

# Curbing Cost Increases and Benefit Shortfalls

Morten Welde and Gro Holst Volden

Department of Civil and Environmental Engineering, NTNU—Norwegian University of Science and Technology, Trondheim, Norway

## 1. Introduction

Projects are tools to achieve political objectives and strategic business development in private and public sectors. Therefore, successful project delivery is essential for delivering political promises and meeting societal needs. The success of a project is often measured in terms of the ability to meet goals formulated in the business case that justified undertaking the project.

Project goals are formulated to operationalise project success – a concept that has attracted considerable attention and debate in the academic literature. Williams (2022) discussed different perspectives on success and suggested that the most basic level of success is project management success, while various strategic success criteria cover longer-term aspects. Samset (2010) argued that public project success has several dimensions, from the immediate project outputs through user benefits to wider and longer-term societal impacts.

Good goals are important for everyone involved in projects and provide an understanding of what the projects are to deliver. The goals ensure that all parties have the same understanding of the project and are used, among other things, to distribute responsibilities and as a basis for further planning. A project’s goals provide information about why the project will be carried out, how much it will cost when it is completed, and the benefits/gains from its implementation. Time and cost are critical success criteria that are relatively unproblematic to measure. By contrast, measuring benefits can be more demanding, especially for projects in the public sector that deliver products that are not traded in markets. Common to all these success criteria is that the track record of projects, especially in the public sector, is mixed.

Costs matter. The investment cost usually attracts the most attention throughout the projects’ front-end and implementation phases. It is suitable for making the responsible actors accountable, gauging progress and performance and assessing economic viability over time. However, the final cost of projects often turns out to be significantly higher than what was first announced to taxpayers and decision-makers. This is often referred to as cost overrun but, among others, Odeck and Welde (2021) argued that the term cost overrun should be distinguished from another related term, ‘cost escalation,’ which is used to express an anticipated growth in the estimated cost before the budget is set due to factors such as inflation or changes in societal needs.

Cost overruns, measured as the difference between actual and budgeted costs in real terms, can harm project progress, financial and social viability, and reputation. Because cost is a metric that can be measured with a high degree of accuracy, the list of studies of cost performance

conducted by academics, auditors and client organisations is extensive. Most of these studies have demonstrated that cost overruns are more prevalent than underruns. Odeck and Welde (2021) listed 48 studies of cost overruns in the transport sector worldwide from 1973 to 2012 and found that the weighted mean overrun (weighted by the number of projects in each study) across all of the studies was 40%. Flyvbjerg et al. (2018) claimed that 9 out of 10 transport projects worldwide experience a cost overrun. Similar results have been found in other sectors, such as ICT (Flyvbjerg and Budzier, 2011; Kashiwagi, 2018), the Olympic Games (Flyvbjerg et al., 2016), and defence acquisition (Hofbauer et al., 2011; Pfeifer and Warrel, 2021). However, even if many studies have documented that cost overruns are a problem, other authors have found more positive results with samples of projects below or close to budget (Odeck et al., 2015; Love et al., 2018; Love et al., 2019; Park, 2021; Welde and Klakegg, 2022). Love and Ahiaga-Dagbui (2018) and Love et al. (2022) have therefore argued that the often repeated argument that “all” projects are prone to optimism bias is misleading and that there may be competing and equally plausible explanations as to why projects fall short of expectations. Therefore, improving cost performance should not be based only on failed projects. There may be more to learn from good practice than bad practice.

However, the purpose of carrying out projects is much broader than simply realising a cost. Through achieving goals, we seek to realise positive effects for the users or the responsible organisation, benefiting the wider society. The positive effects can relate to time or cost savings, a better quality of services, increased security or better opportunities for value creation. Such benefits can be challenging to quantify ex-ante, and it can be even more difficult to follow up on the benefits and determine whether or not they were achieved.

As noted by other authors (Cherns and Bryant, 1984; Zwikael and Smyrk, 2012), it is not the project manager’s responsibility to achieve the higher-order goals in the business case. This is the project owner’s responsibility. The easier-to-measure ‘iron triangle’ and the project management perspective often receive the most attention in public projects. Samset and Volden (2016) referred to this as a paradox in project management and governance, as it can be argued that the strategic success perspective is inherently more important.

In general, benefits performance has been less studied than cost performance. Flyvbjerg et al. (2003) found that demand estimates were of poor quality in numerous transport projects, and the benefits were often overestimated. Moreover, environmental and other adverse side effects tended to be downplayed, while regional economic benefits were overestimated. Solberg and Preuss (2007) described how major sporting events are often justified by anticipated tourism-related and wider economic impacts but fail to realise such effects. Furthermore, many ICT projects do not meet the expectations of users and end up being abandoned or reworked (Cicmil and Braddon, 2012). However, as noted by Volden and Welde (2022), case studies tend to focus on projects for which there is already cause for concern, and there has been a striking lack of systematic ex-post evaluation of public projects for learning purposes. Too little is known about whether or not citizens and taxpayers have reason to view public projects as successful in strategic terms.

