functions in the national economy, and the nature and quality of the corporate law and regulatory mechanisms designed to shape corporate activity (Monks & Minow, 2004, referred in Detomasi, 2006). Detomasi (2006) emphasizes that despite these common elements, corporate governance systems reflect social, political, and economic purposes and differ dramatically between nations with regard to purpose, structure, and function.

Authors like Detomasi (2006), Jacoby (2005), O’Sullivan (2000), and Abbott and Snidal (2001) all discuss differences in the governance systems found in different countries. There seem to be two important categories, the main difference being who are regarded as legitimate stakeholders:

- **Shareholder-value systems** (United States, United Kingdom, Canada), where only shareholders are legitimate stakeholders. The U.S. “policy governance” model asks, “How can a group of peers, on behalf of shareholders, see to it that a business achieves what it should (normally in terms of shareholder value) and avoids unacceptable situations and actions?” Carver (2001) notes, “The model does not prescribe a certain structure, but a set of principles.”
- **Communitarian systems** also hold nonshareholder constituencies such as employees, banks, and the community in general as legitimate stakeholders, in some countries by law (Germany, Norway, etc.), and in others with no legal requirement to do so (Japan).

Clarke (2004) makes a similar distinction but divides the latter into “relationship-based” systems (Europe) and “family-based” systems (Asia Pacific). Today, shareholder-value systems seem to be dominating international governance trends, influencing countries like France and Japan to phase out systems of cross-shareholding to make way for international and institutional investors.

When designing public investment projects, decision makers have to consider the welfare of all relevant stakeholders (users, interest groups, society in general), which seems parallel to the communitarian model. Our chosen definition is useful because it allows both shareholder-value and communitarian models; it also points to structures...
supporting setting of and achieving of goals. Understanding corporate governance is helpful to understand governance of public investment projects—or governance through projects (since projects are the means to achieve something)—and we consider both governance of and governance through (public investment) projects.

Corporate governance is defined thusly (OECD, 2004):

Corporate governance involves a set of relationships between a company’s management, its board, its shareholders, and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined.

Governance has to cover all levels of the organization. Governance should flow from the government level, through government agencies responsible for execution, down to the project level. It should define how resources and risks are distributed among stakeholders (society at large); laws and regulatory mechanisms make up the structure and information. Similarly, accountability flows up the opposite way. The response from organizations and individuals to governance is the use of systems, methods, and tools to comply with the specified goals and demands.

Governance is discussed above without reference to projects. Our setting, however, is major public investment projects. Miller and Hobbs (2005) describe a trend in project management: “Project governance has only recently become an issue of importance in the project management community and literature. Over the last ten years there has been more interest in the governance of projects in general and the governance of large complex public projects in particular” (p. 47). Patel (2007) calls it a “project governance movement”.

But what does governance of projects mean? APM (2002) defines it thusly:

Governance of Project Management (GoPM) concerns those areas of corporate governance that are specifically related to project activities. Effective governance of project management ensures that an organization’s project portfolio is aligned to the organization’s objectives, is delivered efficiently and is sustainable. (p. 4)

This defines GoPM as explicitly a part of corporate governance, with a clear parallel between the governance of project management and internal corporate governance processes. Not all internal governance processes seem to be included, however. Turner (2006) notes, “Project governance provides the structure through which the objectives of the project are set, and the means of attaining those objectives are determined, and the means of monitoring performance are determined” (p. 93).

The focus is that effective governance of project management ensures that an organization’s project portfolio is aligned to the organization’s objectives, is delivered efficiently, and is sustainable. There are, thus, three main goals: choosing the right projects; delivering the chosen projects efficiently; and ensuring projects are sustainable. The second of these goals—delivering the projects efficiently—is important to avoid wasting (public) resources and involves the framework established around the project execution. This is governance of projects. Choosing the right projects (to ensure the right objectives are achieved), and ensuring the projects (actually the goals and effects of the project) are sustainable, is governance through projects—the context in which the critical decisions are made. This is the true governance of projects on a public or corporate level.

Governance of projects concerns those areas of Governance (Public or Corporate) that are specifically related to project activities. Good project governance ensures relevant, sustainable alternatives are chosen and delivered efficiently.

The term “governance framework for (major public) projects” is a key to this study. The initiatives in the United Kingdom and Norway represent a common framework for all (major) projects. In practice, smaller projects are not included for operational (mostly resource) reasons. Some authors question the idea of having a common framework. For example, Miller and Hobbs (2005, p. 49) say:

A specific governance regime must adapt to the particular project and its context. The approach taken is, therefore, not the design of a governance regime but rather the identification of design criteria that should be brought to bear when developing a governance regime for a megaproject. Several of the criteria contrast to the traditional conception in that governance is a static, binary, hierarchical process. Governance regimes for megaprojects are time-dependent and self-organizing. They involve a network of actors in a process through which the project concept, the sponsoring coalition, and the institutional framework co-evolve.

Our position is to accept the general form of a “governance framework” applicable to any project. It should be flexible enough to fit projects of all types, sizes, and complexities. Frameworks may have to adjust to specific features of the situation in special cases.

Other phrases include Gareis’s (1990) “management by projects” and “strategic management of projects” and Winch’s (2001) “governing the project process” (using transaction-cost economics in construction project governance). Winch also points out that “the range of governance options open to any firm is limited by the institutional context within which it trades” (p. 799),
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so there is a link between the governance principles on a high level and on lower levels, and a link between the internal processes (company, project) and its surroundings (the trade, the sector, the industry, etc.). Similarly, “the reality that project governance is the context, not the content, must be reinforced. Meaning, project governance is the space in which the day-to-day project activities occur” (Patel, 2007, p. 2). Artto, Kujala, Dietrich, and Martinsuo (2007) further underpin the point of looking at the project in its environment. We are therefore confident that the framework is a key to understanding how well projects perform.

Major public projects are complex projects in a complex public context. Amin and Hausner (1997) suggest that “the successful governance of complex economic systems... requires a strategic interactive approach... Such an approach can be summarized as one combining central strategic guidance with decentralized associative governance.” This seems to be quite parallel to Miller and Hobbs (2005). They add, “Any attempt to build effective governance mechanisms should include: Simplifying models and practices which reduce the complexity of the world... Developing the capacity for dynamic social learning about various causal processes... Building methods for coordinating actions across different social forces... Establishing both a common world view for individual action and a system of meta-governance to stabilize key players’ orientation, expectations and rules of conduct.” They also say that “the very processes of governance co-constitute the objects which come to be governed in and through these same processes” (pp. 104–5). This leads us to the idea of the “negotiated economy” as a “third way” between market economics and central planning (p. 117).

Above we have only talked about single projects. Clearly, projects that are interlinked into a program of projects need to be looked at as a whole entity. But equally clearly, our structures of governance through projects needs to look at the overall portfolio of projects, and see how the corporate strategy is realized through that portfolio (Morris & Jamieson, 2004) or, alternatively, ask how aligned the portfolio is with the overall strategy of the organization—this reflects the first (and third) point of the previously mentioned APM definition.

Governance framework is defined like this (our definition):

Governance framework: an organized structure established as authoritative within the institution, comprising processes and rules established to ensure projects meet their purpose.

The project meeting its purpose is a way of defining its success. It implies both delivering the relevant solution in an effective way and achieving a sustainable effect.

Study Methodology

The aim of this work is to look at how the governance regimes for major investment projects in different countries affects project performance, as well as comparing this with the frameworks’ intended effect. We wish to investigate how and why underestimation occurs, rather than simplistically comparing estimates with out-turns, such as the Morris and Hough (1987) work admits but as is also in Flyvbjerg et al. (2003), which does not distinguish underestimation in the early governance phase from execution-phase effects such as mismanagement, scope changes, and the “double-dip” underestimation effect (Eden, Ackermann, & Williams, 2005). This type of question cannot be properly answered by a positivist approach. It can only be approached by a phenomenological approach, looking in depth at a small number of cases (see, e.g., Flyvbjerg, 2006). We need case studies offering context-dependent knowledge to comprehend fully the platform for expanding theory into this field. Once this step is complete, and initial understanding gained, this could be confirmed or expanded in the future by a wider, positivist study.

There are essentially two types of such study: action research (Eden & Huxham, 2006), in which we could affect the course of the projects under consideration, or case studies, in which effects are observed by an essentially neutral observer. In this study, we have to take the latter role, although it should be noted that the very existence of the QA regime, of which the Concept Research Program is an associated part, has a significant effect on the estimation process in the Norwegian projects studied.

While we clearly need empirical study of cases to establish the effects of the governance framework, we are not entering the cases blindly. First, we have already established the above underlying theories of what project governance is. Second, since we wish to compare frameworks, we can establish the variations between frameworks to point us to how to carry out the case studies. Therefore, these studies will be pointed and directed, rather than the very open studies carried out under (for example) grounded theory. This was a small study undertaken to find initial results. It was, therefore, proposed to analyze a very small number of projects as case studies, in just two countries.

Norway and the United Kingdom were chosen as having a fairly new public-sector project governance framework and a well-established one, respectively. Two projects were studied in each country. As described below, it was found as part of the U.K. study that defense projects (the largest public projects) were governed under a different framework from other U.K. public projects, so it was decided to study a defense project and a civil project in each country. Similarity between the projects in each country was sought, but, as in most case-study research, access was difficult and to a certain extent we had to accept the projects that were available.
The study proceeded as follows:
• The literature gave us a theoretical underpinning for governance in general, as described above.
• This enabled us to draw from the literature, to specify the characteristics of a public project governance framework and set these characteristics into a clear structure.
• The study studied two specific countries: the United Kingdom and Norway. There are experts in these frameworks who can reflect on them and characterize them. The structure was rephrased into the form of a questionnaire which was sent to the interviewees and then used as the basis for semistructured interviews.
• The results of these interviews, being already structured, could then easily be compared to give a structured analysis of their differences, as set out in a later section.
• This analysis then gave the foundations for the case studies. The structure was taken and set out in areas to study, and a brief summary of this was given to the case-study projects prior to the first meetings. While the investigators were not limited to these areas, this structure did give the foundation for the areas to study.

**Governance Framework Characteristics**
The governance framework defines structures and principles to make the governance of public investment projects possible and effective. Table 1 contains a systematic checklist of framework characteristics.

The characteristics can be divided into four different categories: “the process of development” (why the framework has come to be, and how it is...

<table>
<thead>
<tr>
<th>Category</th>
<th>Theme</th>
<th>Explanation</th>
<th>Categories of Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The process of development</td>
<td>Background—why and how the framework came to be</td>
<td>Setting the stage to understand the context and explain the framework’s initiation and development up until current edition</td>
<td>Political setting; administrative setting; social economics; traditional market mode of operation; initiators; when the framework was officially introduced</td>
</tr>
<tr>
<td></td>
<td>Explicitly stated purpose of the framework</td>
<td>Identify the official policy, the statement the framework is funded on</td>
<td>Any explicit statement of purpose (political), made by the decision makers</td>
</tr>
<tr>
<td></td>
<td>Current status and how framework is maintained and developed</td>
<td>Identify how the framework is implemented, improved, and developed</td>
<td>Political and administrative anchoring; policy/strategy of implementation; policy/strategy of further development and assessment; results of the implemented framework</td>
</tr>
<tr>
<td>2. Embedded governance principles</td>
<td>Governance principles</td>
<td>Descriptions and characteristics of embedded governance principles</td>
<td>Establishing a common worldview and stabilizing rules of conduct; differentiation between projects based on complexity, etc.; mechanisms to reduce complexity, distribute risk, and trigger governance processes in response to environmental turbulence</td>
</tr>
<tr>
<td>3. The structure of the framework</td>
<td>Current structure of the framework</td>
<td>Describe and define the current framework structure</td>
<td>Explicitly stated ends/goals for the framework; users; framework elements; framework structure; vertical and horizontal integration; extent and control of independent/outside engagement</td>
</tr>
<tr>
<td>4. Detailed governance elements</td>
<td>Framework elements concerning cost estimation and time planning</td>
<td>Descriptions/characteristics of framework elements concerning cost estimation and time planning in early phases of the project</td>
<td>Elements specifically addressing the development of cost and time estimates; governance principles concerning cost estimation/control; systematic analysis of the effect of these principles</td>
</tr>
<tr>
<td></td>
<td>Etc.</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

*Table 1: Characteristics of a governance framework.*
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In both countries are based on a wish to improve governance in a wide sense. There seems to be quite similar political backgrounds in the two countries—apart from a difference between Nordic/Scandinavian social welfare tradition and the Anglo-American strong market orientation. The United Kingdom has a strong public administration tradition and a large influential civil service. Government business is divided into departments, such as Defense, Home Office, and so on. Responsibility for a project is entirely within the department. Wider government responsibility only comes through the minister, who reports to the Cabinet. There may be an influence of the U.K. character, which perhaps leans toward a “blame culture.” Gateway reviews are looking to tease out hidden facts. The U.K. Ministry of Defence (MoD) framework came in as the relationship with industry changed; becoming more open and involving industry, with an “industrial strategy” to ensure the whole industrial base is looked at, bearing in mind U.K. sovereign capability. In Norway, the Sectoral Ministry is responsible for large investment projects. The Norwegian state is responsible for the actions of its employees: the state can be sued, but not the person, so bad performance often has no consequence. Building and construction traditions were important in forming the Norwegian framework. The UK Office of Government Commerce framework was more based on the IT sector. One could perhaps say the market is more influential in the United Kingdom, and responsibility of the state is more influential in Norway.

The Beginning—How the Governance Frameworks Came to Be

In the late 1990s in the United Kingdom, Peter Gershon, then at U.K. defense contractors GEC, was asked by the then-prime minister to look at procurement in government. Gershon wrote an influential report (1999). The prime minister asked Gershon to set up the OGC, which he did in April 2000. This pulled together staff from various other agencies (e.g., the Central Computer & Telecommunications Agency and the Property Advisers to the Civil Estate). The methods in the report covered general commodity procurement and project procurement. It included a “Gateway”-type process and a procurement strategy similar to the OGC’s “BuyingSolutions.” This led (Harpham & Kippenberger, 2005) to the establishment of the Gateway Process™ (OGC, 2004) and PRINCE2™ project management methodology (OGC, 2002). Later, there was a general concern for better program management, giving rise to the development of “Centers of Excellence” as part of the framework. The espoused aim of the framework is specifically to achieve financial targets of money saved (for OGC combining work on commodities and projects).

The one major section of the U.K. public sector that uses a different framework is the MoD. The MoD has always had an “extended life-cycle,” going back way before the “project” and after. The Downey report (1969) put the emphasis on the early stage. Projects weren’t delivering to time/cost performance and technology was increasing in complexity. The main motivations for developing a new framework were toward cost control and reducing risks. A process known as CADMID (a life cycle of Concept, Assessment, Demonstration, Manufacture, In-Service, Disposal), part of so-called “SMART” acquisition, came in around 1998 following work by international management consultants McKinsey. Contracting defense budgets gave motivations for value for money (and to getting more accurate predictions). The McKinsey work showed the need for a “stronger customer” within MoD.

The framework is anchored within the MoD Main Board. The user of the projects is known as “capability management” led by a Deputy Chief of Defense staff. The supplier is personified...
by the Chief of Defence Materiel, head of the supplying organization (called DE&S), following the McKane report (MoD, 2006) and the unifying of the procurement and logistics agencies. This enables the other espoused goal of the framework: to manage the MoDs projects as a single portfolio to get the best capability for the MoD as a whole.

In Norway, major investment projects involve big money and tend to draw much attention. The triggering incident in Norway was a series of unsuccessful major projects during the 1980s–90s. Repeated project overspend turned into a political problem. Deputy Secretary General of the Ministry of Finance Peder Berg led a government committee investigating a number of project cases and the report documented the problems (Berg et al., 1999). The Ministry of Finance initiated the development of an obligatory quality assurance (QA) scheme in 2000. The goal was to ensure improved quality at entry in large public projects. It was a bottom-up process within the ministry, with Peder Berg as a driving force.

It was important to achieve anchoring at a high level within the Ministry. The decision to introduce this governance framework was made by the prime minister’s office. For both the first and second generation of the QA regime, the intention was to establish a system where politics and administration is well divided, with the interplay between these two sides well understood. Our interviewee said: “From an administrative point of view, the important thing is to make sure there is always a basis for decision addressing all relevant sides of the issues involved, and an independent assessment confirming its professional quality. The intended effect of such a system is to make the state able to choose the right projects and execute them well.” Compared to the U.K. frameworks, the Norwegian one is new. It should, therefore, be expected to represent the latest developments in project management and project governance. Compared to the United Kingdom, the experience still has to be considered as limited, and there is no accompanying “comprehensive toolbox” like PRINCE2™.

The three initiatives seem to have been prompted by similar developments: uncertainty due to repeated failures of major projects and changes in market; lack of success in public investment projects; strong individual contributions to put focus on the importance of public investment projects; and support at a high political level to act. Better use of public funds may be said to be the aim in both countries. The OGC and Norwegian initiatives are anchored at the top political level and organized under the Ministry of Finance. The process, however, was genuinely different. In Norway, the initiating process was bottom-up, as was the implementation of the improvement and following learning processes. In the United Kingdom, both processes were top-down, as was the implementation of the management system (the toolbox attached to the governance framework).

**Developing and Implementing the Framework**

The U.K. OGC Gateway Reviews derived from the 1999 Gershon Report, and the Peer Review concept originated from the “Successful IT” report in 2000. Additional features were introduced in 2004. A later Gershon review (2004) says: “Looking forward, the OGC is committed to achieving £3 billion in value for money gains in the 3 years to 2005–06, of which around one half will come from the Gateway Review process, which requires independent assessment of projects and programs at key points in their life cycles.” John Healey, financial secretary to the Treasury (HM Treasury, 2007), also points to the delivery of “over £8 billion of efficiency savings from public procurement.” The OGC is currently reforming, becoming a smaller, more focused organization, reducing staff by almost half and introducing new challenges.

The OGC currently works by influence and recommendation; its recommendations are not mandated. This is the traditional UK civil service culture. The OGC does not consider individual project reports once they have reported on them; rather, they look for systemic trends. Reports on a particular project go only to the sponsor (the person known in PRINCE2™ as the “Senior Responsible Owner,” or SRO) and the OGC—so in that sense governance of a project is limited. Responsibility for projects is divided between the OGC, the department, and other bodies, such as the Prime Minister’s Delivery Unit (for critical projects) and the National Audit Office (NAO; for audit purposes). This may give differences in governance across sectors but, hopefully, equally good governance across sectors. There are a substantial number of people involved in implementing the framework, many of them giving advice to users of the tools and methods attached to the framework itself.

In Norway, it is stated by the government (prime minister’s office) that better projects and better execution of investment projects is a political goal. When QA2 was introduced in 2000 (first generation of the framework), it introduced mandatory external assessment of projects before the financing decision by Parliament. The Norwegian framework is mandatory for all major projects with an expected cost of more than NOK 500 million/£42 million financed by the state (excluding oil and gas). External assessments are performed by consultant companies under a framework contract with the Ministry of Finance. While QA2 had the expected effect, experience through 2000–2004 exposed a need to do something at an earlier stage. Some of the projects before Parliament were not mature enough. In 2005, QA1 was introduced (second generation of the framework), and current framework contracts are valid through 2008 with an additional option. QA1 was by far the more difficult arrangement to define and develop.
The same entity is responsible for the framework for all sectors (with few exceptions), expected to give the same governance across sectors. This was implemented without organizational changes. Anchoring is the key to this operation. The top management and leaders of the Ministry of Finance appreciate the benefit of this arrangement and give support to lower organizational levels.

There are many similarities, but also differences between the United Kingdom and Norway here:

- In the United Kingdom, the OGC framework goals are more explicit, administratively focused, and measured in terms of money. In Norway, there are more clearly politically anchored goals, but not specifying the expected effect of implementation.
- The Norwegian framework is mandatory, forced upon agencies/projects (control aspect: top-down), while the U.K. OGC framework works by influence or recommendation. The MoD framework, being in a single department, is mandatory, imposed top-down.
- The Norwegian framework is a bottom-up process of learning from cases—transferring experience to other sectors by coordination and building "the new profession." The U.K. OGC framework to some extent is a top-down introduction of a common "quality system." The Centers of Excellence represent the "new profession" aspect in the United Kingdom.
- Both Norway and the United Kingdom (OGC) have established a support organization looking for systemic trends: in the United Kingdom as a permanent public administration entity and in Norway as an external research program. The MoD reports on systemic trends at a top level.
- The United Kingdom (OGC) looks only at systemic trends; Norway and the MoD also look at single cases.
- Norway has a centralized coordination arena in the project management forum (ministries, agencies, QA consultants, and researchers meeting to discuss principles and practices), while the OGC has established distributed "Centers of Excellence" (the MoD is already a single, organized entity).
- The Norwegian development process appears more step-by-step, whereas the OGC was straight to full scope. The MoD was a development of structured reorganization of existing agencies.

The two countries seem to have chosen different strategies: Norway breaking with tradition and introducing a mandatory new arrangement, and the United Kingdom building on tradition and improving current processes, through influence.

Structural Frameworks

In the United Kingdom, the chief elements of the OGC framework are the Gateway Reviews. Later came categorization and Mission Critical Projects, then Centers of Excellence, and now also the Project Initiation Process. The private-sector engagement comes from the use of private-sector-experienced consultants who have been individually accredited by the OGC for Gateways. The six Gateways are well defined. They are standardized and documentation is available. Gateways 1 to 5 are at project level:

- Gateway Review 0: Strategic management (several times where appropriate)
- Gateway Review 1: Business justification
- Gateway Review 2: Procurement strategy
- Gateway Review 3: Investment decision
- Gateway Review 4: Readiness for service
- Gateway Review 5: Benefits realization

Projects are assessed as to criticality, based on the following criteria: high political significance, riskiness of the program, and the cost (this is actually a lower-level criterion). The top level of criticality is the "Top 20" mission-critical projects (reported to the Prime Minister's office, and the OGC sits on the project board of these projects). The next level is "high-criticality" projects; for these, Gateway reviews have to use senior people or even all independent. Then there are "medium-criticality" projects, for which departments can call on the OGC for help if there is resource available. "Low-criticality projects" are reviewed within departments. Criticality assessment is completed by a department then between the OGC and Permanent Secretaries; the mission-critical list is also decided between the head of the OGC and the Prime Minister. It may be that the level of external input could decrease due to cost considerations. A further element is the development of small Centers of Excellence, bringing "best practice" to the department, acting as a liaison point within a department for the OGC and reporting directly to the Permanent Secretary. The OGC measures the effect of its efforts and publishes results frequently, stated in terms of money saved (according to procedures laid down by the National Audit Office).

The U.K. MoD system works on four different types of projects, a key one being equipment and support. Each type has a (different) categorization—for example, A–D; for Equipment & Support, based on cost. This gives an overall risk portfolio. There are only two gates: the first (Initial Gate) to release funds for assessment, and the second (Main Gate) to release funds for the main project. Categories A&B go, at the two gates, to the Investment Appraisal Board via two routes simultaneously, from the advocate of the project (the SRO) and via "independent" scrutiny.
(within MoD but independent of the project). Each project is undertaken by an “integrated project team” (IPT), responsible on the project to the SRO but responsible overall within DE&S. Thus, the MoD considers the whole portfolio of projects: the “capability” customer considers the program of projects, and the IPT considers the project. To look at DE&S overall performance, the Chief of Defence Materiel reports to corporate targets. Gateways look at the entire project, including the industrial base, so in that sense the system is vertically integrated. The system has a strong basis in trust. The Investment Appraisal Board has to trust industry but have sector management and cost forecasting support and a joint industry management board.

In Norway, the whole framework is a control measure. Control rules are documented in the framework contracts (between the Ministry of Finance and preaccepted QA consulting companies) and the control object is the documents assessed in the QA regime. External control and assessment (independent second opinion) of the documents is a key idea. The QA regime is made up of more or less well-known standard components: good practices in the areas of social economy, planning, and project management. Currently, the sum seems to be quite unique. The framework is simple, consisting of two gateways—(1) QA1, the early choice of concept, the decision to initiate project preplanning, and (2) QA2, the GO decision, the decision to finance the project. Vertical integration in the value chain stops downward at the agency level. Owners traditionally decided what should be delivered and at what cost. This gave an incentive to spend the whole budget, including any contingency. By introducing QA1, focus is put on the rationale of the project, forming a logic sequence starting with the need and ending with the effect. It gives a good foundation for important decisions at a point in time when there still are alternatives. QA1 and QA2 give a tool for control from the top (Parliament—Government—Ministry—Agency). This works as expectation management, and expectations influence performance. The Norwegian QA framework does not address the private sector (suppliers, contractors), but it is a general assumption that what is learned from this in the public sector will be transferred to the private sector.

QA1 includes the control of four documents, each subject to quality assurance: a needs analysis, an overall objectives/strategy document, an overall requirements specification, and an analysis of alternatives. The project has to pass at all these stages to continue (to be presented to Government for formal decision). No shortcuts are allowed. The important logic in QA1 is to base the project on real needs and to choose a strategy and a concept accordingly at a very early stage—it can look at many alternatives. QA2 includes the control of one document, the project management plan, with several subdocuments (cost estimates, progress plans, risk analysis, contract strategy, organization, etc.). The focus from the beginning was very much on cost, because of the historical background (cost overrun). The format is standardized to include elements such as contracts, pitfalls and success factors, uncertainty analysis, flexibility, scope, and organization. QA2 includes assessments with a quite narrow perspective—only the chosen alternative. There are several coordination arenas (forums) where the Ministry of Finance gathers key people from ministries and agencies, QA consultants, and researchers for discussions, often resulting in common understanding and definition of terms and professional standards. The Concept Research Pro-

gram is supporting the development of the regime and studying the practices of the agencies and QA consultants. Measuring the effect of the governance framework has received some attention, but much less than in the United Kingdom.

Comparing the two framework structures highlights some differences. The vertical integration, as well as the horizontal, is quite different. The Norwegian governance framework goes all the way to the top but stops above the private sector (suppliers). The effect is expected to diffuse down to the private sector as results materialize. The U.K. OGC and MoD frameworks, on the other hand, go all the way down but stop at the ministry level. Above this level, committees, the NAO, and the like supplement necessary governance reports and other functions. Horizontally, the U.K. framework (or its equivalents) is implemented by several responsible parties. The major characteristic of the Norwegian framework is its simplicity.

The comparison of the framework components (Table 2) shows some of the same characteristic simplicity on the Norwegian side as the vertical and horizontal integration. The U.K. side is more comprehensive and adequate for more detailed control measures at a lower hierarchical level. Comparing with the literature discussed earlier, it seems as though the Norwegian side is purely a macro-analytic perspective, whereas the U.K. framework also includes the micro-analytic from a program and project management (PPM) point of view. The organization implementing the U.K. governance framework also supplies the management system with the answer to the question “how to achieve,” whereas the Norwegian framework only answers “what to achieve.” The use of external consultants is quite similar in both countries, but in Norway competent companies are assigned; in the United Kingdom, it is competent individuals. This may suggest that there is a need
Governance Frameworks for Public Project Development and Estimation

for more experience and credibility on the individual consultant’s side in a framework based on influence and recommendations. The Norwegian framework is mandatory, and consultants are thus not the ones that have to persuade the agencies and their project organizations. It is probably important that the Norwegian process is one of breaking with tradition and building “a new profession.” New professions are likely to attract younger professionals with the aspiration to find new ways of doing things, compared with a situation implementing best practice. Younger consultants need the support of the company’s resource base including seniors, so assigning a company and not individuals may be a good idea. (Also, there are a very limited number of senior experts in Norway with the right knowledge to fill the role defined in the U.K. framework.) One characteristic difference between the two countries is the amount of resources used in performing each assessment. In the United Kingdom, a four-day assessment is carried out by a senior consultant and planned, performed, and reported over 11–12 weeks (Howard, 2007). In Norway, the QA team performs a complete independent analysis of the project. They may work for six months or more, including several meetings. In both countries, the project organization probably spends many more man-hours in preparing and supporting the assessments than is used to perform them.

**Table 2: Comparison of framework elements.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of gateways</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Control basis</td>
<td>Control rules established by contract</td>
<td>Complete definitive dossier required</td>
<td>Review definitions/ guidelines</td>
</tr>
<tr>
<td>Review [assessor] roles</td>
<td>Agreed in PE Forum</td>
<td>Defined in detail</td>
<td>Defined in detail</td>
</tr>
<tr>
<td>Report format</td>
<td>Standard QA reports defined</td>
<td>Dossier format defined</td>
<td>Standard review report format</td>
</tr>
<tr>
<td>External/internal resources</td>
<td>External assessors</td>
<td>Mostly internal assessors</td>
<td>External, Internal assessors used in some sectors</td>
</tr>
<tr>
<td>Coordination arenas</td>
<td>Project Owners Forum/ Project Management Forum</td>
<td>Coordinated in one Ministry</td>
<td>Centers of Excellence</td>
</tr>
<tr>
<td>Support organization</td>
<td>None [Research program]</td>
<td>Permanent organizations</td>
<td>Permanent administrative organization</td>
</tr>
<tr>
<td>Initiation process</td>
<td>--</td>
<td>Foundation review</td>
<td>Project initiation process</td>
</tr>
<tr>
<td>Process owner</td>
<td>Ministry</td>
<td>Senior responsible owner</td>
<td>Senior responsible owner</td>
</tr>
<tr>
<td>Decision makers</td>
<td>Politicians</td>
<td>Investment board</td>
<td>Senior responsible owner</td>
</tr>
</tbody>
</table>

(a) Common governance principles (stated by both sides):
- Transparency, openness for scrutiny, maximum openness about basis for decisions
- Learning, willingness to change
- Setting common, high professional standards
- External control, independency
- Political anchoring of framework on high level
- QA/Gateway review is nonpolitical
- Look for big, important trends, not the minor details

(b) Expected to be common principles (stated only by one side but implicitly part of both):
- Base projects on needs of the users
- Decisions should be made at the appropriate political level
- Use senior competence as owner representative and in assessment

(c) Differences, shown in Table 3.

The most noticeable difference is the simplicity of the Norwegian framework compared to the completeness...
of the OGC’s (taking into account the toolboxes, not only the framework). The MoD appears in between them. The second is the choice of a mandatory system in Norway and the MoD and the persuasive recommendations with the OGC. Another is the focus on the business case (contents and results) in the United Kingdom versus the focus on method in Norway. This corresponds with cultural differences mentioned earlier. In Norway, the control measures are focused on cost and risk (initially at least, but moving more toward benefit and value), whereas the U.K. side is focused on the business case/value for money. This may be a measure of the maturity in the frameworks; the Norwegian being all new and the U.K. building on long tradition.

**Governance Elements Focusing on Cost and Time**

As expected, the three governance frameworks all have elements focusing on cost and time. There are, however, substantial differences as shown in Table 4. The OGC framework is the complex, complete, and detailed approach, with the MoD framework being the high-level approach linked to specific guidelines. The Norwegian approach is the simplistic approach, remarkable at this level because of the scarce references to time planning.

### The Skjold Class Fast Patrol Boat (FPB) Project of the Norwegian Defence

The project is planned with four case studies looking for proof, or at least indication, of the differences and consequences pointed out in the theoretic part of the work. The case studies are expected to add nuances and deeper knowledge to the subject studied in this project. As such, it is a vital part of it. However, at the time this article was written, only one of four case studies is developed far enough to be described in the article: the Skjold class Fast Patrol Boat (FPB) of the Norwegian Defence.

The project is an example of a complex defense procurement project. It is complex in many dimensions: the decision-making process, the technology, and the contract. The Skjold class FPB project (hereinafter the Skjold project) encompasses the construction of five new Skjold class FPBs. Weapon systems, personnel training, and logistics and support are also included. The pre-series vessel, P960 HNoMS Skjold, was completed in 1999 as a separate project terminated at the time of commission of the new ship. Immediately after the commission of the P960 HNoMS Skjold in 1999, preparations for a subsequent delivery of a series of ships were initiated. The planned upgrade and reconstruction of the P960 HNoMS Skjold is, however, also a part of the delivery of the series of new ships, as it will be temporarily returned to the shipyard to be rebuilt to new specifications.

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**Table 3: Differences in governance principles.**

<table>
<thead>
<tr>
<th>Norway</th>
<th>U.K. (MoD)</th>
<th>U.K. (OGC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic:</td>
<td>Simplicity, robustness</td>
<td>Completeness</td>
</tr>
<tr>
<td>Influence:</td>
<td>Management of expectation</td>
<td>Hurdles to cross</td>
</tr>
<tr>
<td>Authority:</td>
<td>Mandatory</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Review focus:</td>
<td>Control of input and methods</td>
<td>Output within program (contribution to capability)</td>
</tr>
<tr>
<td>Life cycle:</td>
<td>Choose concept early and choose strategy early</td>
<td>Very early gateway, extended life cycle:</td>
</tr>
<tr>
<td>Project focus:</td>
<td>Cost/risk/value</td>
<td>Value for money</td>
</tr>
</tbody>
</table>

**Table 4: Differences in elements focusing cost and time.**

<table>
<thead>
<tr>
<th></th>
<th>Norway</th>
<th>U.K. (MoD)</th>
<th>U.K. (OGC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost and time focus:</td>
<td>Control</td>
<td>Life cycle</td>
<td>Business case</td>
</tr>
<tr>
<td>Debt of details</td>
<td>Accuracy and detail</td>
<td>Accuracy and detail</td>
<td>General comments</td>
</tr>
<tr>
<td>investigated:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative number of</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>elements:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toolbox available:</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Independent cost</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>estimate:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In June 2001 the Norwegian Parliament made the principal decision that six Skjold class vessels (five new plus the P960 HNoMS Skjold) should be phased in as a part of the operational structure of the Royal Norwegian Navy. In October 2003 the final decision to build and finance the ships was made by the Parliament. The budget (upper financial limit) was NOK 4,675 million/ £409 million (price level 2003). A contract was signed in November 2003 with Skjold Prime Consortium (SPC), an umbrella organization for the companies responsible for the design and production of the ships. The series of ships is currently being constructed at the Umoe shipyard in Mandal, Norway. The Norwegian Defence Logistics Organisation (NDLO) is responsible for the execution of the Skjold project. The main tasks of the NDLO are to deliver logistics according to military needs, which includes procurement, investment, support, supply, and maintenance of all weapon systems and military material in times of peace, crises, and war.

The Decision-Making Process

Quality Assurance

The Skjold project was subjected to QA2 in November 2001 (final report March 2002). QA2 supplementary analyses (regarding contractual issues and updated uncertainty analyses of costs) prior to the final decision to finance and execute the project were performed from May to June 2003. The main findings and conclusions from the QA exercises have been compiled in separate reports accessed by the researchers. These reports are our main source of information about the QA process, but semi-structured interviews with key personnel representing the owner, the project organization, and the QA consultant were also used. Interviews indicate that the parties involved generally agree on the main characteristics of the process itself. It was characterized by fair and open discussion; the exchange of information was excellent. The basic need for the project was not an issue in the QA assessment, and could thus be seen as irrelevant in terms of an analysis of the impact of QA. There was, however, a discussion on the political level before the principal decision about whether the project should be prioritized or not, which calls for a short description of the main characteristics of the political process.

The Political Process

We do not focus on the political process, but a short overview is needed to understand the shaping of the project. The principal decision to establish the Skjold class FPBs as a part of the Norwegian Navy was resolved in a broad political compromise. In 2001 the recommendation from the Ministry of Defence was not to pursue the Skjold project further. The Chief of Defence had in the recent Defence Study 2000 concluded that the investment and operating costs of the proposed fleet of FPBs should not be prioritized, considering other investments1 and current liabilities of the Norwegian Defence. An appeal by the Chief of Defence to the Ministry of Defence that the decision should be postponed until the handling of the Long-Term Plan for the Armed Forces coming up the following year was not successful. In October 2003 the political compromise from the principal decision was sustained and the Parliament authorized start-up of the project, and the contract with the supplier followed shortly thereafter. The majority in favor of the project saw the fleet of FPBs as strengthening the capacity of national sovereignty enforcement, territorial security, and civil operations support in the Norwegian maritime zones. There is little doubt that regional politics played a major role in the political decision.

1It should be noted that the Norwegian Parliament in May 2000 decided upon the largest Norwegian defense investment ever, a NOK 21 billion / £1.9 billion program consisting of the delivery of five new multipurpose frigates to the Royal Norwegian Navy. The delivery schedule calls for one new frigate each year from spring 2006.

On the Impacts of the Quality Assurance on Cost Estimation and Planning

Members of the project organization stated in interviews that 90% of the mind-set in the quality assurance report was based on their judgment. The project organization held nothing against the QA (it was stated in interviews that they actually welcomed it). An objective assessment by third-party experts in project management was seen as a learning opportunity. The report itself is in no way judged to be inadequate or faulty. Still, the project organization’s learning from it is characterized as limited. The reason for this was stated to be the particular characteristics of theproject in terms of complex technology and contract. The project organization had experience from the pre-project (the ship delivered in 1999) and an upgrade of the existing FPB fleet, the Hauk class, completed some years ahead. The QA assessment was conducted at a time when the contractor had placed a “price not to exceed” and consisted mainly of uncertainty analysis of costs and risk assessment based on input from the project organization. The initial cost estimate from the project organization, based on background experience from the ship completed in 1999 and the Hauk class upgrade, was raised in response to the result of the uncertainty analysis of costs, although no new risk elements were identified. The project schedule was not revised as a result of the QA. There was a lot of attention concerning the costs of the project, but the increased budget sparked little discussion. It was merely stated as a fact, and the budget recommended
from the external consultants was subsequently used as a basis for the decision to finance the project.

As of today, the project is on budget and schedule. None of the ships has been delivered, but the construction phase goes on as planned.

Theoretical Comparison and Conclusion

The previous sections concluded the OGC framework is the complex, complete, and detailed approach, the MoD framework is the high-level approach linked to concrete guidelines, and the Norwegian approach is the simplistic approach. By use of different theories, we try to point to possible explanations for these differences and their consequences. The aim is not to conclude which is the best: each is adapted to its specific “environment” and should be expected to be different. Our aim is to find the significant reasons and consequences, to help learn how a framework should be designed. This is ongoing research. At the time of writing, we have only conducted one of four case studies. Consequently, this article includes only a theoretical analysis.

The system we analyze is the administrative hierarchical organization that defines, plans, and executes major public projects. We are all legitimate interested parties in major public investment projects, and many perspectives are needed to cover the important issues in this discussion.

There is a variety of theoretical perspectives that might help us when we look at governance. We have looked at theories from both political science and economy, mainly based on Clarke (2004) and Christensen (2007).

- The economic-rational perspective
  - Agency theory (Eisenhardt, 1989) and principal-agent theory (Thatcher, 2005): agents with self-interest
  - Public choice theory (Christensen, 2007) and stewardship theory (Clarke, 2004) that allows for agents to have motivations other than self-interest
- Stakeholder theory—looking at all stakeholders (Clarke, 2004)
- Networking theory (Jones, Heserly, & Borgatti, 1997) and theory of transaction costs (Williamson, 1979), looking at the connections between stakeholders
- Economic analysis and analysis of political behavior (Peltzman, 1998, referred to in Christensen, 2007)
- Bureau-shaping perspective: bureaucrats and experts benefit from decisions (Dunleavy, 1985)
- The instrumental-structural perspective
  - The analytical aspects are important in decision making, but there is only bounded rationality; importance of structure in the process (Simon, 1957)
- The cultural-institutional perspective
  - Gradual development of organizations, emergent properties (March & Olsen, 1989)
- The environmental perspective
  - Organizations dependent on their technical and institutional environment (Meyer & Rowan, 1977)
- The garbage can perspective
  - Ambiguous and flexible decision making processes: unpredictable (March & Olsen, 1976)

The instrumental-structural perspective is probably the best perspective to describe the core of governance frameworks. It suggests that the formal structure is important for selection—that is, the position and tasks the individual actors have—will preselect most of the decision-making premises and govern how he or she thinks and acts, making the choice of introducing a governance framework an obvious one. In this perspective, the limitations to rationality are accepted and the importance of the processes and structures becomes clear. This may be used to argue the need for a framework, the testing of assumptions and the need to tease out the hidden facts. It also delivers arguments for control. Based on theory of political science we recognize these frameworks as post-NPM (new public management) reforms, reinstating a more central political and administrative control.

There are major concerns about information asymmetry and opportunistic behavior when agents perform their specialized tasks on behalf of the principal (the owner—the responsible Ministry), according to principal-agent theory. This leads to the control aspects of the frameworks. The three different frameworks are genuinely different in this aspect. The Norwegian framework is clearly a control measure all the way through: the position of scrutiny is very strong and the gateways are “critical,” meaning you have to meet professional standards to pass them and continue. The U.K. MoD framework includes control measures. The position of scrutiny is less strong than in the Norwegian framework—the assessment is more in the hands of the decision makers themselves (which in this case is more professional) and the gateways are critical. The U.K. OGC framework is not a control measure but uses independent professionals to tease out hidden facts; gateways are “friendly,” meaning the assessment and good advice of the expert may be followed or not, the professional standards may be met or not, but the project can still continue. Gathering more information is another way of reducing information asymmetry and opportunistic behavior. The three frameworks all use this as a measure, but in different ways.

The public-choice theory gives arguments to choose external assessors to balance out the influence of internal professionals. The arguments really used are more about access to competence and capacity (Norway) and additional third-party views (United Kingdom), but also independency (both countries). This theory also underlines the need for increased transparency and insight into vested interests and competition bias and
clearer definition in contracts of rights and duties for public and private actors.