The reasons why projects experience cost overruns or otherwise fail to meet the expectations of owners and stakeholders are many and have been discussed by different scholars, sometimes presenting wildly different theories ranging from strategic behaviour bordering on criminal

misbehaviour to ‘honest’ mistakes. In recent years, the academic debate has been characterised by disagreement about whether project underperformance is due to error or bias. The “error school” attributes cost overruns and benefit shortfalls to issues such as scope changes, increasing complexity and marked issues (Ika et al., 2023). In contrast, the “bias school”, often associated with the work by professor Bent Flyvbjerg and associates (Flyvbjerg and Gardner, 2023), suggests that the biggest risk in projects is human, or the inclination to ignore past project performance and instead focus on a particular case project. Sometimes, bias is intentional; other times, it is unintentional, but the results are the same. There have also been numerous publications, academic as well as from the consulting industry, that offer advice as to how project behaviour can be improved. Although projects are exposed to a range of external factors that may influence their outcomes, humans remain the most crucial resource for projects to be successful. Humans are, however, susceptible to different biases (Flyvbjerg, 2021). From a project behavioural perspective, the improvement in project performance from the initiation through the planning and implementation phases to decades of operation thus relies on ‘soft’ human factors and ‘hard’ institutional arrangements. We must address both error and bias, and this chapter aims to advise both camps in the error vs. bias debate.

This chapter builds on research carried out by the Concept Research Programme,<sup>1</sup> which the Norwegian Ministry of Finance tasks to research large government projects that undergo the ministry’s project governance scheme. The scheme is, in turn, inspired by experiences and best practices identified in other countries, such as the UK, where a similar scheme exists (HM Treasury and Cabinet Office, 2011). Based on empirical data and theoretical studies, the research programme gathers results and develops new knowledge about making sound decisions and governing major public projects. Trailing research and evaluation has the advantage of monitoring changes in project planning and delivery over time and continuously proposing avenues for improvement (Olsen and Lindøe, 2004). The programme has operated since 2002 and has produced many research reports, papers and project evaluations. In Norway, all government projects over a threshold value (currently c. EUR 100 million) must send the programme all front-end reports regarding economic appraisal, cost estimation and risk analysis. This creates rich data material on which to base research and evaluation. The contents and advice in this chapter are based on the authors’ experience working on the programme. We refer to relevant research results based on empirical data and international literature where appropriate. The purpose is to provide practical advice based on experiences from past projects. The chapter concentrates on traditional project governance issues targeted at improving the performance of projects from the perspective of the owner or society. Project success does, however, rely on human beings. Our advice in the chapter is aimed at providing both an organisational and institutional context that both provide those working on planning and delivering projects with good tools and project owners with mechanisms that maximise the net benefit of projects.

The chapter proceeds as follows. Section 2 discusses the importance of the front-end phase and the early estimates of costs and benefits on which de facto project approval is often based. Section 3 constitutes the main part of the chapter, where we offer advice to improve the

---

<sup>1</sup> <https://www.ntnu.edu/concept>

management of costs and benefits. Section 4 highlights ex-post evaluation as a tool underused in learning and improvement, and section 5 concludes the chapter.

## 2. The Importance of Projects' Front-End Phase

Research from the Concept Research Programme has shown that we must distinguish between cost increase during projects' front-end phase (the period before the formal investment decision) and cost overrun after a formal budget is approved. Figure 1 illustrates a hypothetical development of a cost estimate in a project<sup>2</sup>.

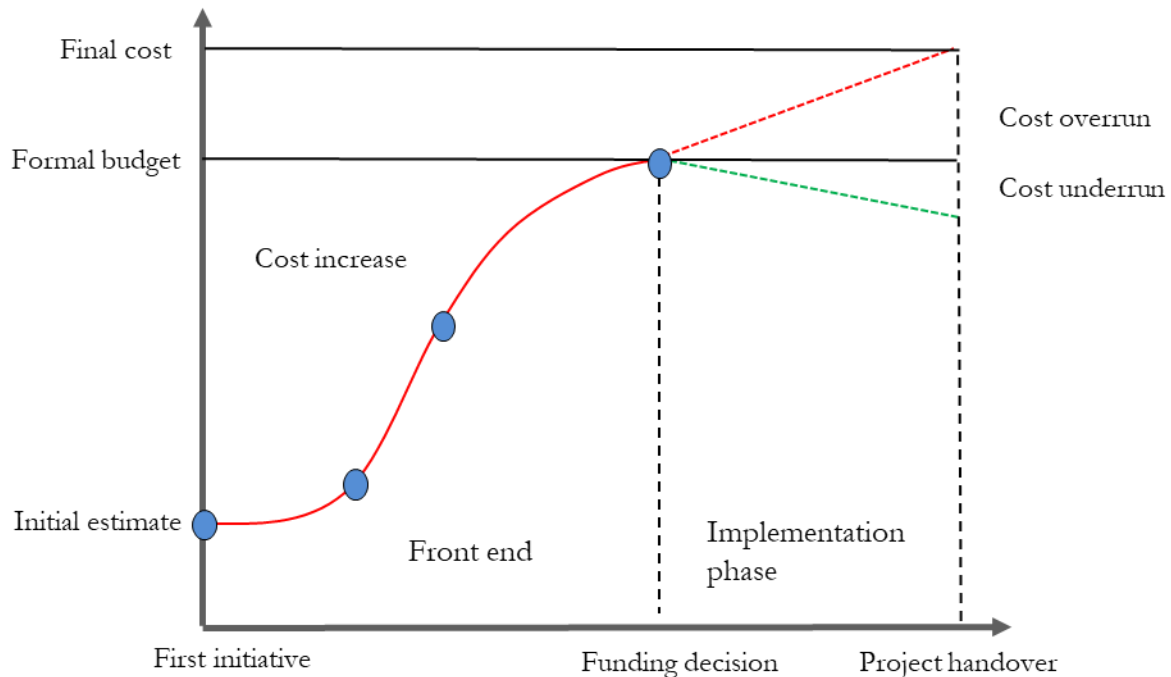


Figure 1. Development of a cost estimate in a project (blue dots indicate potential decision points)

Large projects are often based on a first initiative, idea or vision. At this stage, very few details of a project are known. We may, for example, have a vision to connect an island to the mainland. Still, without further investigation, we will not know whether to build a bridge or a sub-sea tunnel, the standard and capacity of the new link, or whether we should opt for other measures to improve mobility. Cost estimates are typically low initially before more systematic attempts are made to estimate costs. During the front-end phase, the project evolves, often to accommodate user needs or compensate for potential adverse environmental or social impacts. In most projects, the project owner takes an active decision on whether or not to proceed with the project based on estimated costs and benefits throughout the front-end phase (illustrated by the blue dots in Figure 1). However, it is also during this stage, as Ahiaga-Dagbui and Smith (2014) argued, that the effects of human bias and strategic behaviour are particularly heightened. Local promoters may feel they have little to lose and much to gain from an optimistic view of both costs and benefits. The estimation of benefits can have a similar development, with initial

<sup>2</sup> In reality, most projects have more phases than those shown in the figure. The development in costs may differ between stages. The figure aims to illustrate that the biggest increase in costs is often during project development but before formal project approval.

estimates starting high (often including ambitious wider impacts for the community) and gradually becoming more realistic as the project takes shape.

Eventually, a formal budget is approved, and implementation/construction can start. The final cost may be higher or lower than the price-adjusted budget, but more often it is higher. In our opinion, only the deviation from the approved budget can be defined as a cost overrun. Cost estimates evolve as the project matures and are inherently linked to the development of the project scope and schedule (Infrastructure and Projects Authority, 2021). A cost estimate is neither a budget nor a representation of actual expenditure. Unlike the budget, an estimate is not binding. Many projects experience a significant increase in cost estimates, yet they are never implemented. In other projects, the increased costs are justified on environmental, social or economic grounds. One example is the 27 km-long E39 Rogfast tunnel currently under construction. It will reduce the journey time between Stavanger and Bergen, on the western coast of Norway, by 40 minutes. The first formal appraisal of the project was in 2002, when the construction cost was estimated at EUR 470 million. The estimate was based on average costs per metre of other sub-sea tunnels, which were all single tube at the time. This soon turned out to be unrealistic, considering the EU tunnel directive and traffic accidents in much shorter tunnels elsewhere. The revised design was based on a four-lane bidirectional tunnel and improved access roads on both sides. The final budget approved by parliament in 2020 was EUR 1,900 million (first estimate and budget all in nominal values). The tunnel is still considered to have a positive net present value. Clearly, from both a safety and economic perspective, a single-tube tunnel almost 400 metres below the sea surface, carrying up to 10,000 vehicles per day, would be a terrible idea. The cost increase between 2002 and 2020 should not be considered an overrun but a modification to increased safety requirements and societal needs. Welde and Klakegg (2022) discussed the many definitions of overruns in the academic literature. They suggested that this was one of the reasons why the results of studies of cost overruns vary so much.

Figure 1 illustrates an extreme development in the estimated costs, but the research literature on cost estimation and quality during the front-end phase of projects is scarce (Edkins et al., 2013). Still, Andersen et al. (2016) showed that the increase in cost estimates from the first initiative to formal budget approval could amount to several multiples of 100% (and even over 1,000%). The same authors argued that many suboptimal projects are developed further from the first initiative because of unrealistically low first estimates. Early and unrealistically low cost estimates can significantly influence expectations, and as public projects gain momentum, they may be difficult to stop. Once politicians announce a project, they and the public tend to treat this as a commitment (Terril, 2016).

The extent of cost escalation during the front end of projects depends on when the funding decision is taken. This may vary between countries. In Norway, the funding decision allows a budget to be allocated and the client to hire a contractor, i.e., funds are allocated before procurement and detailed design. In the UK, the Infrastructure and Projects Authority (IPA) expects project maturity to be at >60% in the final business case for making a final investment decision (Infrastructure and Projects Authority, 2021). This level of maturity fits well with Norwegian cost estimates prepared for the final investment decision when funds are allocated.

Samset and Volden (2016) referred to the tendency to focus on getting the final estimate right while treating early cost estimates superficially as ‘the cost estimate paradox’, and they argued that this could increase the risk of strategic failure. Therefore, efforts to improve project success should aim to improve cost estimation in both projects’ front-end and implementation phases.

### 3. Improving the Success of Projects Throughout Their Life Cycle

To improve the precision of cost estimates prepared at different stages, to prevent costs from blowing up and to realise the intended goals of projects, we propose a set of advice that could be useful to project-based organisations. We distinguish between advice related to the governance of projects, i.e., processes related to the initiation, selection and organisation of projects, and advice related to traditional project management issues such as cost estimation, risk analysis and project delivery. Finally, we offer some advice concerning the follow-up and documentation of benefits, which should continue after project completion (see Figure 2).