The bureau-shaping perspective suggests that autonomous public units, like regulatory agencies, begin to set their own standards rather than those formulated by the legislature and the political executive. This theory is highly relevant because an important part of the assessment is checking that the documents of the project are still in keeping with the purpose, objectives, and priorities expressed by the decision makers. The frameworks are similar in these perspectives.

In a jurisdictional perspective, the countries are different. In Norway, the state is the responsible entity. The individual civil servant cannot be sued. In this culture, which allows bad performance to have little consequence, strong control measures have to be put in place. In the United Kingdom, there is much more a culture of individual responsibility. With it also comes, of course, blame: “it is not my fault.” In a culture with strong individual responsibility, everyone has to take the blame themselves—they choose whether or not they want to listen to the external expert’s advice.

When people act inside public institutions, they act according to a logic of appropriateness, not according to a logic of consequence, according to the cultural-institutional perspective. Norms and values are important. The function of the frameworks is to clarify better what are the appropriate actions and appropriate choices to make. This theory gives one of the explanations about why the governance frameworks actually work. The differences are the result of what is considered appropriate in each country and sector.

The environmental perspective defines that the system (organization, or in this case framework) is dependent upon its technical and institutional environment. This leads the frameworks to have more emphasis on the market in the United Kingdom and more toward the responsibility of the state in Norway. In the United Kingdom, there is a strong public administration tradition and large influential civil service. In Norway, the civil service has a weaker position and, to a larger extent, has to bargain its way through difficult decision-making processes where other interests (local government, private sector, public) have strong positions. This is probably one of the explanations for the large degree of flexibility built into the Norwegian framework, whereas the U.K. frameworks can be more decisive and define the premise for the decision making.

The garbage can perspective suggests collective rationality and instrumentality is low. The decision-making process is ambiguous, shifting, and unpredictable, and the decision-making situation is flexible and subject to change. This perspective reinforces that flexibility is important.

**Concluding Remarks**

We believe readers will have a better understanding of what considerations have to be made in designing or maintaining governance frameworks in the future. In this study, we have discussed the frameworks in two specific Western countries. The findings will not be easily transferable to other countries, certainly not outside the developed countries. However, we still believe lines of inquiry followed in this work may be helpful in establishing similar frameworks in other contexts. At least the awareness and theories presented here will be of help to anyone working with governance of major public projects.

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Governance Frameworks for Public Project Development and Estimation


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Practical implications of governance frameworks for public projects

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Introduction

There are various governance frameworks set up by different authorities and governments for public projects, but the effects of these on the development of project plans and estimates is not clear. Such frameworks are set up as self-evidently appropriate, but we know that apparently self-evident correctness sometimes do not apply to complex projects (Malgrati and Damiani 2002). The effect of bias in the estimates, such as optimism bias and strategic under-estimation is known (Flyvbjerg et al 2003); however, it is not clear how the various governance frameworks exacerbate or ameliorate these effects, and this is crucial to understanding how to tackle this problem, rather than the “sledgehammer” of simply adding factors onto estimates.

Supported by PMI, the Concept Programme (Norway) and Southampton University are currently undertaking a study analysing the frameworks for front-end appraisal and governance of public investment projects. The aim of this work is to look at how the governance regimes for major investment projects in different countries affects project performance, as well as comparing this with the frameworks’ intended effect. It is focussing on cost and time management (and considering how and why underestimation occurs, rather than simplistically comparing estimates with out-turns, which would not distinguish under-estimation in the early governance phase from execution-phase effects). The study is also looking into four case-studies, to see how the implemented governance frameworks actually affect Project Management and how consistent they are with the stated aims. There is only room to report a small part of this study, so this paper will concentrate on how the frameworks work out in practice, and how consistent the frameworks and good project management are.

This was a small study undertaken to find initial results. A very small number of case studies are being studied, in just two countries. Norway and the UK were chosen as having a fairly new public-sector project governance framework and a well-established one respectively. It was found however as part of the UK study that defence projects (the largest public projects) were governed under a different framework from other UK public projects, so it was decided to study a defence project and a civil project in each country. Similarity between the projects in each country was sought but, as in most case-study research, access was difficult and to a certain extent we had to accept the projects that were available. The study was organised as follows. Firstly, the literature gave us a theoretical underpinning for governance in general. This enabled us to specify and structure the characteristics of a public project governance framework, and this was used in semi-structured interviews with experts in these frameworks. Analysis of framework differences then gave the foundations for the case-studies.

Governance is a term with many meanings and usages. Corporate governance has various models in different countries, which can be categorised as shareholder-value systems (USA, UK, Canada); where only shareholders are legitimate stakeholders, and communitarian systems, which hold other constituencies such as employees, banks and the community as legitimate stakeholders (including “family-based” systems eg Asia Pacific) (see eg Detomasi 2006). For us, public governance “refers to the formal and informal arrangements that determine how public decisions are made and how public actions are carried out, from the perspective of maintaining a country’s constitutional values in the face of changing problems, actors and environments.” OECD (2005). As far as projects are concerned, Governance of Projects concerns those areas of governance (public- or corporate) that are specifically related to project activities; good project governance ensures relevant, sustainable alternatives are chosen and delivered efficiently (based on APM (2002)). There seem to be three main goals: choosing the right projects; delivering the chosen projects efficiently; and ensuring projects are sustainable. The second of these goals - delivering the projects efficiently - is important to avoid wasting (public) resources and involves the framework established around the project execution. This is governance of projects. Choosing the right projects (to ensure the right objectives are achieved) and ensuring the projects (actually the goals and effects of the project) are sustainable, is governance through projects – the context in which the critical decisions are made. This is the true Governance of Projects on a public or corporate level.
The development of the frameworks

UK and Norway are similar countries in many ways. The UK however has a much larger economy with much more limited public funds, and higher unemployment. In the UK there was naturally a motivation for putting emphasis on “value for money” from the start; in Norway the focus from the beginning was directed against cost overrun – a control measure to ensure realistic budgets and a good basis for project execution. The initiatives in both countries are based on a wish to improve governance in a wide sense. There seems to be similar political backgrounds in the two countries – apart from the Nordic/Scandinavian social welfare tradition and the Anglo/American strong market orientation. The UK has a strong public administration tradition and a large influential Civil Service; Government business is divided into Departments, responsibility for a project being entirely within the Department. In Norway (NO) the Sectoral Ministry is responsible for large investment projects.

UK Office of Government Commerce (OGC)

In the late 1990s, Peter Gershon of GEC was asked by the then Prime Minister to look at procurement in government. Gershon wrote an influential report (Gershon, 1999) covering general commodity procurement and projects, and was asked to set up the OGC in 2000, pulling together staff from various agencies. The report led to the establishment of the OGC (2004) Gateway Process™ with 6 well defined, standardized and documented Gateways: Gateway Review 0 looking at strategic management at the programme level (several times where appropriate), and Gateways 1 to 5 at the project level covering different stages of the project life-cycle. Private sector engagement comes from the use of private sector experienced consultants who have been individually accredited by OGC for Gateways. The 6 Gateways look at the Ministerial level all the way down to suppliers. Parliament / Government level is undertaken by mechanisms outside this study.

Later came categorisation (looking at high political significance; riskiness of the programme; and cost, a lower level criterion): the top level is the “Top 20” Mission Critical projects; the OGC will also sit on the project board. The next level is “High Criticality”; for these, Gateway reviews have to use senior people or even all independents. Different rules apply to “Medium” and “Low Criticality” projects. Later still, a general concern for better programme management gave rise to the development of small “Centres of Excellence” as part of the framework, bringing “best practice” to the Department, acting as a liaison point within a Department for the OGC and reporting directly to the Permanent Secretary (head of the Department). Recently also has come a Project Initiation Process. The espoused aim of the framework is specifically for OGC to achieve financial savings (on commodities and projects combined, according to procedures laid down by the National Audit Office). OGC is currently reforming, becoming a smaller, more focused, organisation, reducing staff by almost half, and introducing new challenges. Reports on a particular project go only to OGC and the sponsor (in PRINCE2™ the “Senior Responsible Owner” or SRO) (although special reports on the top “mission critical” projects go to the Prime Minister’s Office) There are a substantial number of people involved in implementing the framework and giving advice.

UK Ministry of Defence (MoD)

The one major section of the UK public sector that uses a different framework is the MoD. MoD has always had an “extended life-cycle”, both very early and very late. The framework came in as the relationship with industry changed, becoming more co-operative, and ensuring both the whole industrial base and UK sovereign capability is considered. Contracting defence budgets gave motivations for Value For Money (and to getting more accurate predictions). The CADMID process, part of SMART acquisition, came in around 1998 following McKinsey work, which also showed the need for a “stronger customer” within MoD (known as “Capability Management” led by a Deputy Chief of Defence Staff). The framework is anchored within the MoD Main Board. Following the McKane report (Ministry of Defence, 2006) the procurement and logistics agencies were unified into “DE&S”. This enables the other espoused goal of the framework: to manage the MoD’s projects as a single portfolio to get the best capability for the MoD as a whole. The UK MoD system works with different types of projects, each having a different categorisation. There are two Gates; the Initial Gate to release funds for assessment, and the Main Gate to release funds for the main project. Projects go to the Investment Appraisal Board via two routes simultaneously, from the advocate of the project (the SRO) and via “independent” scrutiny
(within MoD but independent of the project). (A Foundation Review is also being brought in). The system is vertically integrated in that Gates look at the entire project, including the industrial base. Each project is undertaken by an “Integrated Project Team” (IPT), responsible on the project to the SRO but responsible overall within DE&S. Thus, the MoD considers the whole portfolio of projects; the “Capability” customer considers the programme; and the IPT the individual project. The Chief of Defence Materiel reports to corporate targets on DE&S overall performance.

Norway.

The triggering incident in Norway was a series of unsuccessful major projects and repeated project overspend during the 1980’s-90’s. Deputy Secretary General of the Ministry of Finance, Peder Berg, led a government committee investigating a number of project cases (Berg et al, 1999). The Ministry of Finance initiated the development of an obligatory Quality Assurance Scheme in 2000, with mandatory external assessment of projects (performed by consultant companies) before the financing decision by Parliament (mandatory for all state-financed projects over NOK 500 million / £42 million, excluding Oil & Gas). The goal was to ensure improved quality-at-entry. It was a bottom-up process within the Ministry, with Peder Berg as a driving force. The decision to introduce this governance framework was made by the Prime Minister's Office. In 2005 there was a second generation of the framework reflecting the need to do something at an earlier stage. The same entity is responsible for the framework for all sectors (with few exceptions), expected to give the same governance across sectors. For both generations of the QA-regime the intention was to establish a system where politics and administration is well divided, with the interplay between these two sides well understood.

The whole framework is a control measure. Control rules are documented in the contracts between the Ministry of Finance and consulting companies and the control object is the documents assessed in the regime. There are two gateways. QA1 focusses on the rationale of the project, so is the early choice of concept and strategy, the decision to initiate project pre-planning (using a compulsory dossier of four documents), looking at many alternatives. QA2 is the decision to finance the project (looking at one alternative only), controlling the Project Management Plan, with several sub-documents and a focus on cost. QA1 and QA2 give a tool for control from the top (Parliament – Government – Ministry – Agency); vertical integration stops downwards at the agency-level and the private sector is not addressed. There are several coordination Forums where the Ministry of Finance gathers key interested people for discussions, often resulting in common understanding and definition of terms and professional standards. The Concept Research Programme supports the development of the regime and studies the practices of the Agencies and consultants.

Comparison of frameworks

The three initiatives seem to have been prompted by similar developments and similar motivations; the OGC and Norwegian initiatives are both anchored at the top political level and organised under the Ministry of Finance. OGC goals are more explicit, administratively focused and measured in terms of money; in Norway there are more clearly politically anchored goals, not specifying the expected effect of implementation. All frameworks looked to include transparency (openness for scrutiny, maximum openness about basis for decisions), learning, willingness to change, setting common, high professional standards, political anchoring of framework on a high level, non-political QA/Gateway review. The process of development, however, was genuinely different. In Norway the initiating process was bottom-up, as was the implementation of the improvement. In the UK both processes were top-down, as was the implementation of the management system. Different strategies were chosen: Norway breaking with tradition and introducing a new arrangement, the UK building on tradition. The Norwegian and MoD’s framework is mandatory; the OGC framework currently works by influence, although that is set to change. The Norwegian framework is a bottom-up process of learning from cases, transferring experience to other sectors and building “the new profession”. The OGC framework to some extent is a top-down introduction of a common “quality system”. Centres of Excellence representing the “new profession”. Both Norway and OGC have established a support organization looking for systemic trends: in the UK as a permanent public administration entity: in Norway as an external research program. The MoD reports on systemic trends at a top level. OGC looks only at systemic trends - Norway and the MoD also on single cases. Norway has a centralized co-ordination forum, while the OGC has established distributed “Centres of Excellence”. (the MOD is already a single, organised entity).

Comparing the two frameworks highlights some differences. Vertical and horizontal integration is different. A
notable characteristic of the Norwegian framework, is its simplicity (a more macro-analytic perspective). Comparison of the framework components shows some of the same characteristic simplicity; the UK side is more comprehensive and adequate for more detailed control measures at a lower hierarchical level (more micro-analytic from a PPM point of view). The organisation implementing the UK governance framework also supplies the management system the answer to the question; “how to achieve”, whereas the Norwegian framework only answers “what to achieve”. The use of external consultants is similar in both countries, but in Norway companies are assigned, in UK it is individuals. The Norwegian framework is mandatory and consultants are thus not the ones that have to persuade the agencies and project organisations. In the UK, the assessment requires only a small amount of effort from senior consultants; review roles are defined in detail, and there is a standard report format; in Norway the QA-team (roles agreed in the Forum) performs a complete independent analysis of the project, over many month; for MoD, assessments are effectively within MoD; roles and the dossier format are defined in detail. In Norway the control measures are focussed on cost and risk (initially at least, but moving more towards benefit and value), whereas the UK side is focussed on the business case/value for money. The Norwegian life-cycle chooses the concept and strategy very early; MoD has an even more extended life-cycle with very early gateways. For cost and time estimation, the OGC framework is complex, complete and detailed, the MoD framework being the high level approach linked to concrete guidelines; the Norwegian approach is the simplistic approach; remarkable at this level being maybe the scarce references to time planning – but the only system that carries out full independent cost estimates.

Four Cases

Norway defence case (Skjold)

The Skjold class Fast Patrol Boat (FPB) project encompasses the construction of a new vessel, weapon systems, personnel training and logistics and support. The project includes building a series of six vessels. It is an example of a complex defence procurement project. From an overall perspective the Skjold project is currently on budget and schedule. None of the vessels have been delivered to the end user, but the construction phase goes on as planned. The complexity of the decision making process, the technology and the contractual arrangements proved a challenge for the quality assurance in this case.

Fast patrol boats have been a part of the Norwegian Navy strategy for a long time. In the early 1990’s a need to update current vessels and start planning for the next generation was identified. A pre-series vessel HNoMS Skjold was completed in 1999 as a separate project. The principal decision to establish the Skjold class FPBs as a part of the Norwegian Navy was resolved in a broad political compromise in the Norwegian parliament in June 2001. The recommendation from the Ministry of Defence, however, was not to pursue the Skjold project further. The Chief of Defence had in the recent Defence Study 2000 concluded that the investment and operating costs of the proposed fleet of FPBs should not be prioritized, considering other investments and current liabilities of the Norwegian Defence.

During the planning phase of this project the experience from updating the previous class of vessels and the development and building of a pre-series vessel (the prototype) was important. The result was a unique vessel hardly comparable to any other. The pre-project documents were subject to a Quality Assurance 2 (QA2) in 2002. The QA2 concluded the project was well planned and prepared to go into next phase. In 2003 the Norwegian parliament finally decided to execute the project. Again the Chief of Defence appealed to the Parliament not to make this decision but wait for the next long-term plan coming up next year. This did not happen and the execution started. The process described here seems to uncover some weaknesses in the quality assurance at the time. Some indications:

- The basic need of the project is not part of the QA assignment. (This was not introduced until later as a part of QA1 in 2005.)
- No independent cost estimation was done. The analysis was based only on the projects own cost data – primarily the First-Target-Prize from the supplier consortium.
- The QA2 report (March 2002) comments that the documents produced at the time was of good quality up to the stage of entering a contract, but was not prepared to enter the execution phase (page 9). There was no Project Control Plan established at the time of the QA2, therefore this was not controlled. This was in an early phase of the Norwegian QA scheme and the practical procedures where not yet established as a common basis (this happened later in 2003).
- Due to ongoing negotiations, the QA consultants were not allowed to access the suppliers personnel. This
cut them off from a prime source of information. This questions the timing of the QA2 itself.

These weaknesses were due to the governance framework being less than mature and the special situation analyzing a unique, highly complex project within the context of a sensitive Defence sector with a culture not known to be very open for sharing information – for obvious reasons. The quality assurance documented here is representative for the time it represents.

The impact of the QA2 was less significant in this case. No significant changes to cost estimates or schedule was made. The project organisation did not develop or produce any new or specially adapted documents. The analysis did not identify any new risk elements. However, the process of QA2 gave reassurance that the project was well planned. As shown above, the project goes on according to plan, so there is no sign to indicate this was not a good conclusion.

The potential impacts were not produced in this case. The most important aspect illustrated by this case is that no matter how clear professional advice is for or against the project and whatever result of extensive use of rational methods, the final decision is a political one. This is not altered by QA2 or any other control instrument. This is how it should be – it is anchored deep is the democratic system and the governance framework.

**UK civil case (2MS)**

The UK Home Office began a procurement process in 1996 after a review of its accommodation concluded that it existing estate needed to be refurbished. In 1998, the Home Office had obtained three competing bids, proposing the existing building at 2 Marsham Street (or 2MS) as temporary accommodation during the refurbishment. Annes Gate Property plc (AGP), however, made a developed and costed variant bid for a new building at 2MS, and it was this plan that was adopted. Two bidders submitted Further Best and Final Offers. AGP’s turned out to be the winning bid. Extensive probing of the bid by the Project Team was undertaken, covering the history of the company and previous similar projects, risk, the detailed resourced programme, and a Quantity Survey-type analysis of the price.

The first Gateway Review of the contract was a Gateway 3, in January 2001, in the lead up to placement of contract (this was only around 8 months after the foundation of OGC). The aims of the Review were (very briefly) to confirm the business case and benefits plan in the light of the final tender, confirm that the plan should deliver the specified outcomes and Value for Money, and ensure controls were in place. Outstanding issues were looked at a Supplementary Gateway 3, and further issues later arose which led to a Further Supplementary Gateway 3 in August 2001. At this point the Home Office was starting on a relationship with a bidder; who was very experienced and sophisticated, and having expert support was a good idea for the project.

Analysis following advice taken from consultants and correspondence with the National Audit Office indicated that using the UK Private Finance Initiative would give the best value, and in March 2002, the Home Office signed a 29 year contract with AGP for funding demolition, design and construction of the new accommodation on the site and provision of associated services. Because this is a PFI project, the authors do not have access to detailed time and cost estimates (although no increase in price has been reported to date). However, it is interesting that a Parliamentary enquiry later identified evidence of optimism bias, in over-estimating reductions in staff numbers due to outsourcing, efficiency gains and changes in working practices.

During the contract, internal governance was managed through an on-going Project Board; this decided when Gateways were to be held, and tracked the external governance processes. Key risk areas or issues could be tracked here, such us uncertainties in the numbers of staff actually going into the building. A Gateway 4 review was held in January 2002 (‘slightly early’ within the process at the request of the Treasury – implying that they held a watching brief). This had 15 specified purposes, including to check that the current phase of the contract was properly completed, that the business case was still valid and unaffected by events (reflecting some of what a Gateway 0 might be expected to investigate), and looking at risks particularly. (There was also more than one Gateway 4). There was a separate PFI contract for the information Technology provision in the building; however, the governance mechanism appears to have been single project-based, and the governance of this linked project was not clear.

External governance operated through the Home Office’ Audit and Assurance Unit, and beyond the Home
Office to the National Audit Office (NAO). The NAO were able to come in between contract signature and start of construction, and issued a favourable report in July 2003, particularly on the nature of the PFI contract. The NAO is there to scrutinise public spending on behalf of Parliament (independent of Government), and the report was taken up by the key Parliamentary Accounts Committee (PAC). It met in November 2003 to look into Value for Money, including the running costs, financing, numbers of staff and refinancing charges. The most senior members of the Home Office and contractors were called to give evidence. The hard-hitting report made recommendations on under-forecasting of staff numbers, identification of wider business benefits from the move to the new building, questioning a specific financing issue, and a question about disposal of the existing estate. PAC reports are taken extremely seriously by the Civil Service. This being a very visible public project, there was also a considerably interest more generally within Parliament, and a succession of Parliamentary Questions - some covering fundamental issues in the project, but many on much more detailed issues only tangential to the success of the project.