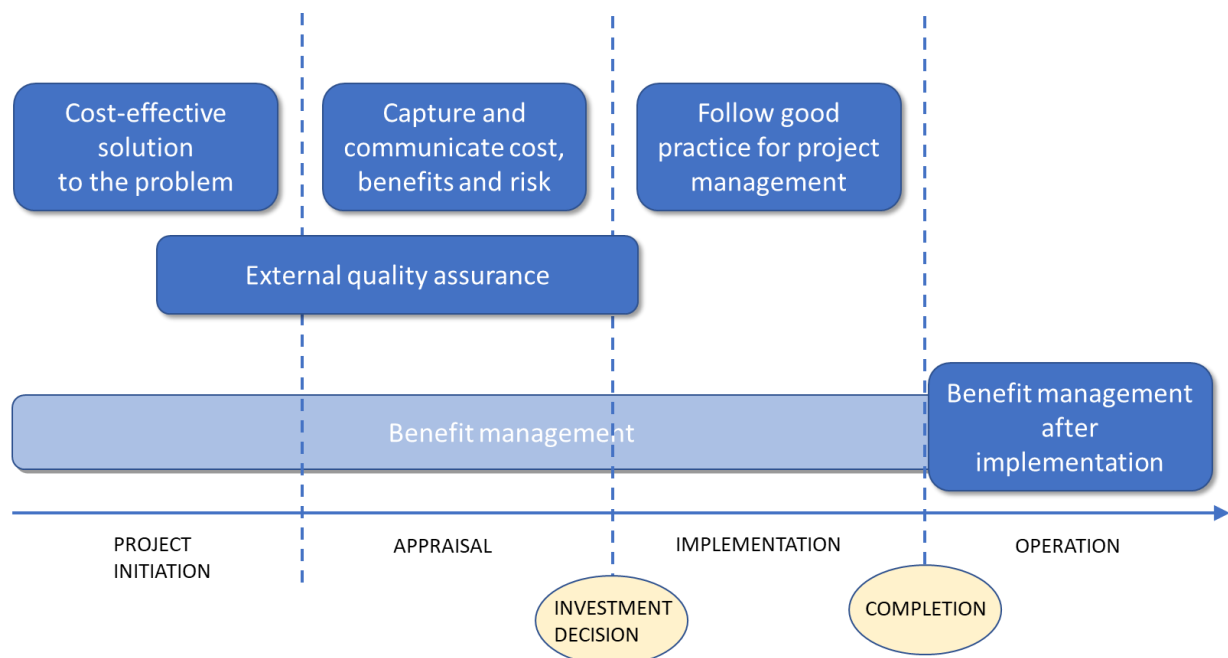


Figure 2. Activities to improve project success from project initiation to operation

#### 3.1. Develop a Cost-Effective Solution to the Problem

The first question should be whether we need a project at all. The question is not what, but why. Projects are often prepared on an ad-hoc basis, and often, the solution (the project) is selected before we adequately address which problem the project should solve (i.e., we end up with a project looking for a problem rather than the opposite). Politically, there is often pressure to ‘be seen to be doing something’, which may lead to opting quickly for the seemingly best solution without exploring options (Zwikael and Gilchrist, 2022). The mandate for project appraisal is a formally initiating document in a chain of events. It gives instructions on how to start a review or appraisal to find the best and most cost-effective solution to a problem. It should give investigators and relevant government agencies clear instructions to clarify the triggering problem, justify the need for change, explain why a project might be needed, and define the superior goal (Samset and Welde, 2019). The mandate should also emphasise the strategic

perspective and clarify the ambition level. It should always be clear that a do-nothing or a do-minimum alternative is an option throughout the appraisal process if the project is unviable in economic, social and environmental terms.

Too often, appraisal and planning turn out to be a wish list of the needs and desires of different stakeholders to be met, which often results in spiralling costs while social benefits remain constant. Bakke et al. (2019) argued that many projects experience increasing costs from the estimated pre-design to the completion phase because of weak project mandates, poorly defined scopes and unrealistic constraints. Active project ownership, starting with the mandate, is a condition to avoid that.

A piece of final advice on project mandates relates to who receives them. As Abraham Maslow formulated, if all you have is a hammer, everything looks like a nail (Wikipedia, 2022). For example, suppose you give a railway authority the task of investigating solutions to mobility problems between two cities. In that case, it is unlikely that improved road access will be the preferred option. For proper investigation of the opportunity space, the responsibility for the appraisal should not be given to an enterprise with a limited area of responsibility that may have the incentive to pursue one specific course of action.

### 3.2. Broad Overview of Consequences

A broad overview of alternatives' benefits, costs and risks should be presented as part of the initial appraisal. As discussed in Section 2, few details are known at this stage and over-optimism regarding both costs and benefits can be a significant problem. This is because decision-makers often become de facto committed early on, and the political cost of turning the project down later can be high. Any efforts to improve the quality of early project appraisals should give good results.

A key issue is to ensure that all relevant consequences are considered. Experience shows that unintended consequences are often ignored, whereas intended costs and benefits are typically covered. Furthermore, while consequences that are easy to quantify receive much attention, unquantifiable consequences do not. This is especially true for some benefits and intangible costs, such as disturbances during construction and environmental costs. Political decision-makers care not only about the net benefits but often also about how benefits and costs are distributed across groups and regions. For example, suppose a particular group will have to bear a high negative consequence. In that case, knowing about this in advance will be crucial because otherwise, the project will risk a high extra cost of compensatory measures later.