The building handover was completed on time in January 2005, amid considerable publicity. The Home Office then began paying AGP a monthly charge for the building and services amounting to £311 million (net present cost) over the life of the project.

Norway civil case (IFI2)

The IFI2-project includes the construction of a new building for teaching, research and ICT operations at the Department of Informatics at the University of Oslo (UiO). The building’s planned gross area is around 28 250 square meter. The current base estimate of the building is of NOK 1 040 million, and the current total budget is NOK 1 080 million (both price level 2006). The need for new facilities for the UiO Department of Informatics was explicitly mentioned in a Government proposition to the Parliament in 1998. The driving forces seem to have been the Department for Informatics’ expressed needs for more space closely aligned with government strategies to strengthen research and higher education in ICT. In 1999 the Research Council of Norway (NRC) ordered a design proposition for a new building which was presented in 2000. The initial plans included a 10 000 square meter extension of an existing building financed by the Research Council of Norway. The new facilities would then be rented by the University of Oslo. In 2001, following discussions on the level of rent in this alternative, the Parliament decided to put the new building on the list of prioritised state building projects. This meant 100 % state funding of the new building and execution by Statsbygg (Directorate of Public Construction and Property). The project thus went into a new planning phase, and in 2002 Statsbygg, launched a design contest for the IFI2-building. The preproject was completed in February 2004, but the project had to wait for funding, until the parliamentary decision to finance and execute the project was made in May 2005. The new building will, according to the current schedule, be completed in 2010.

The early stages of development shows that issues concerning the execution model and funding sparked some discussion, but there seems to have been no disagreement of the basic need for the project.

The cost focus is prevalent in the QA2 analysis performed in 2004. Without performing complete independent cost estimation, the quality assurance confirmed the project’s own cost estimates and assumed needs for budgets. The corresponding uncertainty analyses of the cost placed the market situation on top of the list of identified uncertainty elements. Due to price increase in the construction market the budget of the project has later been raised, first by authorisation to use the contingency reserve and later by a regular budget increase in November 2007. Should the successfullness of the QA be judged from the ability to accurately predict costs or just from the ability to identify the most important risk? The project has not been completed, so the real accuracy of the cost estimate remains to be seen. Due to waiting for funding, the project came to market roughly a year later than what had been assumed. Cost uncertainty analyses cannot be regarded as relevant without continuous updates. The project faced a totally different market situation when the decision to finance and execute the project was made, and the uncertainty analysis had not been updated.

There is no doubt that the control focus is prevalent in the QA2 assignment. The main argument is that there should be a review of cost, schedule and other key areas before the decision to finance and execute large public projects is taken. It is observed that the subordinate agency generally does not oppose this, but their assessment of QA and its output in this project is that it is redundant and cost-consuming. In this case the QA did not lead to budget changes or other direct changes to the decision basis. This is perhaps the reason for one of the interviewees from the project to suggest that: “The QA is done more to relieve the Ministry of Finance than to
help Statsbygg”. However, there seems to be a great deal of consensus on how the process itself should be described. Interviewees from the project organisation and the QA team described the exchange of information as excellent and the interaction between the involved parties as very good.

On the question of output of the process, we observe that the project organisation expects a bit more than a “scratch of the surface” of project documents. The QA2 cost focus is described as important by interviewees from the project organisation. The control of cost should also include an assessment of technical solutions and their cost effectiveness. This would require another focus in the analysis, from control of numbers to evaluation of technical solutions, and thus, more technical skills from those responsible for conducting the analyses.

**UK defence case (NEADS)**

Ground Based Air Defence (GBAD) is an important defence against an increasing range of low-level airborne threats (e.g., helicopters, unmanned air-vehicles and cruise missiles). In order to be effective, as well as a weapon, there needs to be the ability to take and fuse data from multiple sensors to form a reliable picture of the situation, identify the target and control of the weapon. UK defence currently has two GBAD weapons in its armoury: “HVM” and “Rapier” which are to be replaced. A “future GBAD” “Integrated Project Team” (IPT) was set up following a 1994 NATO feasibility study which suggested an £8bn solution, which seemed reasonable to the independent MoD estimators based on historic data—the basis by which this group estimates; a funding line for this amount was “endorsed”, which means that it was accepted as a programme (i.e., it appears in the long-term funding plans, but no Gate has been gone through yet).

There were two stages to the project: the air-defence Command, Control, Communication & Intelligence under which UK air defence assets would be integrated, and secondly the defensive missile and battle-space management (including sensors and data-fusion). The Business Case for the first was prepared, with a budget of approximately $1bn. Initial Gate was passed in 2001, allowing an Assessment Phase (and a concept phase for the second phase). However, in 2003 there was a general funding reduction. The Customer had to cut funding; he had two other programmes within his remit at that point, both well forward with a lot of money committed, and at least one clearly politically very sensitive. He therefore changed the £1bn to £200M, to give only limited situation awareness. This very basic version of the first phase is now coming to the end of its 2nd assessment phase and has a Main Gate around March 2008, with forecast in-service date of 2010.

NEADS (Network Enabled Air-Space Defence & Surveillance) was established as the remaining capability, with a slightly limited budget; it is currently in Concept phase (began Oct 2006), expecting Initial Gate in 2009, expecting a Main Gate in 2012, and has a Planning Assumption for Service Entry of 2020. When the funding was cut (see above), there was a “cancellation charge”, giving the opportunity for some industrial work, which was used to develop the missile (without necessarily the user-requirement, system requirement, capability gap analysis, a concept of employment etc – let along the bulk of NEADS, the sensors, data-fusion and communications). The budget for the concept stage of NEADS was also cut substantially in 2003/4, but a Technology Demonstration Programme has been placed which finishes shortly.

For the point of the view of the MoD the strategic need for this capability is clear. There are two weapons that will be going out of service. The main drivers to decision-making here, which affected the project process fundamentally, therefore appear at the first instance to be three-fold: the essential In-Service Date for the capability due to obsolescence of current equipment; the needs of the UK industrial base, and cost restrictions, increasing during the course of the project so far. Three other drivers also come into play: political sensitivity, opportunistic behaviour, and the requirement to keep some UK sovereign aspects.

In considering the impact of the MoD governance framework on the project, there are two notable aspects of the NEADS project: the organisation takes less interest than they might because they are part of an IPT in which the other projects are nearer to Gates; and the project is in the early stages, where a project within DE&S perhaps finds it easier to minimise visibility and get the task done. The NEADS project has so far been governed through a mixture of internal (to the IPT) and external assurance. It has not undertaken any OGC Gateway reviews so far, and no Foundation Review was undertaken; it will be reviewed by an internal board prior to submission for the Initial Gate expected in 2009. The NEADS project is an example of a complex defence development project. It illustrates why emphasis is needed on the concept stage of such projects, as while there may be a clear understanding of the requirement, the best way to fulfil this requirement in a cost-constrained environment is a
highly complex and changing decision. It perhaps illustrates the need for structured governance processes in the long period up to the MoD Initial Gate, where the project can travel a long and windy path. It also illustrates the difference between a straightforward statement of “the” governance process, and the actuality in projects operating over a number of years within an environment of changing political and cost priorities.

Conclusions

A number of conclusions can be drawn from these cases.

- It is clear from these cases – particularly NEADS – that the complexity (of decision making, technology and contracts) shows why a governance framework is important, although it is also clearly (from Skjold) a challenge for quality assurance.
- The governance mechanism throughout appears to have been project-based, and the governance of linked projects was not clear (eg in 2MS), and more importantly, there are clear issues in the division of a programme into projects (eg NEADS). Having said that, in the OGC methodology (2MS) it was clear that Gateways could include study of business-case issues.
- The cases illustrate why emphasis is needed on the concept stage of such projects. For Skjold, neither the basic need of the project nor the value perspective were included in the QA. NEADS illustrates the need for structured governance processes in the long period up to the first decision.
- The amount of cost and time information available in all of these case was very limited (for 2MS, particularly because of the PFI nature). However we do know that the cost analyses presented for IFI2 by the project organisation and the QA team were very close. It is interesting that it was another governance mechanism (Parliament) that picked up the optimism bias for 2MS (and that in benefits, rather than costs). For Skjold, despite being within the Norwegian QA system, there was no independent cost estimation.
- Indeed in general, the cases have illustrated the difference between a straightforward statement of “the” governance process, and the actuality in projects. This is particularly seen (as positive and negative) in NEADS, but 2MS shows also flexibility in the OGC system, where Gateways can be repeated and moved.
- Transaction Cost economics will highlight the power of the suppliers. For 2MS, having expert support from those experienced in dealing with sophisticated and experienced contractors appears to have been valuable; Skjold had the problem that the QA consultants were not allowed to access the suppliers personnel.
- For 2MS, the effect of other governance processes were interesting - NAO, Parliament and Treasury.
- It is clear from theses cases that the control focus is prevalent in the QA system – and there are similar hints in the MoD system; this is less true for the Gateways which are more “friendly” gates.
- Having said that, it is also clear that the QA process gives reassurance (for Skjold and IFI2); for both Skjold and 2MS the project went according to plan, making it more difficult to conclude about the effect of the framework on the system.
- Finally, the Skjold project shows that no matter what the professional advice or the result of rational methods, the final decision is a political one. (Skjold)

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An investigation of governance frameworks for public projects in Norway and the UK

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Abstract

This paper describes four case studies which formed a key part of an investigation into public investment project governance frameworks in Norway and the UK. The studies looked at how the embedded governance principles worked out in practice, how they affected PM, and how consistent their effects were with their aims. Conclusion is made about the actual effects of the frameworks, and various areas for improvement or further study are highlighted.

Keywords: Governance; Case studies; Public projects

1. Introduction

Authorities and governments set up various governance frameworks for public projects, but the effect of these on the development of project plans and estimates is not clear. Such frameworks are set up to be self-evidently appropriate, but this does not always apply to complex projects [1]. The effect of bias in the estimates, such as optimism bias and strategic under-estimation is known [2]. However, it is not clear how the various governance frameworks exacerbate or ameliorate these effects, and this is crucial to understanding how to tackle the problem, rather than the “sledgehammer” approach of simply adding factors onto estimates.

Supported by the Project Management Institute (PMI), researchers from the Concept Programme (Norway) and Southampton University have been undertaking a study which analyses the frameworks for front-end appraisal and governance of public investment projects. The aim of this work is to look at how governance regimes for major investment projects in different countries affect project performance, comparing this with the intended effect, including cost and time management. This type of “how” and “why” question cannot be properly answered by a positivist approach. Rather, it requires a phenomenological approach [3], looking in depth at a small number of cases. There are essentially two types of such study: action research, in which we could affect the course of the projects under consideration [4], or case studies, in which effects are observed by an essentially neutral observer [5]. In this study, we had to take the latter role, although it should be noted that the very existence of the Quality Assurance Scheme has a significant effect on the estimation process in the Norwegian projects studied. Four case studies are examined to see how the implemented governance frameworks actually affect Project Management and how consistent they are with the stated aims. While definitive conclusions cannot be drawn, some interesting pointers are given as to the behaviour of the frameworks [6]. This paper only describes conclusions from the case studies, rather than offering the more philosophical and theoretical conclusions, found in the final report [7].

This was a small study, undertaken to find initial results. Two case studies are examined, in two different countries. Norway and the UK were chosen as having, respectively,
a fairly new public-sector project governance framework, and a well-established one. It was found, however, during the UK study, that defence projects (the largest set of public projects) were governed under a different framework from other UK public projects, so it was decided to study a defence project and a civil project in each country. Similarity between the projects in each was sought but, as in most case study research, access was difficult and the choice of projects was largely based on their availability.

The frameworks studied in this paper were developed carefully and rationally, and set out what ought to happen, or what is “espoused” as (or claimed to be) happening. However, in much empirical research it is found that what happens in practice can vary significantly from the espoused approach [8]. Any such difference (and the reasons for it) is of interest when looking at governance structure [9]. Indeed, what is needed to improve project management and project governance in practice generally, is not simply more research on what should be done. Cicmil et al. [10] describe a research approach that takes seriously practitioners’ lived experience of the actuality of projects. It looks not only at the circumstances of the project, but also at praxis, at context-dependent judgement, bounded rationality, power and politics, etc. Our case studies touch on some of these themes.

The study was organised as follows: firstly, the literature provided a theoretical underpinning for governance in general. This enabled us to specify and structure the characteristics of a public project governance framework, and was used in semi-structured interviews with experts in the frameworks. Full details of these steps are given in the final Report [7], which describes the espoused frameworks and their differences. This paper, however, aims to look at the outworkings in actuality of the frameworks and differences. Analysis of framework differences provided foundations for the case studies: in particular, it developed a structured questionnaire that was sent to certain senior project personnel, and a structured set of pointers for each researcher, so that there was commonality of approach across the case studies.

“Governance” is a term with many meanings and usages. Corporate governance has various models in different countries, which can be categorised as shareholder-value systems, where only shareholders are legitimate stakeholders (USA, UK, Canada), and communitarian systems, which hold other constituencies such as employees, banks and the community as legitimate stakeholders. The latter may include “family-based” systems, e.g. Asia Pacific [11]. In this paper, public governance “refers to the formal and informal arrangements that determine how public decisions are made and how public actions are carried out, from the perspective of maintaining a country’s constitutional values in the face of changing problems, actors and environments” (OECD [12]).

As far as projects are concerned, “governance of projects” concerns those areas of governance (public or corporate) that are specifically related to project activities. Good project governance ensures that relevant, sustainable alternatives are chosen and delivered efficiently (APM [13]). There are three main aims: choosing the right projects, delivering the chosen projects efficiently and ensuring projects are sustainable. The second of these aims – delivering the projects efficiently – is important to avoid wasting public resources, and involves the framework established around the project execution. This is governance of projects. Choosing the right projects, achieving the right objectives, and ensuring the projects and their effects are sustainable, is governance through projects – the context in which the critical decisions are made. This is true governance of projects on a public or corporate level. As will become evident through the description of the frameworks and cases in this paper, a strong focus on reviews and intervention logic is present in practice. This suggests a more narrow and traditional definition of governance as control than that envisaged by these researchers.

This paper will briefly describe the frameworks, discuss the case studies and draw some conclusions.

2. The development of the frameworks

The UK and Norway are similar countries in many ways, but the UK has a much larger economy with much more limited public funds, and higher unemployment. In the UK there was naturally a motivation for putting emphasis on “value for money” from the start; in Norway the focus from the beginning was directed against cost overrun – a control measure to ensure realistic budgets and a good basis for project execution. The initiatives in both countries were based on a wish to improve governance in a wide sense. The two countries have similar political backgrounds – apart from the Nordic/Scandinavian social welfare tradition and the Anglo/American strong market orientation. The UK has a strong public administration tradition with a large and influential Civil Service. Government business is divided into Departments, responsibility for a project being entirely within the Department. In Norway (NO) the Sectoral Ministry is responsible for large investment projects.

This section describes the development of the different frameworks. It should be noted that all three frameworks underwent development between 2007, when the investigation was carried out, and 2008 when this paper was written. Interestingly, the experience of implementing their particular frameworks led both the UK and Norwegian Governments to adjust them. The result of these changes and improvements gave the frameworks a certain degree of similarity.

2.1. UK Office of Government Commerce (OGC)

In the late 1990s, Peter Gershon of GEC was asked by the then Prime Minister to look at procurement in government. Gershon wrote an influential report, covering general commodity procurement and projects, and was asked to set
up the OGC in 2000, pulling together staff from various agencies [14]. The report led to the establishment of the OGC (2004) Gateway Process™ with six well-defined, standardized and documented Gateways. Gateway Review 0 looked at strategic management at the programme level, and Gateways 1–5 at the project level, covering different stages of the project life-cycle. Private sector engagement came from the use of experienced consultants who had been individually accredited by OGC for Gateways. The Six Gateways start at Ministerial level and work all the way down to suppliers. Parliamentary/Governmental level is undertaken by mechanisms outside this study.

Criticality came later, looking at high political significance, riskiness of the programme and cost. At the top level were the “Top 20” Mission Critical projects, the OGC sitting on the project board. The next level was “High Criticality”: for these, Gateway reviews had to use senior people or independents. Different rules applied to “Medium” and “Low Criticality” projects. Later still, a general concern for better programme management gave rise to the development of small Centres of Excellence as part of the framework, bringing “best practice” to the Department, acting as an OGC liaison point within a Department and reporting directly to the Head of Department. More recently came a Project Initiation Process. The espoused aim of the framework is specifically for the OGC to achieve financial savings (according to procedures laid down by the National Audit Office). At the time of this research, the OGC worked by influence – its recommendations had not then been mandated (although this is set to change). This is the traditional UK civil service culture. The OGC did not consider individual project Gateway reports; rather they looked for systemic trends. Reports on a particular project went only to the OGC and the sponsor (the “Senior Responsible Owner”/SRO), although special reports on the top “mission critical” projects go to the Prime Minister’s Office. A substantial number of people were involved in implementing the framework and giving advice.

A Treasury report entitled “Transforming government procurement” [15], stated that the OGC would become more focused, powerful and smaller, and, since this research was carried out, the Gateway Process has been mandated, with four areas of development in the OGC framework:

- **Major Projects Portfolio**: The system of criticality has been replaced by the Major Projects Portfolio – a list of the key projects across the public sector for delivering the Government’s service imperatives. A single integrated quarterly report on the health of the Government’s Major Projects Portfolio will be produced in conjunction with the Cabinet Office.
- **Major Projects Review Group**: This is a scrutiny committee for major Government projects, sponsored by the Treasury, challenging projects on deliverability, affordability and value-for-money. Their intervention will not only help the team, but will also be of the nature of a scrutiny so will have much stronger power, with an emphasis on actions to be taken. It consists of eleven very senior members of the Civil Service or Government agencies.
- **Enhanced Gateway Reviews**: There will be a new overarching rating of “delivery confidence” to supplement the current rating, indicating the Review team’s assessment of their confidence that the project will deliver its intended outcomes and benefits. When there is a “Red” rating, the report will not only go to the sponsor, but will be escalated to the Head of Department and beyond. The reviews will also include action plans, monitored by OGC.
- **“Starting Gate”**: A new intervention is to be introduced, intended to provide assurance at the stage of developing major new policy options, prior to initiation of a project or programme.

### 2.2. UK Ministry of Defence (MoD)

The one major section of the UK public sector that uses a different framework is the MoD. The MoD has always had an “extended life-cycle”, both very early and very late. The framework came in as the relationship with industry changed, becoming more co-operative, and ensuring that both the whole industrial base and UK sovereign capability are considered. Contracting defence budgets gave motivation for value-for-money and to procuring more accurate predictions. The CADMID process, part of SMART acquisition, was introduced in 1998, following McKinsey work, which also showed the need for a stronger customer within the MoD. This became known as “Capability Management” and was led by a Deputy Chief of Defence Staff. The framework is anchored within the MoD Main Board. Following the McKane report [16], the procurement and logistics agencies were unified into “DE&S”. This encompassed the other espoused goal of the framework: to manage the MoD’s projects as a single portfolio in order to get the best capability for the MoD as a whole. The UK MoD system works with different types of projects, each having a different categorisation. There are two Gates: the Initial Gate to release funds for assessment, and the Main Gate to release funds for the main project. Projects go to the Investment Appraisal Board via two routes simultaneously, from the advocate of the project (the SRO) and via independent scrutiny (within MoD but independent of the project). A preliminary “Foundation Review” is also being brought in. The system is vertically integrated, in that Gates look at the entire project, including the industrial base. Each project is undertaken by an “Integrated Project Team” (IPT), responsible on the project to the SRO, but responsible overall within DE&S. Thus, the MoD considers the whole portfolio of projects; the “Capability” customer considers the programme; and the IPT, the individual project. The Chief of Defence Material reports to corporate targets on DE&S overall performance. Current transitions of the framework consist of minor changes following the McKane report.
2.3. Norway

The triggering incident in Norway was a series of unsuccessful major projects and repeated project overspend during the 1980–90s. Deputy Secretary General of the Ministry of Finance, Peder Berg, led a government committee investigating a number of project cases [17]. The Ministry of Finance initiated the development of an obligatory Quality Assurance Scheme in 2000, with mandatory external assessment of projects, performed by consultant companies, before the financing decision by Parliament. This was mandatory for all state-financed projects over NOK 500 million/£42 million, excluding Oil and Gas. The goal was to ensure improved quality-at-entry. It was a bottom-up process within the Ministry, with Peder Berg as a driving force. The decision to introduce this governance framework was made by the Prime Minister’s Office. In 2005 there was a second generation of the framework, reflecting the need to do something at an earlier stage. The same entity is responsible for the governance framework across all sectors, with few exceptions. For both generations of the QA Scheme the intention was to establish a system where politics and administration is well divided, with the interplay between these two sides well understood.

The whole framework is a control measure. Control rules are documented in the contracts between the Ministry of Finance and consulting companies, the control object being the documents assessed in the regime. There are two gateways: QA1 focuses on the rationale of the project. It covers the early choice of concept and strategy, and the decision to initiate project pre-planning, using a compulsory dossier of four documents, and looking at many alternatives. QA2 considers the decision to finance the project, looking at one alternative only, and controlling the Project Management Plan, with several sub-documents and a focus on cost. QA1 and QA2 provide a tool for control from the top; Parliament–Government–Ministry–Agency. Vertical integration stops at the agency-level and the private sector is not addressed. There are several coordination Forums where the Ministry of Finance gathers key interested people for discussions, often resulting in common understanding and definition of terms and professional standards. The Concept Research Programme supports the development of the regime and studies the practices of the agencies and consultants.

As soon as the new framework was introduced in 2005, the need to develop new common definitions and guidelines was evident. Using the same model as that in the previous introduction period, a number of development processes have been started, resulting in a series of new guidelines.

2.4. Comparison of frameworks

The three initiatives seem to have been prompted by similar developments and motivations; the OGC and Norwegian initiatives are both anchored at the top political level and organised under the Ministry of Finance. OGC goals are more explicit, administratively focused and measured in terms of money; in Norway there are more clearly politically anchored goals, which do not specify the expected effect of implementation. All frameworks aimed to include transparency, being open to scrutiny, and particularly candid about the basis for decision-making. Also included were learning, willingness to change, the setting of common, high professional standards and political anchoring of the framework on a high level, or non-political QA/Gateway review. The process of development, however, was genuinely different. In Norway the initiating process was bottom-up, as was the implementation of the improvement. In the UK both processes were top-down, as was the implementation of the management system. Different strategies were chosen: Norway breaking with tradition and introducing a new arrangement, the UK building on tradition. The Norwegian and MoD’s frameworks are mandatory; the OGC framework currently works by influence. The Norwegian framework is a bottom-up process of learning from cases, transferring experience to other sectors and building “the new profession”. The UK OGC and MoD frameworks, to some extent, are a top-down introduction of a common “quality system”, the Centres of Excellence representing the “new profession”. Both Norway and the OGC have established a support organisation looking for systemic trends: in the UK as a permanent public entity; in Norway as an external research programme. The MoD reports on systemic trends at a top level. The OGC looks only at systemic trends; Norway and the MoD also report on single cases. Norway has a centralized co-ordination forum, while the OGC has established distributed “Centres of Excellence”. (The MOD is already a single, organised entity.)

Comparison of the two frameworks highlights some differences. Vertical and horizontal integration is different. A notable characteristic of the Norwegian framework, and its components, is its simplicity, with a more macro-analytic perspective; the UK side is more comprehensive, and adequate for more detailed control measures at a lower hierarchical level, being more micro-analytic from a PPM point of view. The organisation implementing the UK governance framework also supplies the answer to the question: “how to achieve”, whereas the Norwegian framework only answers “what to achieve”. The use of external consultants is similar in both countries, but in Norway companies are assigned to carry out reviews; in the UK this is done by individuals. The Norwegian framework is mandatory, so consultants do not have to persuade the agencies and project organisations. In the UK, the assessment requires only a small amount of effort from senior consultants [18], review roles are defined in detail, and there is a standard report format; in Norway the QA-team performs a complete independent analysis of the project, over many months, with roles agreed in the Forum; within the MoD, assessments are made internally, roles and the dossier format being defined in detail. In Norway the control measures were focused initially on cost and risk, but are...
moving more towards benefit and value, particularly following the introduction of QA1; whereas the UK side is focused on the business case/value for money. In the Norway life-cycle, concept and strategy are chosen very early; the MoD has an even more extended life-cycle with very early gateways. For cost and time estimation, the OGC framework is complex, complete and detailed, the MoD framework has a high level approach linked to concrete guidelines; the Norwegian approach is more simplistic, with scant reference to time-planning. However it is the only system that carries out full independent cost estimates.

3. Four cases

3.1. Norway defence case (Skjold)

Information about this case came from semi-structured interviews, supported by a pre-supplied questionnaire, with senior personnel involved in the project, and extensive study of the project and QA documentation. There is little in the public domain about the details of how this project was operated, but there is a publically available report [19].

The Skjold class Fast Patrol Boat (FPB) project encompasses the construction of a new vessel, weapon systems, personnel training and logistics and support. The project includes building a series of six vessels. It is an example of a complex defence procurement project. From an overall perspective the Skjold project is currently on budget and schedule. None of the vessels has been delivered to the end user, but the construction phase is proceeding as planned. The complexity of the decision-making process, the technology and the contractual arrangements proved a challenge for quality assurance in this case.

Fast Patrol Boats have been a part of the Norwegian Navy strategy for a long time. In the early 1990s a need to update current vessels and start planning for the next generation was identified. A pre-series vessel, HNoMS Skjold, was completed in 1999 as a separate project. The principal decision to establish the Skjold class FPBs as a part of the Norwegian Navy was resolved in a broad political compromise by the Norwegian Parliament in June 2001. The recommendation from the Ministry of Defence, however, was not to pursue the Skjold project further. The Chief of Defence had, in the recent Defence Study 2000, concluded that the investment and operating costs of the proposed fleet of FPBs should not be prioritized, considering other investments and current liabilities of Norwegian Defence.

During the planning phase of this project the experience of updating the previous class of vessels and the development and building of a pre-series vessel (the prototype) was important. The result was a unique vessel, incomparable to any other. The pre-project documents were subject to a Quality Assurance 2 (QA2) in 2002. The QA2 concluded that the project was well-planned, and prepared to go into next phase. In 2003 the Norwegian Parliament finally decided to execute the project. Again the Chief of Defence appealed to Parliament not to make this decision but to wait for the next long-term plan the following year. This did not happen and execution of the project began. The process described here uncovers some weaknesses in the quality assurance at the time:

- The basic need for the project was not part of the QA assignment. This was not introduced until 2005, as a part of QA1.
- No independent cost estimation was done. The analysis was based only on the project’s own cost data – primarily the First Target Prize from the supplier consortium.
- The QA2 report (March 2002) comments that the document produced at the time was of good quality up to the stage of entering a contract, but was not prepared to enter the execution phase. There was no “Project Control Plan” or steering document in place at the time of the QA2, so this was not controlled. The QA scheme was in its early phase, and practical procedures were not commonly established until 2003.
- Due to ongoing negotiations, the QA consultants were not allowed to access the suppliers’ personnel. This cut them off from a prime source of information, and questions the whole timing of the QA2.

These weaknesses were due to the governance framework being less than mature, and the special situation in which a unique, highly complex project was analysed within the context of a sensitive Defence sector. The quality assurance documented here is representative of the time.

The impact of the QA2 was less significant here. No significant changes to cost estimates or schedule were made. The project organisation did not develop any new or specially adapted documents. The analysis did not identify any new risk elements. On the contrary, the findings of QA2 gave some reassurance that the project was well-formulated, and it is proceeding according to plan.

The potential impacts were not considered here. The most important aspect illustrated by this case is that no matter how strong professional advice may be for, or against, a project, and whatever the result of extensive use of rational methods, the final decision is a political one. This is not altered by QA2 or any other control instrument.

3.2. UK civil case (2MS)

Information about this case came from semi-structured interviews, supported by a pre-supplied questionnaire, with senior personnel involved in the project, and from an extensive review of the case archives held by the client. In addition, useful summaries may be found in public documents [20,21].

The UK Home Office began a procurement process in 1996 after a review of its accommodation concluded that its existing estate needed to be refurbished. In 1998, the Home Office obtained three competing bids, proposing
the existing building at 2 Marsham Street (or 2MS) as temporary accommodation during the refurbishment. Anne’s Gate Property plc (AGP), however, made a developed and costed variant bid for a new building at 2MS, and this plan was adopted. Two bidders submitted further best and final offers. AGP’s bid turned out to be the winner. Extensive probing of the bid by the Project Team was undertaken, investigating the history of the company and previous similar projects, risk, the detailed resourced programme, and a Quantity Survey-type analysis of the price.

The first Gateway Review of the contract was a Gateway 3, in January 2001, during the lead-up to placement of contract. This was only about eight months after the foundation of the OGC. The aims of the Review were, briefly, to confirm the business case and benefits plan in the light of the final tender, to ascertain that the plan should deliver the specified outcomes and value-for-money, and to ensure controls were in place. Outstanding issues were looked at in a Supplementary Gateway 3, with further issues arising later, and leading to a Further Supplementary Gateway 3 in August 2001. At this point the Home Office was embarking on a relationship with a bidder who was very experienced and sophisticated. Having expert support was beneficial to the project.

Analysis following advice taken from consultants and correspondence with the National Audit Office indicated that using the UK Private Finance Initiative would give the best value. In March 2002, the Home Office signed a 29 year contract with AGP for funding demolition, design and construction of the new accommodation on the site, together with provision of associated services. Because this is a PFI project, the authors of this paper do not have access to detailed time and cost estimates, although no increase in price has been reported to date. However, it is interesting that a Parliamentary enquiry later identified evidence of optimism bias, in over-estimating reductions in staff numbers due to outsourcing, efficiency gains and changes in working practices.

During the contract, internal governance was managed through an ongoing Project Board, which decided when Gateways were to be held, and tracked the external governance processes. Key risk areas or issues could be tracked here, such as uncertainties in the numbers of staff actually going into the building. A Gateway 4 review was held in January 2002, at the request of the Treasury – implying that they held a watching brief. This had fifteen specified purposes, including to check that the current phase of the contract was properly completed, that the business case was still valid and unaffected by events – reflecting some of what a Gateway 0 might be expected to investigate – and looking at risks in particular. There was, in fact, more than one Gateway 4, together with a separate PFI contract for information technology provision in the building. However, the governance mechanism appears to have been single project-based, and the governance of this linked project was not clear.

External governance operated through the Home Office Audit and Assurance Unit, and beyond this, to the National Audit Office (NAO). The NAO came on the scene between contract signature and start of construction, and issued a favourable report in July 2003, particularly on the nature of the PFI contract. The role of the NAO is to scrutinise public spending on behalf of Parliament, independently of Government, and their report was taken up by the key Parliamentary Accounts Committee (PAC). This Committee met in November 2003 to look into value-for-money, including running costs, financing numbers of staff and refinancing charges. The most senior members of the Home Office and contractors were called to give evidence. The hard-hitting report made recommendations on under-forecasting of staff numbers, identification of wider business benefits from the move to the new building, questioned a specific financing issue, and also posed a question about disposal of the existing estate. PAC reports are taken extremely seriously by the Civil Service. This being a very visible public project, there was also considerable interest generally within Parliament, and a succession of Parliamentary Questions were asked, some covering fundamental issues about the project, but many concerning other, more detailed issues, only tangential to its success.

The building handover was completed on time in January 2005, amid considerable publicity. The Home Office then began paying AGP a monthly charge for the building and services amounting to £311 million (net present cost) over the life of the project.

3.3. Norway civil case (IFI2)

Information about this case came from semi-structured interviews, supported by a pre-supplied questionnaire, with senior personnel involved in the project, and extensive study of the project and QA documentation. One publicly available reference is a Statsbygg report [22].

The IFI2 project includes the construction of a new building for teaching, research and ICT operations in the Department of Informatics at the University of Oslo (UiO). The building’s planned gross area is approximately 28,250 m². The current base estimate for the building is NOK 1040 million, and the current total budget is NOK 1080 million, based on 2006 price levels. The need for new facilities for the UiO Department of Informatics was explicitly mentioned in a Government proposition to the Norwegian Parliament in 1998. The driving forces were the Department for Informatics’ expressed needs for more space, closely aligned with government strategies to strengthen research and higher education in ICT. In 1999 the Research Council of Norway (NRC) ordered a design proposition for a new building, which was presented in 2000. The initial plans included a 10,000 m² extension of an existing building, financed by the Research Council of Norway. The new facilities were to be rented by the University of Oslo. In 2001, following discussions on the level of rent, Parliament decided to put the new building on the list of prioritised state building projects. This meant 100% state funding of the new building and execution by Stats-
bygg (Directorate of Public Construction and Property). The project thus went into a new planning phase, and in 2002 Statsbygg launched a design contest for the IF12 building. The pre-project was completed in February 2004, but funding had to wait for a parliamentary decision to finance and execute the project, in May 2005. The new building will, according to the current schedule, be completed in 2010.

The early stages of development show that issues concerning the execution model and funding sparked some debate, but there was no question about the need for the project.

Cost figured strongly in the 2004 QA2 analysis. Without a total independent cost estimation, the quality assurance confirmed the project’s own cost estimates and need to budget. The corresponding uncertainty analysis of costing placed market situation at the top of the list of identified uncertainty elements. Price rises in the construction market forced an increase in the budget of the project, with funds being drawn from the contingency reserve, and, subsequently, from a regular budget increase in November 2007. Should the success of the QA be judged from the ability to accurately predict costs, or only from the ability to identify the most important risk? The project is not yet completed, so the true accuracy of the cost estimate remains to be seen. The project started up roughly a year later than expected, in the wait for funding, and faced a totally different market situation from that which existed when the decision to finance and execute the project was made. The uncertainty analysis had not been updated: such analyses cannot be regarded as relevant without continuous updates.

There is no doubt that the control focus was prevalent in the QA2 assignment. It is clear that there should be a review of cost, schedule and other key areas before the decision to finance and execute large public projects is taken. It is observed that the subordinate agency generally does not oppose this, but their assessment of QA and its output in this project is that it was redundant and time/cost-consuming. The QA did not result in budget modification or any other decision-making changes. An interviewee from the project suggested that: “The QA has done more to relieve the Ministry of Finance than to help Statsbygg”. However, there seems to be a good deal of consensus on how the process itself should be described. Interviewees from the project organisation and the QA team described the exchange of information as excellent and the interaction between the involved parties as very good.

On the question of QA output, it is observed that the project organisation expected a bit more than a superficial insight into project documents. The QA2 cost focus is described as important by interviewees from the organisation, but control of cost should also include an assessment of technical solutions and their cost effectiveness. This would require an additional focus in the analysis, to include both control of numbers and evaluation of technical solutions, and would demand enhanced technical skills from those responsible for conducting the analyses.

3.4. UK defence case (NEADS)

Information about this case came from semi-structured interviews, supported by a pre-supplied questionnaire, with senior personnel involved in the project. There is obviously little in the public domain about the details of the operation of this project, although it is mentioned in the 2006 Defence Statistics [23].

Ground Based Air Defence (GBAD) is an important defence against an increasing range of low-level airborne threats, e.g. helicopters, unmanned air-vehicles and cruise missiles. In order to be both effective, and a weapon, there must be the ability to take and fuse data from multiple sensors to form a reliable picture of the situation, identify the target and control of the weapon. UK defence currently has two GBAD weapons in its armoury: “HVM” and “Rapier” although these are to be replaced. A “future GBAD” Integrated Project Team (IPT) was set up, following a 1994 NATO feasibility study which suggested an £8 billion solution. This seemed reasonable to the independent MoD estimators, based on historic data, and a funding line for this amount was endorsed. This means that it was accepted as a programme, i.e. it appears in the long-term funding plans, but no Gate has been gone through yet.

There were two stages to the project: the air-defence Command, Control, Communication and Intelligence, under which UK air defence assets would be integrated, and the defensive missile and battle-space management, including sensors and data-fusion. The business case for the first stage was prepared, with a budget of approximately $1 billion. The Initial Gate was passed in 2001, allowing an Assessment Phase, together with a concept second phase. However, in 2003 there was a general funding reduction. The Customer had to cut funding; he had two other programmes within his remit at that point, both well forward with a lot of money committed, and one was politically very sensitive. He therefore changed the £1 billion to £200 million, to give only limited situation awareness. This very basic version of the first phase is now coming to the end of its second assessment phase and has a Main Gate during March 2008, with in-service date forecast for 2010.

Network Enabled Air-Space Defence and Surveillance (NEADS) was established as the remaining capability, with a limited budget. It is currently in the Concept phase, having started off in October 2006, expecting Initial Gate in 2009, and a Main Gate in 2012, and having a Planning Assumption for Service Entry of 2020. When the funding was cut, a cancellation charge was levied, giving the opportunity for some industrial work, which was used to develop the missile, without the need for user-requirement, system requirement, capability gap analysis, a concept of employment, etc., let alone the bulk of NEADS, sensors, data-fusion and communications. The budget for the concept stage of NEADS was also cut substantially in 2003/4, but
a Technology Demonstration Programme has been placed, which is due to finish soon.

From the point of the view of the MoD, the strategic need for this capability is clear. There are two weapons that will be going out of service. The main drivers to decision-making here, which affected the project process fundamentally, therefore appear to be threefold: the essential in-service date for the capability due to obsolescence of current equipment, the needs of the UK industrial base and cost restrictions. Three other drivers also come into play: political sensitivity, opportunistic behaviour and the requirement to keep some UK sovereign aspects.

In considering the impact of the MoD governance framework on the project, there are two notable aspects of NEADS: the organisation takes less interest than they might because they are part of an IPT, in which the other schemes are nearer to Gates; and the project is in its early stages, where a project within DE&S may find it easier to minimise visibility and get the task done. The NEADS project has so far been governed through a mixture of internal (to the IPT) and external assurance. It has not yet undertaken any OGC Gateway reviews, and no Foundation Review was performed. It will be reviewed by an internal board prior to submission for the Initial Gate, expected in 2009. The NEADS project is an example of a complex defence development scheme. It illustrates why emphasis is needed on the concept stage of such projects, as while there may be a clear understanding of the requirement, the best way to fulfil this requirement in a cost-constrained environment is a highly complex and changing decision. It illustrates the need for structured governance processes in the long period leading up to the MoD Initial Gate, during which the project can travel a long and circuitous path. It also illustrates the difference between a straightforward statement of the governance process, and the actuality in projects operating over a number of years within an environment of changing political and cost priorities.

4. Analysis of cases and framework practices

The Home Office case illustrates flexible use of a complex governance framework. The project does not appear to be a technical challenge, but the complicated PFI contract arrangement was a challenge to handle within the common framework. Important findings by the Parliamentary Accounts Committee outside the Gateway Process illustrates the importance of the status of the framework and what organisational level is challenged by the review; this points towards other additional important governance measures. Although a political decision, this case documents substantial influence by rational decision-making. The building was delivered in 2005, on time and without a rise in the service charge – a success story from the project perspective, and, hopefully, also from the strategic perspective. This implies that flexing of the framework, which at first glance might appear rigid, can give useful benefits.

NEADS is an extremely complex development and procurement project, illustrating the need for governance in the early phases of a system development. The case gives a practical example of why a governance framework is important. It also illustrates how assumptions change over time, and the degree of change to be faced during the initiation and development of a complex defence system. It shows the effects of political decision-making and judicious use of the framework in the actuality of the project. The case poses a question about how long a development should be allowed to continue before a formal external review is called for. It illustrates why governance in the early phases is vital to project success. It is not possible to know whether it will be a success or not from the strategic or project perspective.

In the IFI2 project the contract arrangements had a special focus, following discussions about the fundamental project concept. This focus was sparked by early direct interventions by the Ministry, based on identifying the cost as being too high. Although a political decision, this case documents substantial influence by rational decision-making. There are no indications that QA had a large impact, but there was clear reassurance, and thus legitimization, in having an independent review. One interesting aspect is the question about how to evaluate the performance of a review. Is it the ability to identify the risks that is important, or to predict the exact cost? In this case, the identified market risk had considerable consequence on cost, and the budget had to be increased. Does this imply a successful QA2 performance or not? Does the need for an increased budget in such a situation deem the project a failure, given that the delivery will be on time and of the right quality?

The Skjold case illustrates why it was important to expand the QA scheme to include QA1, introducing the value focus in the early stages of development. The strategic perspective, critical from the decision-making point of view, is not present in QA2. However, it would need to be early – in this case a late QA1 may not have made any difference: the Defence organisation’s lack of support was well known to the decision-makers. Ultimately, decisions were clearly made on a political basis, taking into account Norway’s ship-building industry. There might be a rational normative framework, but this is embedded in a society which includes influences of power and politics. Indeed, this is how it should be – it is anchored deep in the democratic system and the governance framework. The performance of QA2 had weaknesses, since the rules of practice had not yet been fully established. Thus, the impact of quality assurance was lessened; reassurance was the benefit gained from it. The project perspective shows a well-defined, -prepared and -executed project, but it is likely to be a failure, as was publicly proclaimed by high level officials long before the project was started.