A broad, multidisciplinary appraisal of consequences should be presented to decision-makers early. The needs of different stakeholders must be mapped, goals must be formulated, and conceptually different alternatives must be appraised before the financing party can decide whether to proceed with planning and eventually allocate a budget.

### 3.3. Capture and Communicate the Uncertainty of Estimates of Costs and Benefits

Early estimates of costs and benefits are inherently uncertain. For example, presenting a cost estimate as a single-point estimate at an early stage can obscure rather than clarify the likely cost of a scheme. Dysert (2006) thus argued that cost-estimate accuracy is an oxymoron or a contradiction in terms. Planners tend to forget, and decision-makers tend to be unaware, that an

estimated cost or benefit is always a point on a probability distribution curve representing a range of potential outcomes. For example, the probability that the cost will be at or lower than a single-point deterministic estimate may be less than 30%. In such cases, we should expect cost overruns. Uncertainty arises from measured and unmeasured uncertainty ranges around defined elements and unknown uncertainties that are neither known nor understood. In the early stages of projects, a significant proportion of cost increase will come from unknown unknowns. The base case's inability to capture these is not 'optimism bias' but is a natural part of most projects. An uplift or contingency to account for these unspecified risks should be added to the base estimate. Furthermore, the cost estimate should be presented as a range to account for the risk and uncertainty inherent in the project. The range should decrease as the project develops (Infrastructure and Projects Authority, 2021). If the accuracy range is expressed as a percentage, it is important to note whether it is around the estimate before or after contingency.

The literature on cost performance provides limited insight into what cost estimation methodologies are applied in different countries and industries, and to our knowledge, there are no reviews of which methods provide the best results. Welde and Klakegg (2022) argued that stochastic estimation coupled with Monte Carlo simulation and group processes can produce robust estimates. Total uncertainty can be better identified when a relatively large number of people provide input to the cost estimation and risk analysis process. Norway has used this method for large government projects for over two decades, and the results are good at the portfolio level (75% of projects within budget, n=96). The Danish Road Directorate formerly employed a similar method but has since used budget uplifts based on different project maturity levels. There, the national auditor general has demonstrated that over 90% of projects are delivered within budget, leading to criticism that the budgets have been overly generous (Rigsrevisionen, 2019).

While it is increasingly accepted that cost estimates and budgets must include uncertainty and that presenting cost estimates with high precision is unrealistic, the estimation of benefits and their uncertainty is much less developed. Cost engineering for tangible assets has a long tradition, and estimates could be presented with increasing accuracy as the project develops. After completion, the costs can be summarised with 100% accuracy. However, the benefits are much fuzzier. Effects such as increased interaction between organisational units, increased well-being of individuals and improved organisational quality are much more demanding to express accurately. In the transport sector, for example, where the practice of social cost-benefit analysis is well developed, benefits accruing from travel-time savings and traffic-safety improvements are often expressed to the nearest decimal point, yet most ex-post studies show that ex-ante estimates can be very inaccurate (Odeck and Kjerkreit, 2019; Hoque et al., 2022). The uncertainty of benefits cannot be planned or estimated away. Instead, we need to develop methods that express and visualise benefit success and, if possible, use probabilistic methods such as Monte Carlo simulation for benefits and costs (Salling and Leleur, 2011; Salci and Jenkins, 2016).

#### 3.4. Develop Projects Through a Stage-Gate Project Governance Model

It is gradually recognised that front-end activities like those above are best managed within a standardised project governance framework to ensure successful implementation and outcomes. Project governance refers to the processes, systems and regulations the financing party must

have to ensure that projects succeed (Volden and Samset, 2017). A governance framework, or a project governance model, is a collection of minimum requirements for how a project must be carried out from the idea phase to completion. It defines roles, concepts, and decision points between different phases. A stage-gate model requires cost estimates of increasing accuracy to make decisions to proceed to the next stage and eventually consent to implement the project and authorise project funding (Dysert and Elliott, 2020).

The most important aspects of a project governance model can be described as follows:

- Clear separation of project stages
- Decision points between stages
- Quality-assured basis for decisions
- Simplicity.

The purpose of decision points is to ensure that the participants in the decision process are aware of (1) when a decision is made, (2) what the decision is about, and (3) what the consequences of the decision are. At each decision point, the project can be terminated, changed or continue as planned.

A standardised project governance model provides a structure for the preparation of projects and guides implementation. It increases the understanding of the purpose and content of the project and ensures that project participants have a common understanding of where they are in the decision-making process. In a democratic system, a project governance model also has another significant advantage: it ensures that projects are subject to effective political control and makes the participants accountable.

### 3.5. Take an Outside View of Plans and Estimates Through External Quality Assurance

As mentioned above, quality assurance of estimates and other decision documents should be an integrated part of a project governance scheme. Individuals and groups can be susceptible to over-optimism, self-delusion, groupthink and even wilful deception (Lovallo and Kahneman, 2003; Bénabou, 2013). As individuals, we are poor at assessing our performance, yet that bias is much less predominant when assessing the performance of others. A system of project controls that includes external quality assurance (QA) can help debias estimates and keep a project on track. QA is a system for ensuring a desired level of quality in the development, production and delivery of products and services (Odeck et al., 2015). Independent and external peer reviews of forecasts and business cases can be a potential remedy for cost overruns, and benefits shortfall and improve the quality of front-end management by taking an ‘outside view’ of planned actions (Flyvbjerg, 2013). QA can be performed between project stages and before final budget authorisation. In 2000 (later extended in 2005), Norway introduced a system that requires external QA of cost estimates and business cases for large government projects. It is a gateway model that requires all large projects to go through two external reviews:

- (1) QA1: Quality assurance of choice of concept before the government decision to start a pre-project.
- (2) QA2: Quality assurance of cost estimates before the project is submitted to Parliament for approval and funding.