In Table 1 some facts about the four cases are compared. This may question the choice of cases for this study and the performance of the reviews/operation of the frameworks. All cases show deviations from the rules defined by
the framework at the time of the review, although these are explained by situational causes, so this can been seen as a positive flexibility in the frameworks. There are also individual considerations as to how strong the scrutiny should be, depending on the established (or lack of such) practice. It is perhaps of greater concern that none of the cases shows the frameworks as having much direct effect on the project activities. This may be a result of how these cases were selected, all being judged to be performing positively. Another aspect is that typically the projects always have to spend a substantial amount of time and resources to prepare for review.

Table 2 shows a selection of interesting aspects, including both good performance and potential for improving the projects. This does not cover time and cost, as the researchers were unable to access these aspects. Reading this table across horizontally shows the different circumstances or solutions found by the different cases in each of these aspects. Reading the table vertically, a story about each case emerges, where the different aspects can be seen to be causally linked to a certain extent, e.g. in IFI2 many of the observations indicate a strong owner and customer position. Direct intervention and control is typical for the governance and management strategy here. The review questions the degree of adaptation to the current situation and the method used for cost estimation. This has no direct consequence for the project but the project manager admits he has learned a lot on a general level about the management of large projects.

Finally, Table 3 shows our interpretation of these cases and their links to the governance frameworks. Each case documents the importance of governance frameworks in its own way. The potential improvements at the time of the review (compared to the framework as it was defined...
Other governance mechanisms

Potential improvements to current frameworks

Information issues

Achieved value* of review

Documents the importance of governance frameworks

Table 3
Cases and governance frameworks.

<table>
<thead>
<tr>
<th>Project name</th>
<th>Home Office</th>
<th>NEADS</th>
<th>IFI2</th>
<th>Skjold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documents the importance of governance frameworks</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Achieved value* of review</td>
<td>Reassurance</td>
<td>Review for part of project: legitimation</td>
<td>Reassurance and legitimation</td>
<td>Reassurance and legitimation</td>
</tr>
<tr>
<td>Potential improvements to framework at the time of review</td>
<td>Need for early reviews (G0-1-2)</td>
<td>Need for early reviews (before MoD1)</td>
<td>Need for early review (QA1)</td>
<td>Need for early review (QA1)</td>
</tr>
<tr>
<td>Information issues</td>
<td>Info dependant on who asks and who is asked</td>
<td>No information issues known (everything kept within MoD)</td>
<td>All information was available</td>
<td>Supplier not available for reviewers</td>
</tr>
<tr>
<td>Potential improvements to current frameworks</td>
<td>Wider perspective of reviews</td>
<td>Stronger governance in early phases</td>
<td>Need to update analysis regularly</td>
<td>Stronger technical focus</td>
</tr>
<tr>
<td>Other governance mechanisms identified</td>
<td>NAO/Parliamentary Accounts Committee</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

at the time) are well known, and most of these are already established in later versions of the frameworks. This indicates that the development of these governance frameworks is targeted and efficient. Even today’s frameworks have potential for improvement based on these cases. Noted here is the need for: stronger governance in the early stages of development, the wider perspective of reviews, a stronger technical focus in reviews and the regular renewal of the analysis to ensure its relevance. The Home Office case also reminds us that there are other additional, and highly relevant governance mechanisms available.

5. Conclusions

A number of conclusions can be drawn from these cases. Firstly, there are some clear similarities between them:

- In all cases the framework was applied flexibly, although perhaps less so in IFI2.
- The cases illustrate the difference between a straightforward statement of “the” governance process, and the actuality in projects. This is particularly apparent in NEADS, but 2MS also shows flexibility in the OGC system.
- None of the cases shows any obvious influence on the project under review.
- However, in all projects there was value in providing reassurance and legitimization; this is particularly seen in Skjold, IFI2 and 2MS. Although not relevant for NEADS, reviews confirmed what was required: cost, risk, contract, or business case, as relevant.
- Project managers gained experience from the processes.
- All cases appeared to confirm the importance of a governance framework. It is clear that the complexity involved in the decision-making, technology and contracts means that a governance framework is particularly important, although it may be a challenge for quality assurance.
- All the cases illustrate the same potential improvement to the framework as it existed at the time of the review, and the need for much more assessment of a project during its early stages. NEADS illustrates the need for structured governance processes in the long period up to the first decision. Emphasis is needed on the concept stage: for Skjold, neither the basic need of the project nor the value perspective was included in the QA. There was a mixture of unsatisfactory mechanisms in the early stages of the cases.

Conclusions can also be drawn from the differences between the cases:

- Decision-making was sometimes rational and sometimes political. The Skjold project, particularly, shows that no matter what the professional advice or the result of rational methods, the final decision is a political one.
- Other potential improvements to the current frameworks were identified. These included a wider perspective of the reviews (2MS) and the need to update analysis regularly and achieve a stronger technical focus (IFI2).
- It is clear from these cases that the control focus is prevalent in the QA system, and there are similar hints in the MoD system. This is less true for the Gateways which are more “friendly”, although current changes are making them somewhat less so.
- The governance mechanisms throughout appear to have been project-based, but the governance of linked projects was not clear, e.g. 2MS. More importantly, there are clear issues in the division of a programme into projects, e.g. NEADS. Having said that, in the OGC methodology (2MS) it was clear that Gateways could include studies of portfolio business case issues.
- Transaction Cost economics highlight the power of the suppliers. For 2MS, having expert support from those accustomed to dealing with sophisticated and
experienced contractors appears to have been valuable. Skjold had the problem that the QA consultants were not allowed to access the suppliers’ personnel.

- For 2MS, the effect of other governance processes were interesting, i.e. NAO, Parliament and Treasury.
- The ability to look at cost and time issues varied. NEADS had a project-independent cost; there were methodological issues in IFI2, and the problem of no alternative source of data in Skjold. The cost analyses presented for IFI2 by the project organisation and the QA team may have differed. It is interesting that it was another governance mechanism (Parliament) that picked up the optimism bias for 2MS, in benefits, rather than costs.

This study has looked at a number of frameworks in a structured way, and provides a checklist for anyone looking at a particular framework and wondering about its essential nature, or designing a new framework: the discussion here outlines how frameworks differ. But the main topic of this paper was to look at how these frameworks and their differences actually play out in practice, generally following, but always a little different, from those espoused by the authorities. The two sets of bullet-points above give detailed conclusions as to what was beneficial and what was less so in the actual use of the frameworks.

This is a very small sample from which to draw conclusions, although we did try to make it balanced. Clearly, there also were issues in the cases that were provided for the researchers to study, which limited not only the findings, but also the generalizability of those findings. This may partly explain why we found surprisingly little impact of governance frameworks on the projects. Due to the complexity and sensitivity of defence projects, and commercial considerations, the authors could not get data on some governance aspects, and we also had disappointingly little visibility of cost and time estimation. Moreover, this research is just one small step; further research could usefully seek a wider understanding of the influence between frameworks and their context by studying more frameworks in different contexts, together with more programmes and projects.

In conclusion, we have characterized the institutional frameworks and their differences. We have seen how they work out in practice, and that while the potential effect was large, the cases we studied did not show their full potential, key benefits being legitimation for the project and reassurance for the project owner. The importance of governance was apparent, particularly in the early stages of projects where concepts are established.

References

Cost development in quality-assured major infrastructure projects

Abstract

The cost developments from the early stages of definition to the actual outcomes were analyzed in a complete count of 28 major transportation infrastructure projects that had been subjected to institutionalized framework for up-front assessment and quality assurance. It is shown that the development of costs in the early stages of a project has the most significant impact on actual cost. Alone, a cost control measure introduced prior to the decision to build has little impact on the budgeted cost. The presentation of actual outcomes shows that cost estimates may be more reliable, but observed cost reductions are negligible, if costs presented at the early stages of definition are taken into account.

Introduction

The purpose of this paper is to examine projects subjected to a large project improvement scheme in Norway with respect to salient matters including whether up-front assessment and quality assurance guard against underestimation of cost, whether agreed boundaries for cost development are followed in practice and the extent to which improved budgetary compliance is encouraged. This is done by analyzing the cost estimates from the early stages of definition to completion in transportation infrastructure projects. While previous studies in this area have compared budgeted costs (costs at the time of decision to build) with actual outcomes, often on the basis of unsystematic selections of diverse, albeit large, samples of projects, this study is concerned with investigating the cost development from the early stages of definition to completion in a selection of projects planned and executed under a common framework for project improvement that was first implemented in 2000. Magnussen and Olsson (2006) were the first to attempt an analysis of the development of cost estimates in the early stages of projects subjected to up-front assessment and quality assurance. In that paper, the results from a study of 31 projects in transportation infrastructure, public building, defence procurement and information technology were presented. This paper focuses on projects in a single sector, transportation infrastructure, but extends the view to also include the early stages of project development and actual performance.

As is the case in many similar studies, the nature of this study indicates that caution should be exercised in interpreting its results. All the projects examined were carried out under the Norwegian Public Roads Administration1 (NPRA), which may seem unrepresentative, since they represent only a sub-sample of projects subjected to quality review. As of 2008, a total of 81 projects, each with an expected overall cost of more than NOK 500 million (€ 6.2 million) in the fields of transportation infrastructure, public building, defence procurement, and information technology have been subjected to studies such as this one. In this paper no attempt is made to suggest that results may be transferable to other project types or contexts, but it is worth noting that transportation infrastructure projects constitute a dominant part of the total number of projects, and that data concerning them are readily available. It should also be noted that the relatively small selection of projects presented here is not amenable to statistical tests of consistency and co-variation of data. On the other hand, the projects presented here are a complete count of transportation infrastructure projects under the NPRA which as of 2008 have been through the project approval process. Although individual projects and their contextual settings vary, all were planned and executed under the same regulatory and construction regime.

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1 The Norwegian Public Roads Administration plans, builds and operates national and county roads in the country.
One constraint is that actual costs are available only in a small number of projects. Moreover, the study presented in this paper focuses only on the efficiency issue (time and cost), which, as will be discussed later, comprises only a few of the aspects that the improvement scheme addresses. That said, it should be mentioned at the outset that the Author shares the frequently-held view that measures of efficiency alone are inadequate measures of project performance. In a recent study of project success, Dvir, Sadeh and Malach-Pines (2006) assert that the operational mindset caused by a business aspect focus in project execution reflects the frequent use of time, budget and performance as the main indicators of project success. However, they contend that frequent use can’t conceal the fact that these measures are incomplete, even when taken together. First of all, it is worth noting that new elements should be added to the assessment. For example it is clear that a project, even if it meets time and budget constraints, should not be described as successful if the end user needs were not met. Second, project success assessments may differ according to the assessor. In other words, the perspectives of various project stakeholders should be taken into account. Finally, timing is crucial in the assessment of project success. If, for example, the assessment is carried out soon after the output of the project work is completed, it may be justifiable to assess whether actual costs are in accordance with budgeted costs, while an approach which distinguishes between issues of efficiency (cost and schedule results) and effectiveness (long-term feasibility and profitability) may be more difficult to address at this point in time. The Author shares this view and finds it appropriate to underline that the focus on efficiency issues in this study reflects the control and investment cost focus in the quality assurance evaluations completed so far. (The conduct of quality assurance is described in greater detail in a subsequent Section of this paper.) It is also clear that the study includes data from projects that only recently have been completed. The data presented at this point are therefore inadequate to address any issues regarding effectiveness. It is too early to draw definitive conclusions about the impacts of adopting the practice of external expert review of large public projects. As a consequence, this study should not be seen as an attempt to reach a final conclusion on how the improvement scheme may lead to more consistent achievement of success in projects subjected to it. A measurement of project success requires more than an assessment of performance in terms of investment cost. In other words, this study comprises an attempt to explore how certain attributes of an improvement scheme in the early stages of projects may affect a certain aspect of project performance.

Previous studies

The work by Flyvbjerg and colleagues (Flyvbjerg, Bruzelius and Rothengatter 2003, Flyvbjerg, Holm and Buhl 2002; 2004; 2005) points to a significant problem in transportation project management: more often than not, the information that managers use to decide whether to invest in new projects is both inaccurate and biased, which makes projects risky. A conundrum arises whenever the cost of a project is underestimated and presented to the decision-makers. Hence, nonviable projects may be implemented due to inaccurate estimates, which in turn may lead to inefficient allocation of resources. Cost overruns are frequent in road construction. Consequently, cost estimates presented to decision makers always should be scrutinized.

Odeck (2004) investigated the statistical relationship between actual and estimated costs of road construction using data from 620 NPRA projects over the years 1992-1995. He found a discrepancy between estimated and actual costs. Cost overruns ranged from -59% to +183% with a mean of 7.9%. One particularly interesting finding in this sample of projects was that overruns were prevalent among smaller projects while underruns were more frequent in larger projects. Odeck suggested that the effort exerted in diligent management of large project, with an emphasis on staying within budget, may explain this observation.
As reported by Berg, Stene Fon, Kvarsvik, Bye, Aksnes, Hallquist and Pedersen (1998), a working group appointed by the Norwegian Ministry of Finance to assess investments in the transport and communication sectors found that cost overrun was the norm in a sample of four projects completed between 1996 and 1998. The group was divided in opinion on the extent and cause of the cost overruns, but its consensus was that cost overruns due to insufficient control and management of projects were too frequent and that the reporting of uncertainties to decision makers was disorganized and incomplete. This report was one of several that ultimately resulted in the introduction of the quality assurance scheme in 2000.

Another study by the Auditor General of Norway (2002) covered five large road construction projects under the NPRA completed between 2000 and 2002. Its report admitted that though the selection and number of cases did not ensure representativeness, the character of the findings implied that there may be relevant issues in a larger number of projects. Estimates were found to be inadequately prepared and presented and in some cases apparently lacking. Uncertainty was not adequately addressed or reported to decision makers. Poor quality of plans resulted in extensive redesign, which, ultimately, led to higher costs and cost overrun. The Auditor General further pointed out that the NPRA did not have the necessary tools to properly follow up costs in investment projects. This was seen as a serious flaw in project execution.

One approach to up-front assessment and quality assurance

In 2000, the Norwegian Ministry of Finance took steps to improve the management and control of major public investment projects, with the expressed aim of preventing cost overruns, by implementing external Quality-at-entry analyses of all public investments in Norway with an expected budget or more than NOK 500 million (€ 62 million).

Quality assurance (QA) is performed by independent commercial quality assurers having framework contracts with the Ministry of Finance. The QA team, typically five or six members, thoroughly analyzes the project over a period of six months or more, though not on a full-time basis, and holds several meetings with the project team. The work is documented in a final report submitted to the Ministry responsible for the project. The QA tasks to date have cost NOK 1-1.5 million (€ 125,000 – 188,000), independent of project size.

QA takes place at an early stage in the project cycle and currently comprises two analyses:

- Quality assurance of the choice of concept (QA1)
- Quality assurance of the basis for control and management, including cost estimates and uncertainty analysis for the chosen project alternative (QA2)

QA1 was introduced in 2005, and is carried out at the end of the pre-study phase, just prior to the responsible Ministry’s decision whether or not to proceed with pre-planning. The purpose of QA1 is to assist the Ministry in ensuring that the choice of concept has been subjected to a political process of fair and rational choice. Of course, the ultimate choice of concept is the result of a political process, in which external reviewers have no role. Their role is restricted to controlling the professional quality of underlying documents constituting the basis for decision.

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2 The decisions to finance and execute these projects were taken before the quality assurance scheme was put in place.
3 In fact, it was explicitly stated in the report that the cases were selected based on project size (measured as expected cost) and more than 20% cost overrun. This means that the study is (intentionally) biased in terms of occurrence of cost overrun.
In other words, the QA scheme is a tool for evaluating the quality of information and for providing additional information as required.

QA1 entails quality assurance of four types of documents:

- Needs analysis
- Overall strategy document
- Overall requirements specification
- Analysis of alternatives

The quality assurance includes a complete economic assessment of alternatives, according to guidelines set forth by the Ministry of Finance. At least two viable alternative concepts must be presented for review, in addition to the zero-alternative of no project. The quality assurers are required to present their findings in a report that at least covers:

- Uncertainties likely to affect the project
- Anticipated socio-economic benefits versus costs
- Anticipated relevance, efficiency of implementation and sustainability
- Ranking of alternatives
- Management strategy

QA2, the first QA initiative introduced in 2000, takes place at the end of the pre-planning phase, before formal submission to the Parliament. Its purpose is to provide the Ministry with an independent review of the project before its budget is appropriated by Parliament. It functions as a final control to ensure that the basis for allocation of funds is acceptable in terms of scope and quality. In part, it’s a forward-looking exercise that identifies the managerial challenges of the project, so it should be used during implementation as a basis for Ministerial control. It is documented in a final report that at least covers:

- The total capital costs, including an additional contingency allowance
- How the project should be managed to make sure the cost frame will hold

QA2 alone is merely an instrument to ensure that a project performs adequately within the constraints of time, resources and target efficiency. It is not concerned with the question of whether a project is the best solution to the needs identified; that’s a task for QA1.

Even so, QA2 brought sophistication to monitoring project costs. The independent quality assurer reviews the estimate prepared by the government agency responsible for execution of the project and accordingly puts forth a total budget, including reserves to cover the consequences of identified uncertainties. The executing government agency is responsible for the basic budget plus anticipated extra costs. However, use of reserves must be approved by the responsible Ministry. Should the total budget then need an upward adjustment during execution, the project may be presented anew to Parliament. At the outset in 2000, the ambition for QA2 was that it would help cut additional funding and increase the reliability of cost estimates.

Data and Method

The study includes historical data from projects subjected to QA2 from 2000 through 2007. Projects where data on actual cost are obtainable were completed between September 2004 and March 2008. The data for this study were obtained from a variety of sources, including final
reports from quality assurers, government documents (proposals and reports to Parliament), NPRA reports on cost estimating, and NPRA annual reports.

Several cost estimates are associated with each project. The first cost estimate is usually made as part of the feasibility studies and usually has an accuracy of about ±40%. The second cost estimate is made when the corridor plan (a plan for a strip of land between two endpoints within which roads and other transportation infrastructure facilities are evaluated) is drawn up. The first two cost estimates then are refined to an accuracy of about ±25%. The final refinements are made at a detailed planning level during which design, specifications and final cost estimates are made with a resultant accuracy of ±10%. Two estimates are highlighted at the detailed planning level: the estimate based on 50% subjective probability (the P50 estimate) that the project will be completed within budget, and an estimate based on the 85% subjective probability (the P85 estimate) of staying within budget. These two estimates are often incorporated in the expected cost and the upper financial level of the budget presented to Parliament. The difference between the upper financial level and the expected cost serves as an additional financial back-up. This financial back up is not expected to be used and is not administered at the level of the project or the agency. Reserves may be used only as approved by the project owner, in this case the Ministry responsible for the project.

The P50 and the P85 estimates suggested by the NPRA are at the detailed planning level reviewed by independent quality assurers before they are presented in the national budget for approval by Parliament. The estimation technique used is judgmental forecasting, which aims to predict how future factors may influence project costs so as to arrive at a reliable estimate of the cost and/or duration of a project. In practice, judgemental forecasting involves a team of professionals experienced in cost estimates and construction who work together to identify factors that may contribute to accurate cost estimates.

In principle, the external review of costs by independent quality assurers is, as their designation implies, independent. But in practice, there are some constraints on independence. Cost estimating is arduous and time consuming. So it might be argued that an independent cost estimate would take months to compile and therefore could not be completed within the time window of a quality assurance task. This brings in the nigh classic dilemma of the trustworthiness of input data. In most large projects, the project organisation itself acquires most of the data that an external reviewer may use as input to the uncertainty analysis. If the external reviewer trusts the data, he is not completely independent of the project. If he distrusts the data, he must compile his own and therefore may not get the QA job done. So usually the data used by a quality assurer are a mix of project data and data compiled in investigations of costs or other aspects of the project. Independence then rests in the assurer’s ability to independently judge existing material and the methods employed in producing it.

In this paper, estimates from the feasibility study level and the corridor plan level are used as the early estimates as they are first presented to decision-makers. The early estimates are compared with the estimates presented at the detailed planning level, which are scrutinized by independent quality assurers before being submitted to Parliament. Finally, the paper compares budgeted costs at the time of decision to build with actual costs. As mentioned above, to the knowledge of this

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4 Some may argue that stating the level of accuracy without the corresponding level of confidence is misleading and thereby incorrect. The essential matter is that the level of confidence rarely is explicitly communicated to decision makers, but has been verified by the underlying rule on the detailed planning level of a likelihood of 30% that the outcome will fall outside the ±10% range (i.e a 70% confidence interval).

5 The value at which the likelihood of staying within budget is 50%.

6 The value at which the likelihood of staying within budget is 85%.
author, there apparently are no studies that track the cost development through all the stages of planning and execution, as only comparisons between budgeted and actual costs have been made. In previous studies terms such as “cost inaccuracy” or “cost overrun” (or underrun) are frequently used to designate differences. In this paper, the term deviation, the amount by which an estimate, budget or actual cost differs from another, is used to denote differences between estimates or differences between budgeted costs and actual costs. This interpretation has been chosen principally because it seems inappropriate to denote a difference between early estimates as overrun (or underrun) or even inaccuracy, simply because a baseline for measuring overrun/underrun or inaccuracy is established at the time of decision to build. Another advantage may be that while an actual cost different from budgeted cost would traditionally be described as a cost overrun (or underrun), in this paper, the term deviation circumvents the need to define one set of terms to describe differences between estimates and another set of terms to describe differences between budgeted and actual costs. The parameters then are:

- All costs are construction costs.
- Estimated costs are any forecasted construction costs presented earlier than the budgeted costs appropriated at the time of decision to build.
- Budgeted costs are the construction costs determined at the decision to build. Budgeted costs consist of a budget (primary baseline for project execution) and a total capital cost (the budget including an additional allowance for contingencies). The total capital cost minus the budget is termed reserve or contingency allowance.8
- Actual costs are construction costs presented at the time of project completion.9
- Differences between estimated costs, budgeted costs and actual costs are labelled cost deviation.
- When cost data are compared, they are always brought to the same price level, i.e. fixed prices are used.

In the literature, there are arguments against the estimates, as in Flyvbjerg et al. (2002). As these authors have proposed, if these estimates cannot be used as the point of departure for assessing cost development, it would be nearly impossible to make meaningful comparison of costs because no common standard of comparison would be available. The study presented in this paper might also be criticised in that early estimates are brought into the picture, as they are inaccurate (as mentioned above, the early analyses produce estimate accuracies of ±40%). This will be discussed later in greater detail, but at the moment it may be said that this comparison is justified by the commonplace occurrence that regardless of the inaccuracy of early estimates are (and we assume decision-makers are informed about the involved risks), in practice they are used directly to prioritize between projects and even to finalise agreements on the allocation of actual costs between financing parties. As long as the early estimates are used for decision-making and for risk allocation, there is justification for investigating the extent to which early estimates deviate from subsequent estimates and, finally, actual outcomes.

The data for this study came from 28 projects under the NPRA subjected to QA2. The total worth of the projects is NOK 30 billion (€ 3.7 billion).10 The sample consists of motorways, trunk roads, bridges, and tunnels, with costs ranging from NOK 450 to 4000 million (€ 56 to 500 million).

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7 The definitions here are based on what Flyvbjerg et al (2002:281) calls “international convention” for measuring inaccuracy of cost estimates.
8 The decision to finance and build is made by the Parliament, and there is always a cost estimate available for the decision-makers at this point in time.
9 The point in time at which the construction work is completed and the project is ready to be opened for traffic.
10 Based on budgeted costs.
Empirical results

As stated above, the principal purpose of this paper is to examine the results from a study that in addition to comparing budgeted costs with actual costs, brings in early estimates and hence permits tracing the cost development from the earliest stages of definition to actual outcome. Intuitively, it’s tempting to present the data chronologically, starting with the estimates presented at the earliest stages. However, the chief characteristic of the projects analyzed in this paper is that they have been subjected to a common framework for project approval prior to the decision to build. First, the estimates presented by the NPRA at the detailed planning level as scrutinized according to QA2 were considered.

The deviations between the estimate prepared by the agency responsible for the execution of the project (the NPRA) and the budget recommended by the independent quality assurers in 28 projects were expressed in percent and compared, as shown in Figure 1.\textsuperscript{11} For each project, two points are plotted, the expected cost (the P50 estimate) and the total budget (the P85 estimate). The points are in ordinal sequence along the horizontal axis, by the dates that the final QA2 reports were completed.

The mean deviation of the P50 points shown in Figure 1 is 1.8%, and the mean deviation of the P85 points is 1.5%, which basically reflects that the quality assurers recommend increasing costs (in 18 of the 28 projects). The range of the deviation is from -14.0% to 10.8% for the P50 estimates and from -12.3% to 10.8% for the P85 estimates, which implies large variation. However, the standard deviations are 5.7% for the P50 estimates and 5.6% for the P85 estimates, which implies lesser variation.

\textsuperscript{11} Measured as ((external analyst’s estimate - NPRA estimate)/NPRA estimate) x 100
Next consider Table 1, which shows how frequently estimates made by the NPRA, the independent quality assurer, or a combination of the two were used to settle the budget and the total capital cost.

<table>
<thead>
<tr>
<th>Estimate by</th>
<th>Applied to settle the Budget (total cases) N=28</th>
<th>Applied to settle the Total capital cost (total cases) N=28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality assurer</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>NPRA</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Both</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1 Whose recommendation is the approved budget and total capital cost based on? Frequencies

As can be seen in Table 1, external review by a quality assurer is most frequently used in settling the budget (17 of 28 cases) as well as in settling the total capital cost (23 of 28 cases).12

One particularly interesting observation is that the two extreme cases of 14.0% budget reduction and 10.2% budget increase were both P85 recommendations by the quality assurer that were applied in the binding budget.

At the time of submission of this paper, 11 projects had been completed, the latest in March 2008. The projects took from 22 to 60 months to complete, for an average of 39 months. In one

12 The originator of the estimate that the responsible ministry builds upon when the project is put forward for Parliamentary appropriation is often, though not always mentioned.
of the projects, reliable data for actual costs were not available. There was no evidence suggesting that the project suffered substantial cost escalation, but because accurate numbers for the actual result were not readily available, there’s no cause for speculation\(^\text{13}\) and the project was discarded from the analysis. The reconstruction of the actual costs of the completed projects could otherwise be said to be straightforward in the sense that, according to the procedure for monitoring project cost, the actual cost often is automatically compared to the budgeted cost in available sources.

![Figure 2: Actual cost: Deviation from the estimate prepared by the agency, the estimate recommended by the quality assurer as an external analyst, and the budgeted cost, N=10](image)

Figure 2 shows how results of actual cost performance deviate in per cent from the NPRA estimate, the estimates recommended by quality assurers as external analysts and the budgeted costs in 10 completed projects. Deviations are expressed in percent\(^\text{14}\). Each of the points in Figure 2 represents the result for one project. In each case, the actual outcome is compared with the estimate proposed by the agency, the budget recommended by the quality assurer, and the committed budget. Consequently, there are three plotted points for each project (as identified in the legend for Figure 2). For example, a black square above the horizontal axis, it means that the actual result was higher than the allocated budget, whilst one below means that the actual outcome was lower than budgeted. The points are in ordinal sequence along the horizontal axis, by the dates of completion.

\(^{13}\) The 2006 NPRA Annual Report predicts a 0.3% increase from budgeted costs.

\(^{14}\) Measured as \((\text{actual outcome} - \text{budgeted cost})/\text{budgeted cost}\) x 100, \((\text{actual outcome} - \text{external analyst's recommendation})/\text{external analyst's recommendation}\) x 100, \((\text{actual outcome} - \text{NPRA estimate})/\text{NPRA estimate}\) x 100
The pre-eminent result is that the actual cost was below the upper financial level in all 10 projects, although this is not directly evident in Figure 2. The deviations from budget, based on 50% probability for staying within budget, were plotted in Figure 2 because they are used as the primary baselines for project execution. Seven projects were finished below the budgeted cost, while three projects were completed above budgeted cost. The mean deviation from budgeted cost is -7.6%, meaning that even if the range is from 7.5% (above budget) to -33.1% (below budget), cost savings dominate. In absolute terms, the total cost reduction compared with the projected course for the 10 projects together amounted to more than NOK 600 million (€ 75 million), from total budgeted costs of NOK 8896 million (€ 1112 million) to total actual costs of NOK 8276 million (€ 1037 million). Moreover, the savings were realized with no observable reductions in functionality to save costs.

In Figure 2, the actual costs are compared to the budgets recommended by the quality assurers and those initially proposed by the agencies. Most strikingly, as shown in Figure 2, the differences between the estimates on this level are small. However, some ancillary details are worth mentioning. The project with the greatest deviation from the budgeted cost in Figure 2 (7.5% overrun) is also the one that has the third largest deviation in Figure 1 (the quality assurer recommended a 9.2% reduction of costs compared to the amount proposed by the agency). The recommendation made by the external analyst was followed up in the decision to finance the project, which meant a downward adjustment of the budget allocated. The actual outcome for this particular project shows an overrun compared to the committed budget, though it was within the estimate as proposed by the NPRA. It is further observed that the project deviates significantly from the other projects analyzed in this study in other ways. It consists of a new highway section where the speed of planning and execution was forced from the outset to facilitate rapid completion. The decision to build was based upon a preliminary estimate and the work on two major contracts had already begun when the external review was carried out. No formal procedures were breached, but the situation was abnormal.

The project with the largest relative underrun (33.1% reduction compared to the committed budget) was also the smallest in total cost.

Two of the completed projects were delayed, respectively by two and nine months. The project that was delayed nine months also deviated 5.0% from the budgeted cost, the second largest deviation of the 10 projects.

Estimates from the early stages of definition were available in 14 of the 28 projects. A project that was completely redrafted between the early stages and the detailed planning level was deleted in the analysis. The point of this exercise is to try to understand how costs associated with a specific project alternative may change, not how large differences might be calculated between different alternatives. The early estimates were normalized to the same price level and compared to the NPRA estimates, the budgets recommended by the quality assurers, and the budgets determined at the time of decision to build.

From the early estimates presented at the time of feasibility studies and at the corridor plan level there is an average deviation of 53%. One of the 14 projects had a slightly lower (1%) estimate at the detailed planning level than at the early stages of definition. The other 13 estimates deviated from 9% up to 178%. As mentioned above, these early estimates are inaccurate (±40% accuracy

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15 All numbers are in fixed prices at the 2007 level.
16 Which means that the impact of significant conceptual or technical changes have been taken into account. Note, however, that though project alternatives may vary, if they ultimately are designated to serve the same needs, there is nothing wrong in comparing costs associated with different alternatives.
level). Consequently, some of the observed deviations from the early estimates may be said to be “tolerated inefficiencies”. It’s illuminating to combine the numbers and consider the projects as a whole, as illustrated in Figure 3.

**Figure 3 Cost development from the early stages of definition to budget at the time of decision to build, N=14**

All financial figures in Figure 3 are at the 2007 level. In absolute terms, the total costs for the 14 projects increased by NOK 5.2 billion (€ 650 million) from the earliest estimates to the estimates proposed by the agency at the detailed planning level. It should be noted that all save one contributed to the cost increase. At the detailed planning level, the estimates are reviewed by external quality assurers who recommend adding NOK 0.5 billion (€ 625 million). At the time of decision to build the projects have a total budget of NOK 18.7 billion (€ 2.3 billion), somewhat lower than the total budget recommended by the consultants, but NOK 5.5 billion (€ 687 million) above the costs associated with these projects at the early stages of definition.

**Discussion**

The data presented in this paper concern projects that have been subjected to the QA2 quality assurance requirements as conducted prior to the decision to build. The focus in QA2 is on the control aspect. It merely consists of a review by external quality assurers to verify that the basis for decision on appropriation of funds is acceptable in terms of scope and quality.

The nature of the quality assurance is that it is conducted at a stage gate before pre-planning and the decision to build. The QA2 quality assurance is mandatory, but if and how the recommendations made by the analysts are applied in the subsequent production of the project output rests solely in the hands of the executing government agency and the project owners, that is the responsible Ministries. The external quality assurers have no formal role in the execution of the projects and cannot be held accountable should costs at a later stage get out of control.
Results from the analysis of the deviation between the estimate proposed by the executing agency and the external quality assurer support one of the results highlighted in Magnussen and Olsson (2006). In most cases, the quality assurer recommend increasing costs, both those for which the likelihood of staying within budget is 50% (the P50 estimate) and those for which the value the likelihood of staying within budget is 85% (the P85 estimate). Although the variation from project to project may be considerable, few projects exhibit differences larger than the standard of accuracy at this level (±10%). The overall cost effects of the exercise can be said to be practically negligible: an average deviation between what was proposed by the agency and what was recommended by the quality assurer of 1.8% (based on P50 estimates) and 1.5% (based on P85 estimates).

The external quality assurers’ recommendations were seen to be frequently used directly to settle the budget and the total capital cost for the projects. As these recommendations most often called for cost increases, it could be claimed that the QA2 merely “extends the target”, which suggests that project budgets generally are larger than they would have been without the external review, which makes it easier to stay within budget. This may easily explain the result shown above, that all completed projects stayed within the total capital cost. However, this may be contradicted by the observation that in the extreme case, where the external quality assurer recommended a 14% budget reduction, the project owner used that very same number to settle a budget. This would not be the expected behaviour of a project owner seeking the maximum amount of money for his project.

On a more general level, it may of course be argued that the quality assurance may influence projected costs simply because it exists. Agencies and project organisations always are notified of upcoming quality assurance, so estimates may be adjusted in advance of the external independent review. As discussed above, the independence of the external review of cost may be challenged, as the project is mainly responsible for the cost data collection, which exacerbates the situation. The data presented here would in any event be inadequate to shed light on cases in which upward (or downward) adjustments to budgets have been made prior to quality assurance. Clearly, should such behaviour be widespread, the validity of the results presented here would be reduced. However, as the external quality assessors may question all aspects of the material subject to review, such chicanery seems unlikely. The external review of costs involves not only a control of figures but also an assessment as to whether the estimate has been rigorously prepared using relevant methods and procedures.

Another concern raised by the new approach to project costs was that although budgets may be on an appropriate level, planned use of reserves could occur. Figure 2 shows that the use of reserves has been limited in the 10 projects completed thus far, although the quality of projects’ outputs or agreed specifications was kept at the same level, costs have generally been kept within budget. Judged by the results from these 10 projects, planned use of reserves is not a strategy commonly adopted by project owners to finance scope or functionality increases.

Figure 2 also is an early indication of the reliability of cost estimates. It is shown that the completed projects, which have been through the procedure for quality improvement, exhibit good cost performance. Scope or quality reductions have been accounted for, which means that the presented underruns represent actual cost savings. The total cost reduction for the 10 completed projects combined amounts to some NOK 600 million (€ 75 million).17

17 Note that this number alone may not serve as an adequate quantification of saved funds directly resulting from up-front assessment and quality assurance.
The results observed in the 10 completed projects are consistent with the results for 11 large projects under the NPRA, completed between 1992 and 1995, presented in Odeck (2004). It was found that overruns seem to occur more often in smaller projects than in larger projects, in which underruns occur more often. It was suggested by Odeck (2004) that this could indicate that larger projects may have been under better management.

One particularly revealing observation is that in the project that exhibited the largest deviation from budgeted costs, the principles underlying QA2 were in part ignored. The project was subjected to the same scrutiny as the other projects, but a closer look into its historical records revealed that the established process in practical terms was short-circuited. The project work was speeded up, and when the external quality assurers started their review, production of the project output had already begun. There is no doubt that formal procedures were followed, meaning that the project was authorized to proceed to the execution phase before the quality assurance took place. Of course, this project could be seen as an exceptional case, but the results from it underscore the importance of rigorous scrutiny before project execution begins.

In the presentation of results based on early estimates in 14 projects, the early estimate costs were highly uncertain. But as this exercise has shown, is that though the ±40% accuracy level may be used to justify some of the upward adjustments, all save one project in the sample contribute to cost growth. This observation implies that the effects of considering deviations of cost within any level of accuracy as “tolerated inefficiencies” would be devastating, because, judging from these 14 projects, costs are more prone to be on the upper side of the interval than on the lower. As shown in Figure 3, cost escalation from early estimates to the detailed planning level in absolute terms amounts to some NOK 5.2 billion (€ 650 million). The budgetary impact of such an increase may seem severe, but not when fractional distributions of costs between stakeholders are based on these early estimates. Some might argue that Figure 3 only illustrates that estimates become more accurate with time as projects become more properly defined. In this respect, it may be said that the observed distribution of cost deviation between the early estimates and the estimates at the detailed planning level differs from the required level of accuracy, which implies that decision makers are inadequately informed about uncertainties. Hence, Figure 3 may be said to illustrate that the largest potential for improvement lies in the early stages of definition and support the argument that more careful estimations and risk assessments are needed.

Implications

The questions examined in this paper have been addressed by analyzing data on the estimated and actual investment costs of 28 large transportation infrastructure projects in Norway. Although the projects’ contextual backgrounds varied considerably, all shared the commonality of having been subjected to a central clearinghouse prior to the decision to build, introduced by the Ministry of Finance in 2000 the “Quality Assurance 2 (QA2)’ initiative. The focus in QA2 is on the control aspect. It consists of a review by external quality assurers to verify that the basis for decision on appropriation of funds is acceptable in terms of scope and quality.

At the outset, the question whether up-front assessment and quality assurance could guard against underestimation of cost was raised. The analyses of deviations in cost estimates on the detailed planning level and of deviations between budgeted and actual costs have shown that the quality control process in which costs are validated by independent consultants at the end of pre-planning may increase the reliability of projects. It is shown that agreed boundaries for cost development established at the time of decision to build are followed, though the path costs follow in the sample of projects illustrate that significant improvements are contingent upon
more fundamental assessments of project concepts and better estimations earlier in the project life cycle.

The impartial observer might note that other factors not observable in the data presented in this paper could underlie the performances of the projects studied. Though this study has not probed any ancillary or deeper causes, it seems plausible that they may include the impacts of market and management and hence might be relevant in future research.
References


Explaining cost estimate differences in up-front assessments and quality assurance of large projects.

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Explaining cost estimate differences in the up-front assessment and quality assurance of large projects.

Abstract

The cost estimates made before a large project is authorized for execution often differ, sometimes considerably. This paper is a report of a study of the magnitudes and underlying causes of such cost estimate differences. The study material comprised a sample of 61 transportation infrastructure, public building, defence procurement and information technology projects subjected to an institutionalized framework for up-front assessment and quality assurance. In two thirds of the cases analyzed, external experts had recommend that budgets be raised. Although there were considerable differences in the estimates in some individual projects, the combined impact for project costs for the sample as a whole seemed low, as the average recommended budget increase was just 3 %. Dissimilarities in cost estimation methods and in assessments of the potential impact of risks were found to be among the leading causes of the differences observed.

Keywords: Managing Projects; Design and Appraisal

1. Introduction

In a recent paper, Magnussen and Olsson (2006) found that revised estimates were higher than initial estimates in 23 of a sample of 31 projects and that the average external expert recommendation was that the project budget be increased by 5 %. Some differences were seen in the estimates, but the causes of them were not investigated. This study of 61 projects includes analyses of the differences in estimates and consequently may be regarded to be a sequel to study reported by Magnussen and Olsson (2006). The approach used is similar to that of Magnussen and Olsson, augmented by the use of graphic and tabular devices and some summary statistics to reveal patterns in the data. The upshot comprises qualitative descriptions of why estimates differ. That said, in general, the causes of such differences may well be as varied as the particulars of projects undertaken. Therefore, the analysis aims to rule out project-specific causes and focus on aspects that are meaningful above the level of the single project. As pointed out by Venkataraman and Pinto (2008), project cost estimates often have significance beyond their mere numbers, as they may become standards against which future costs are compared. Although estimates become more accurate as decisions are made and uncertainties resolved, they also are a principal means for assessing project feasibility, in the sense that a comparison of cost estimates with revenue estimates is crucial in determining whether the project is worth starting or not. The decision to finance and execute the project almost always is based on estimates. Hence, cost estimation is among the factors that influence project success. This paper explores how external quality assurance, with an emphasis on the review of cost in the front-end of major projects, may contribute to projects being more consistently successful.

2. Background

The research reported in this paper was made possible by recent developments in the quality assurance of major projects. As reported by Magnussen and Olsson (2006), around the turn of the Millennium, a call for better governance of major investment projects arose in Norway as well as in many other countries. It was a reaction to the sometimes sensational mishaps in major public projects, including inadequate engineering, slipshod management, unrealistic budgets, late changes of scope, unanticipated cost overruns and critical delays. In 2000, the Norwegian
Ministry of Finance responded to that call by establishing the Quality Assurance 2 (QA2) scheme then made mandatory for public sector projects having overall cost estimates of more than NOK 500 million (€62 million). In short, QA2 requires a Ministry responsible for a project to first assess it up front, with a particular focus on its cost estimates and risks, and then to submit the documents of that assessment to scrutiny by an independent commercial quality assurer having a framework contract with the Ministry of Finance. Only when the requirements of QA2 have been fulfilled can a Ministry bring a project before Parliament for budgetary approval. Despite the ways that QA2 obviously can contribute to improving project performance, it is concerned with the project as an entity and not with the question of whether the project is a suitable response to a societal need. Clearly, even a successful project may have little or no benefit if it need not have been implemented in the first place. Consequently, in 2005 the quality assurance scheme was extended with the establishment of Quality Assurance 1 (QA1) to be performed at the end of the pre-study phase, in which the concept is chosen. A satisfactory QA1 supports the decisions to be made before starting design and engineering that lead to the figures and attributes assessed in QA2.