The results in terms of cost performance after formal budget approval are good. Odeck et al. (2015) and Welde and Klakegg (2022) demonstrated that most (75%) projects subjected to external QA have been completed within budget. However, the scheme has traditionally been less successful in curbing cost escalation in the front-end of projects (between QA1 and QA2 - before formal budget approval) (Welde and Odeck, 2017). However, in 2019, the Ministry of Finance introduced a formal requirement for all large government projects to maintain a change log of all changes in costs and scope during their front-end. Coupled with a stronger emphasis on a target cost after QA1, this will hopefully improve cost performance during the early phases of project development.

### 3.6. Align the Incentives of Project Stakeholders

Project or programme benefits are rarely realised top-down but require buy-in from critical stakeholders. Stakeholder alignment (i.e., making the different parties that contribute to and benefit from a project agree on context, goals and processes) is critical to controlling costs and realising benefits. However, this task is challenging in projects in the public sector, where typically, there is one financing party and several stakeholders set to benefit from the investment, often without financial contribution. Volden (2019) described such agency problems as ‘perverse incentives’, which can occur especially when two preconditions are present: an underlying conflict of interest and information asymmetry.

#### 3.6.1. Incentives to Initiate a Project

Perverse incentives can be a significant risk in the initiation phase of a public project. For local interest groups, project approval and funding are often discretionary; the alternative is to receive nothing. The role of local interest groups is to provide the government with information about local needs and other conditions and to describe the suggested project and its results in a desirable manner. The cost is often assumed to be carried 100% by the government. This means that users have an incentive to ‘gold-plate’ investment, as they have little to lose and everything to gain by demanding solutions that benefit them but where the cost to society as a whole exceeds the total benefits. Even when there is a local contribution, for example, in the form of road tolls, the contribution of the individual user of the new facility will be negligible compared with the total cost of the facility. Sager (2016) suggested that perverse incentives are one of the reasons why the results of cost-benefit analyses in the Norwegian road sector have traditionally had little impact on project selection.

Volden (2019) argued that the absence of liabilities, such as local co-funding, is a risk factor that all project funders should be aware of. There is no quick fix for the misalignment of incentives. However, a thorough discussion of the terms of financing should be part of every project assessment. Furthermore, the government should base project selection on high-quality information about the problems, needs, benefits, costs and risks. In this respect, external quality assurance and full data transparency, results and decisions can play a role. Finally, in projects that require discretionary funding, there should be a legal requirement for local financial contribution, and project selection should meet specific criteria, such as value for money.

#### 3.6.2. Incentives to Realise the Planned Effects

A related problem to poor incentives for keeping costs down is the lack of incentives to realise the intended benefits (and costs) during and after construction. In the construction industry, it is

increasingly recognised that traditional contract arrangements, such as unit price contracts where the client specifies the scope in detail in the description of works, may give unfortunate incentives to contractors to produce unrealistically low tenders (Ewerhart and Fieseler, 2003; Welde and Dahl, 2021). To align incentives in the delivery phase, many clients now use partnering and alliancing to achieve targeted costs (Walker et al., 2022).

Achieving the intended benefits may be more complicated as they do not happen automatically and will often depend on the efforts of a wide range of internal and external groups and individuals, some of whom may not have personal incentives to make such efforts. For example, assume that an organisation introduces an ICT system to save time and eventually save costs. While this may be perfectly rational from a top management perspective, it may also imply that some employees will lose their jobs, and some department managers will receive a lower budget. If benefits realisation depends on the same employees and department managers, we should not be surprised if they do not give their best effort. The situation is even more complex when more organisations are involved, which is often the case in public projects. The solution to this problem could be establishing an incentive scheme that allows those involved to keep a certain amount of the profits.

### 3.7. Follow Good Practices for Project Management

Much of the advice presented in the preceding sections (3.1-3.6) relates to the projects' front-end and how this could be better managed and governed. There are good reasons to focus on the front-end phase, as there is solid empirical evidence to suggest that most projects that fail do so because of actions, or the lack of actions, taken before formal project sanctioning. However, this should not lead to the assumption that traditional project management activities are less important. Front-end loading can only improve cost performance to a certain extent before weaknesses in other practices become a constraint (Hollmann, 2002). Front-end activities such as risk analysis are carried out to support the subsequent delivery of the projects. Having the right skills to follow up on these pieces of advice is crucial for efficiently converting resources into results. The discipline of project management is far older than that of project governance, and there is a wealth of advice on managing projects efficiently (e.g., Project Management Institute, 2021).

Within the more than 200 large government projects that the Concept Research Programme has been tasked to research, the risk analysis reports rank the most critical risk factors for the subsequent delivery. The risk factors that dominate the risk analyses are typically as follows:

- Project organisation and human factors (e.g., skills within project organisation, capacity, continuity, cooperation with contractor/supplier).
- Contract strategy (e.g., contract type, settlement terms, number and size of contracts, interface between contracts).
- Market issues (e.g., the number of bids and price offers compared with the client's estimate).
- Geotechnical conditions (e.g., soil carrying capacity, erodibility, compressibility, proportion of quick clay).

These issues should be identified along with strategies for managing them in the front-end, but they should also be managed during the project delivery stage. Efficient project delivery is a highly complex matter, and assuming that the problem of cost overruns and benefit shortfalls will be solved merely by having accurate estimates of costs and benefits is a somewhat naive approach.

### 3.8. Benefits Management Must Continue After Project Completion

Benefits management includes all processes and roles to 1) identify and structure benefits, 2) plans to realise them, 3) management of benefits during the implementation phase and 4) documentation of realised benefits (Figure 3). In other words, benefits management requires continuous attention throughout the project life cycle.

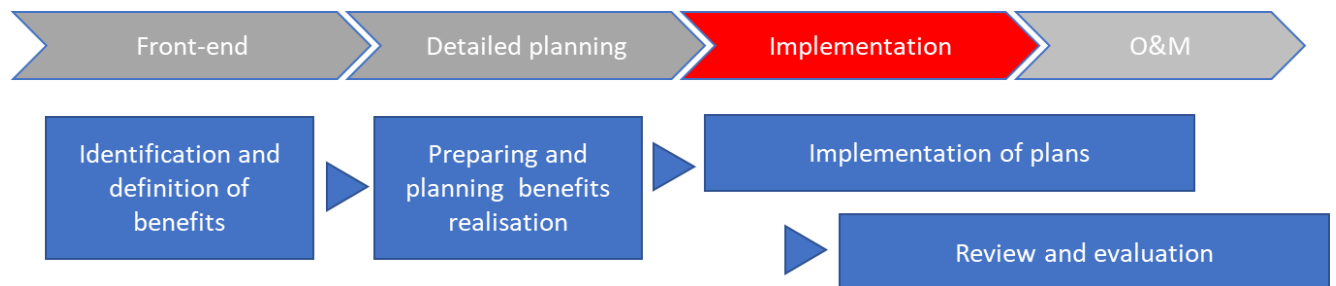


Figure 3. Benefits management through the project life cycle

Benefits management is still an immature area in the public sector. A study based on 23 Norwegian public digitalisation projects found that whereas benefits typically receive much attention in the early phases of projects; systematic benefits management practices are applied to a lesser extent during later phases of the project (Berg et al., 2021). Thus, as important as ensuring that the early estimates are of high quality, the main weakness in practice is the lack of follow-up activities during and after construction. Berg et al. (2021) found that the follow-up and documentation of effects were often superficial and brief, focusing only on a few quantifiable effects. Ex-post evaluations some years after the start of the operational phase were rare.

Berg et al. (2021) also found that although all the projects had a cost-benefit analysis as part of the business case, those analyses served mainly to secure project approval and financing. Project participants are eager to document a positive net present value ex-ante. Still, they do not necessarily use the cost-benefit analysis actively to plan and manage benefits during the project.

We recommend paying more attention to the later phases of the benefits management cycles. Specifically, we advise the following:

- Use the cost-benefit analysis to plan how to realise the benefits (when, how, and who).
- In doing so, *benefits mapping* (see Figure 4, using an ICT project as an example) can visualise and communicate the project logic and planned benefits to internal and external stakeholders. The map in Figure 4 shows the relationships between deliveries and benefits and between benefits and strategic goals.
- Have personnel responsible for the realisation of benefits.

- Define processes for evaluating realised benefits, preferably through continuous monitoring and evaluation. Ensure that given benefits can be both evaluated and managed. Not all benefits can be quantified directly, but they can be evaluated using, for example, indicators or surveys.
- Improved mechanisms for sharing experiences from benefits management across projects and organisations.

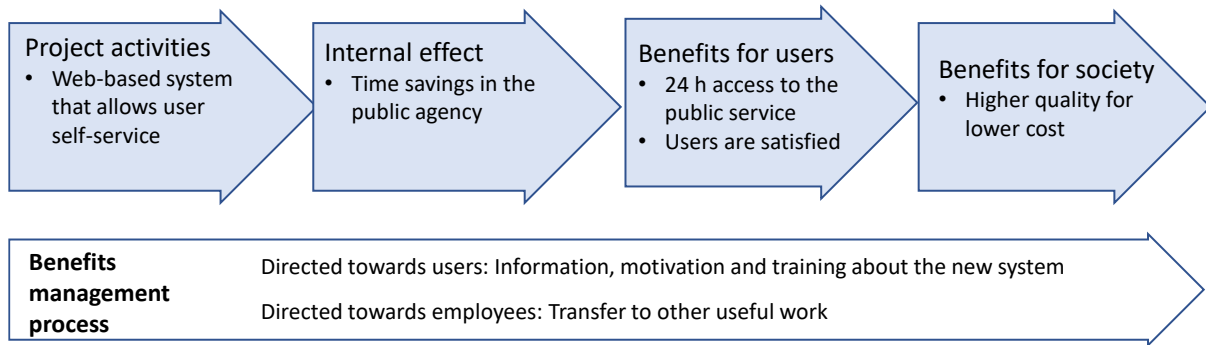


Figure 4. Benefits map, simplified example

#### 4. Learn from Past Mistakes and Successes Through Ex-Post Evaluation

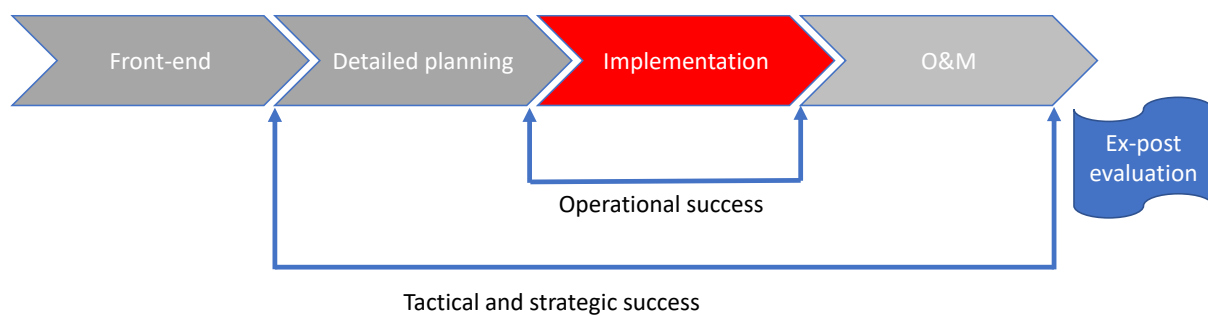
The challenges experienced by many projects in terms of cost performance and benefits realisation may seem a paradox based on the large number of projects carried out annually. According to some estimates, the total world annual expenditure on projects is USD 10 trillion (Williams et al., 2022). Ideally, this should create experiences facilitating learning and improving practices in future projects. Nevertheless, there is a tendency for projects to replicate the mistakes of the past. The skills and experiences of individuals within organisations may be considerable, yet the link from individual learning to organisational knowledge is often weak. Beste and Klakegg (2022) recommended that project-based organisations should use a wide range of efforts, including ‘hard’ actions such as courses, databases with previous experiences and extending the project governance model with more mandatory points, as well as ‘soft’ actions that facilitate networks and encourage project members to share experiences.

Ex-post evaluation – the assessment of whether a specific intervention was justified, whether it achieved its objectives and why, and whether it had any unintended consequences – is rarely conducted as a systematic activity but instead takes the form of ad-hoc investigations of projects that have gone wrong (Worsley, 2015; Samset and Christensen, 2017). To the extent that some countries require ex-post evaluation of investment projects, it is typically restricted to the transport sector, with the main focus on economic aspects (Volden and Welde, 2022). Knowledge of projects’ actual value for money, effectiveness and sustainability may be limited. This contrasts with the extensive ex-ante evaluations that most organisations require before sanctioning large projects. Despite the considerable uncertainty at the time of the investment decision, it is assumed a priori that the intended effects will materialise within the proposed budget.

As discussed in the preceding section (section 3), there is a tendency for projects to perform comprehensive assessments of intended benefits upfront and then not follow up to find out

whether or not the effects materialised. While the final cost will usually be disclosed one way or another, the actual benefits will often remain unknown. A requirement (from the financing party) to document benefits is crucial for benefits management and should be introduced in every project. In addition, broad ex-post evaluations should be conducted on a selection of projects as a means for learning and improvement in future projects. Such evaluations should focus on cost and benefit management and include questions about *why* the results are as they are.

Thus, there is a need to ‘close the loop’ between ex-ante and ex-post evaluation through systematic ex-post evaluation to improve the planning and implementation of future projects and to strengthen the strategies for benefit and cost management (Volden and Welde, 2022) (Figure 5). Effective learning requires that projects be followed over time, from the front-end phase through detailed planning and implementation to the operation and maintenance phase. It is insufficient merely to consider cost performance or user effects in the first year after implementation. Evaluations should be based on operational success (often referred to as the achievement of objectives for time, cost and quality) and tactical/strategic success concerning long-term societal goals and sustainability.



**Figure 5. Closing the loop between ex-ante and ex-post evaluation through measuring different perspectives of success**

Samset and Volden (2022) argued that evaluation should be based on the project’s logic model, i.e., the link between project activities/inputs and intended effects and impacts. It should take a broad and multifaceted view of project success. They also argued that project failures could be avoided if project planners and managers learned better from their experiences. Ex-post evaluation should be a mandatory part of a project governance framework to facilitate this.

## 5. Conclusion

Project appraisal, planning and estimation take place against a background of uncertainty. The research literature on project performance has demonstrated that many projects have failed to consider this uncertainty, as costs often turn out to be higher than estimated and benefits lower. This means that error, or deviation between estimates and real outturn values is inevitable as perfect knowledge of the future is impossible. Paired with bias, a natural part of human behaviour, this increases the risk of project underperformance and -failure. Therefore, we need to account for uncertainty and risk factors in project plans and, as far as possible, debias the project development and decision-making process. The discussion of error or bias has been the subject of much academic debate over the last few years. The purpose of this chapter has not

been to support one side in the debate or the other but to draw on lessons from projects that have worked and that have improved cost performance and goal achievement.

In the chapter, we have argued that the front-end of projects is vital for project success, even if other practices during later project stages may be crucial. Projects that fail don't just end badly; they start badly. Therefore, to improve project performance, we must focus on the left side of project development, where the problems are discussed, alternatives are considered, and risks are investigated.

We contribute to practice by demonstrating how various activities are necessary to reduce risk, avoid cost overruns, and benefit shortfalls. We have provided advice regarding the governance, delivery, and operation of projects. Our advice is based mainly on research conducted by the Concept Research Programme in