With QA1 and QA2 in place, for the first time it became possible to compare and evaluate equally large yet dissimilar projects. In short, that is what has been done in the study reported in this paper. As of 2008, 81 major public investment projects were subjected to these new quality assurance requirements. Of them, only five were subjected to the newer QA1 requirements, so this study focuses on parameters identified in the QA2 evaluations.

3. Previous studies

Research has traditionally been concerned with comparing budgeted costs with actual outcomes. In contradistinction, this paper is concerned with the differences in the cost estimates made by the project organizations and those made by the independent quality assurers prior to the budget appropriations. Previous research involved some quantitative comparisons of costs, but only meagre inquires as to why the predictions of costs differ. However, as Flyvbjerg et al. (2004) point out in their comparison of estimates with outcomes, there are four categories of causes of cost underestimation, technical, economic, psychological and political. The technical causes include imperfect techniques, inadequate data, lack of experience on the part of forecasters, etc. The economic causes reflect the classic conflict between self-interest and public interest. Doubtlessly, stakeholders may indirectly influence the forecasting process, because a proposed project that materializes it may generate activities on which they can make money. Economic causes reflecting public interest reflect the opposite, as the costs associated with a project may be deliberately cut by officials in attempts to keep budgets low. The psychological causes reflect the mentalities of project promoters and forecasters as well as their frequently being overly optimistic about project outcomes, “appraisal optimism”. Finally, the political causes include penchants such as intentional bias to serve the interests of project promoters to get projects initiated, in other words, strategic misrepresentation to maximize the chances of getting a project started. Flyvbjerg et al. (2004) admit that it’s difficult to acquire meaningful data on this issue, as to do so would require knowledge of the intentions of actors. It would require that people openly admit their involvements in deceptions. Flyvbjerg et al. (2004) identified one study in which a number of persons admitted in interviews that figures were produced to satisfy superiors and get projects started. Despite that incriminating evidence (described as circumstantial by the researcher himself), one such incident is insufficient to draw a conclusion about the entire population, that an explanation of cost underestimation in terms of strategic misrepresentation fit their data particularly well, and opt for political and economic explanations. Venkataraman and Pinto (2008) state that the most significant reasons for project cost overrun are low initial cost estimates, unanticipated technical difficulties, lack of or poor scope definition, specification
changes and external factors. Factors that lead to low initial cost estimates are underestimations
of the magnitude and complexity of the task, and the misleading assumption that everything will
go as planned. The factor “business and political gamesmanship” described by Venkataraman
and Pinto (2008), “… project managers may feel that presenting an initial low cost estimate will increase their
chances of gaining board level approval for their project, making it more likely to win in a competitive situation”,
fit well with the economic and political explanations suggested by Flyvbjerg et al. (2004).
However, Venkataraman and Pinto (2008) and Flyvbjerg et al. (2004) differ in the ways that they
ascribe cost overruns to technical causes. Unanticipated technical difficulties may be attributed to
from poor initial design, but problems and technical failures may arise due to the complexity and
uniqueness of project tasks. Problems caused by inadequate or lacking scope definition are
germane because reasonable and informative analyses are a waste of time if previous work has
failed to define clear directions, goals or purposes. Specification changes, often termed “scope
creep”, are said to be among the main causes of cost overruns. Requests for specification changes
during project execution are known to escalate costs and may come from internal or external
sources. Finally, Venkataraman and Pinto (2008) point to external factors such as inflation,
interest rates, environmental issues and currency exchange rate fluctuations as causes of project
cost increases. External factors may be instrumental in combination with technical problems and
other difficulties during execution. To summarize, the literature apparently implies that political
causes (intentionally biased forecasts) adequately explain cost overruns. Technical causes for cost
overrun are refuted by Flyvbjerg et al. (2004), while Venkataraman and Pinto (2008) include
unanticipated technical difficulties as relevant causes. The empirical bases of these points of view
are enigmatic, in as much as Flyvbjerg et al. (2004) cannot claim much empirical support for the
contention that technical causes are irrelevant, only that some causes seem to fit their data better
than others, and that accounts in one study went on record as saying that estimates were
intentionally biased. The contribution by Venkataraman and Pinto (2008) refers to some
secondary sources (studies of a large number Information Technology projects) and to a few
project cases, but there are no concrete statements of how the significant reasons for cost
overruns are identified (other than referring to ‘industry data’, p. 46). What this basically reflects
is that explanations, and thereby the underlying reasons for cost overrun, are difficult to come by.
The study reported in this paper may, based on empirical data from 61 projects, shed some light
on what is emphasized in the cost estimation in the early stages of a project before it is approved
for execution. It may be assumed that the actual causes of cost overrun are known both by the
project organization and by the quality assurers, and that this can play a role in their predictions
of costs. Hence, the possible causes discussed above may be pertinent in exploring the
differences in predictions of costs.

4. Data and Method

This study is of 61 large public projects in four business sectors in Norway, as listed in Table 1.
Historical data are included from the 81 projects subjected to the framework for up-front
assessment and quality assurance introduced by the Norwegian Ministry of Finance in 2000,
which means that the study includes data from projects implemented from 2000 to 2008. The
sample is dominated by the transportation infrastructure projects category (55.7 %), which
consists of motorway, trunk road, bridge, tunnel, station building and rail projects. The building
project category (24.6 %) is second largest, followed by defence procurement (14.8 %), in which,
for some projects, a certain degree of development also is involved. In a similar manner, the
information technology projects category (4.9 %) includes projects which often may involve
hardware procurement, software development or both. As mentioned in Section 1 above and as
the composition of the sample reflects, the particulars of the projects studied vary. However, they
share the common denominator of being projects that appear in public budgets, as described by
Flyvbjerg et al. (2002), under the conventional form of public ownership, typically with a Ministry
as project owner. It’s also worth noting that the projects are planned and implemented under similar regulatory regimes and within similar institutional frameworks.

<table>
<thead>
<tr>
<th>Type of project</th>
<th>Number of projects</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation infrastructure</td>
<td>34</td>
<td>55.7</td>
</tr>
<tr>
<td>Building</td>
<td>15</td>
<td>24.6</td>
</tr>
<tr>
<td>Defence procurement</td>
<td>9</td>
<td>14.8</td>
</tr>
<tr>
<td>Information technology</td>
<td>3</td>
<td>4.9</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Magnussen and Olsson (2006) provide a comprehensive description of the relevant data collection and methodology.

In theory, evaluations of the cost estimate differences should be as reliable as QA2 itself. But in practice, bias may enter because there are more project organizations than independent quality assurers. So while there are at least as many sources of the magnitudes of cost estimate differences as there are projects, there far fewer sources of their clarifications. Usually, as was the case in this study, clarifications of the differences for all projects are in the quality assurer reports, but few clarifications were forthcoming from the project organizations themselves.

Bias also may enter in the subjective judgments of the researcher, principally whenever pieces of information obtained were of a more general character and related to differences in results in less verifiable terms. Moreover, it’s always possible that essential contextual information may be overlooked. Likewise, the scope of this study does not include addressing political issues (misleading and intentionally biased forecasts) that Flyvbjerg et al. (2004) claim are plausible causes of the differences between expected and actual outcomes. This study is principally concerned with technical explanations, which Flyvbjerg et al. (2004) refutes as the causes of forecasting errors. These aspects might suggest that there are weaknesses associated with this study, but arguably they are negligible in view of the light shed on some key issues.

5. Findings

The main output of the study of differences in estimates is shown in Figure 1. For each of the 61 projects, the percentage difference between the independent quality assurer’s estimate and the project organization’s estimate is plotted as a point, located on the horizontal scale according to the date of the QA2 assessment.
The essential finding evident in Figure 1 is that the independent quality assurers recommended budget increases in 40 of 61 projects. Although the differences are small, within the ±5 % range, for nearly half the projects (30 of 61), the range of the total sample is from 24.2 % (recommended budget raise) to -14.0 % (recommended budget reduction). So the difference in an individual project may be significant. However, the average difference is 3.4 % and the standard deviation is 6.9 %, which together imply fair consistency of the estimates.

In comparison, Magnussen and Olsson (2006) reported quality assurer’s recommended budget increases in 23 of 31 projects and an overall recommended budget raise of 5.1 %. Moreover, the differences apparently decreased systematically after QA2 was introduced. First, the distribution of projects where the quality assurers recommend higher budgets is sustained by the updated sample. As apparent in Figure 1, the differences tended to be larger when QA2 was new. For example, early on, eight projects exhibited differences of more than 10 %, but subsequent differences were not as great. Furthermore, 13 projects in a sample of the first 31 exhibited differences were within the ±5 % range. The extended sample adds 17 cases to this category. If we compare summary statistics of the first 31 projects with the subsequent 30, it can be seen that both the average recommended budget increase (1.6 %) and the standard deviation (5.2 %) are lower in the last 30 projects.¹

Though the differences observed are spread over a period of eight years, they are assumed to be comparable, as the underlying cost data have been normalized to the same price level, and factors such as price escalation, project changes, and so on, have been accounted for. Consequently, it’s reasonable to assume that the observed differences between estimates are real. However, this quantitative assessment provides no evidence as to why the differences arose. So the next section presents results from an investigation of differences based on available contextual information.

¹ Extra care should be exercised in interpreting the results of the comparison because the cut-off between the first 31 and the 30 following projects was selected arbitrarily.
6. What might explain the observed differences?

The type of each of the projects is known, so the projects could have been segmented by type. But this was not done, as the initial aim is to analyse possible explanations and present and discuss them in a manner which could be meaningful above the level of an individual project. The magnitudes of the differences in estimates presented above might comprise another dimension that could be segmented in the data. Yet that would reveal little, as the investigation was guided by (and to some extent was adjusted for) the empirical observation that the distinctness of identifiable explanations for differences in estimates do not increase with the size of the observed difference. In other words, it would not be easier to verify causes of large differences than the causes of small differences. Projects with small differences were found to be just as important targets for investigation as those with large differences. As an example, in the final report from a review of a transportation infrastructure project, where the recommended a budget increase was 2.3 %, some NOK 40 million (€ 5 million) in absolute terms, the quality assurer made the following statement about the estimation process carried out by the project organization before the quality assurance took place: “The approach applied here, in which [the estimation tool] is employed without good, unambiguous and easily traceable documentation with respect to design basis and experience data, is not in accordance with good practices for estimation and untenable in the [agency]. It is purely coincidental that the discrepancy [between the estimate proposed by the agency and the external consultant] is not substantially larger, and this illustrates the need for the [agency] to implement immediate measures to improve the project’s estimate.” (Author’s translation from the Norwegian)

The project organization’s response to this statement was not made available, so the statement must be regarded to be one actor’s subjective view about the estimation process of one particular project. However, this particular case illustrates the sort of qualitative information that may be available. It also shows that reviewers explicitly comment on cost estimation practices and suggest why differences in results may arise. Above all, it shows that quantitative evidence alone is insufficient to assess how front-end quality assurance may affect planning. The areas associated with explanations for differences in estimates are listed in Table 2. The descriptions of identified issues are impartial to avoid result bias.
### Table 2 Areas associated with explanations for differences in estimates

<table>
<thead>
<tr>
<th>Overall issues with sub-categories</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The assessment of uncertainty</strong></td>
<td></td>
</tr>
<tr>
<td>Internal factors(^2)</td>
<td>10</td>
</tr>
<tr>
<td>External factors(^3)</td>
<td>6</td>
</tr>
<tr>
<td>General uncertainty(^4)</td>
<td>6</td>
</tr>
<tr>
<td>Degree of scope changes</td>
<td>3</td>
</tr>
<tr>
<td>Quality of uncertainty management</td>
<td>1</td>
</tr>
<tr>
<td><strong>Estimation method and process</strong></td>
<td></td>
</tr>
<tr>
<td>Quality of method(^5)</td>
<td>16</td>
</tr>
<tr>
<td>Quality of process(^6)</td>
<td>4</td>
</tr>
<tr>
<td>Quality of documentation(^7)</td>
<td>9</td>
</tr>
<tr>
<td>Experience data(^8)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Price changes(^9)</strong></td>
<td>11</td>
</tr>
<tr>
<td><strong>Total number of identified explanations(^{10})</strong></td>
<td>70</td>
</tr>
</tbody>
</table>

Apart from price changes, 11 explanations, and the 12 explanations connected to external factors and general uncertainty, the explanations seem to be related to internal issues. This is evident in the large internal factors category, which contains explanations related to different perceptions of uncertainty regarding project management and control, the project organization, contracting, etc.

Considering the focus of the QA2, it’s unsurprising that quality of method accounts for the largest number of cases (16). The essence of QA2 is that the independent quality assurers are encouraged to question, on their own initiative, basic assumptions of costs, and that methods or procedures applied to produce the estimates draw significant attention. Also how the process is performed and documented is seen as important, and the Estimation method and process category combined accounts for 33 of the 70 identified explanations. Apart from the Experience data subcategory, in which experience data collected by the quality auditors were used to change input variables, most explanations reported in the Estimation method and process category suggest that the methods applied by the project organisations may benefit from improvements. For example, this pertains to how cost elements are grouped and how dependencies are managed, but also to the level and to how uncertainties are included in the analysis. Reviewers have often pointed to the issue of applied methods. One of the agencies responsible for project planning and execution has set an acceptance criterion, which implies that the level of accuracy of estimates at the detailed planning level should be within ±10%. A large part of the 16 cases of

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2 Includes different perceptions of uncertainty related to project management and control, the project organisation, contracting, etc.

3 Includes different perceptions of uncertainties assumed to be outside the project’s control; general economic trends, regional economy, rules and regulations, etc.

4 Related to issues which usually are indeterminate and may have a general, indirect impact on the overall result.

5 This subcategory accounts for explanations in which the quality of the applied method or procedure for cost estimation is prominent.

6 This subcategory entails cases where the quality of the analysis process itself (for example degree of project manager involvement, design and engineering team involvement, analysts’ qualifications, etc) explains different outputs.

7 This is related to cases where the quality of the documentation of the general procedures, processes, and input variables is pointed to as differences in estimates.

8 Cases in which reference data were called upon to explain differences.

9 In this category, changes in input variables due to price or market changes occurring after the initial estimate prepared by the project organization are used to explain differences.

10 The number of identified explanations does not equal the number of cases (61) because in some projects more than one identified explanation was included. For example, in some projects, both the method for and the documentation of cost estimation were identified as equally important and included in the table.
cost estimation method category contain explicit critique of this practice. A fixed level of 
accuracy defined by a general decision alone may, according to the quality auditors, lead to 
underestimation of the uncertainties involved in individual projects. The level of accuracy of an 
estimate should be obtained by assessing a particular project’s stage of development and maturity, 
and by an accompanying uncertainty analysis of costs. Another issue which has sparked some 
attention is the cost estimation practice in one particular agency. The method involves 
multiplying separate cost items presented by the project engineering team with a factor which is 
supposed to account for expected cost additions up to the stage of tendering. The next step 
involves multiplying the separate cost item with another factor (based on historical experience 
data from completed projects) that is meant to cover expected cost additions during execution. 
Finally, an additional mark-up for uncertainty defined by an assessment of the project at hand is 
included. One of the pre-qualified consultancy firms has challenged the method and suggests that 
it introduces bias in the result of the cost analysis. It would, according to the consultant result in 
excessive estimates, because the same uncertainty factors are included several times (hence the 
use of a factor based on experience data and an additional mark-up for unforeseen events)\textsuperscript{11}, and 
 furthermore too low contingency allowance because dependencies between cost elements are 
 ignored. However, it may be noted that results for the 12 projects from this agency, which have 
been subjected to quality assurance review, show that in these particular projects the average 
difference is 3.4\% (which means that external consultants on average recommend higher 
budgets). The agency’s average contingency allowance (7.7\%) displays a somewhat lower result 
than the allowance recommended by the quality assurer (10.3\%). The small sample does not 
allow concise conclusions, but suggests that the predicted impacts from methodical issues are 
only partially supported by empirical evidence.

While the quality of how cost estimations are facilitated or organized seems to have little affect 
on differences, the other notable issue in this category pertains how general procedures, 
processes, and input variables are documented. For example, most quality assurers find it hard to 
validate statements of the type “We assume ten per cent allowance for unpredictable events”, and 
frequently request that the background for such assumptions be described in greater detail.

Judged by the literature reviewed above, one particularly interesting observation is the lack of 
explanations associated with scope changes. Scope changes were identified as explanatory factor 
for differences in estimates in three cases. However, a look into further empirical evidence 
collected from these projects shows that management of scope is not a neglected area. A study of 
the uncertainty elements most frequently identified by quality assurers in connection with QA2 in 
56 projects, as reported by Torp et al. (2006), show that scope management is the fourth largest 
of 16 identified issues. The data in this study reveal that differences in estimates can to a limited 
degree be explained by a different assessment of the impact of scope management. This implies 
that equal emphasis is placed on scope management by the project organizations and the quality 
assurers.

As shown in Figure 1, the sample covers eight years of experience with up-front assessments. 
What, then, can be said about potential developments over time in explaining differences? Do 
some issues persist over time? It was observed that the explanations for differences changed little 
over time, as they seem to be equally distributed along the time axis. In this respect, it’s 
illustrative to revert to the example above, in which a 2.3\% difference was observed and the 
quality assurer described the project organization’s estimation practice as poor. The QA2 report 
in this particular project was completed in August 2005. In September 2006, the same consultancy 
firm submitted a report from another QA2 assignment regarding a project under the same

\textsuperscript{11} It is argued by the external experts that the factor based on data from completed projects may cover unpredictable 
events which may arise in future projects.
agency. In this case, the observed difference in results was 2.0 % (budget reduction), but the critique of the agency’s approach to estimation was repeated in nearly similar terms, and actions to improve cost estimation were sought after. This may indicate some reluctance by agencies to implement changes based on recommendations from quality assurers. However, the agency which was criticized, particularly by one of the consultancy firms, for employing a method with possible bias responded by hiring the same firm to facilitate the cost estimation process in projects which subsequently were encompassed by the procedures for quality assurance. These examples show some of the practical responses by project organizations to quality assurer recommendations.

7. Concluding discussion

The objective of this paper has been to investigate the difference in estimates in projects subjected to an institutionalized framework for up-front assessment and quality assurance. This is done to explore how external quality assurance with particular emphasis on review of cost in the front-end of major projects may contribute to more consistent achievement of project success. First, quantitative differences in a sample of 61 projects were presented as a follow-up to the study of 31 projects reported by Magnussen and Olsson (2006). Second, emphasis in this paper was extended to include approaches to explaining why differences occur.

The data of quantitative differences revealed that external review by quality assurers is likely to result in recommendations for budget increase (66 % of the cases), although the combined cost impact for the projects seen as a whole seems to remain low (3 % budget increase on average). As can be seen in Figure 1 and as suggested by some summary statistics, there seem to be greater differences in the early stages of the quality assurance scheme, yet it was concluded that analyses involving only quantitative aspects are inadequate to reveal any underlying reasons for the observed differences. Therefore, contextual information, data which could have the potential to identify explanations for differences was sought. The most important lesson was that projects which displayed small differences in estimates were just as important as those with large differences. Explanations were just as readily available and informative even if differences were small, and estimates for all practical purposes could be said to be equal. This implies that analyses of quantitative differences alone are insufficient to determine how up-front assessment and quality assurance may affect planning and implementation.

The identified explanations were structured within three overall issues, two of which were broken down into subcategories. That different perceptions of the uncertainty involved accounted for a significant part of the explanations for differences did not come as a surprise. As suggested by Magnussen and Olsson (2006), whenever project organisations and quality assurers have different views about uncertainty elements, results may be affected. Magnussen and Olsson (2006) further assumed that independent quality assurers may be more prone to include impacts of uncertainties of a more unpredictable and unmanageable nature. This can not be said to be supported by the results of this study. The data have revealed that explanations most often are concerned with internal issues such as project management and control, the project organisation, contracting and the methods employed for cost estimation. These are issues that to a great degree may be controlled by the project organization. Cost estimation issues alone, which sort into the traditional category of technical causes, account for 33 of the 70 identified explanations of differences. Of course, this should be interpreted relative to the background that a larger part of the QA2 exercise concerns projected cost verification. Both the numbers proposed and the methods used to produce those numbers are scrutinised by independent commercial quality assurers. However, while the analysis of quantitative differences suggests that methodical issues may be insignificant, in the sense that observed differences are small, a closer look at the
contextual information shows the contrary. One of the examples above illustrated that although differences were small, it was argued by the quality assurer that the approaches applied showed such significant inequalities that the size of the quantitative difference was judged to be coincidental.

Some practical steps taken by agencies in response to some of the issues raised by the quality assurers were identified, but a main weakness of this study is that little is known about the project organizations’ reactions to QA2. Clearly, this study might have been more comprehensive had more information been available from the project organizers. Moreover, this study has not been concerned with psychological or political issues (misleading and intentionally biased forecasts), which have been pointed out by previous studies as relevant explanations for cost overruns.
References


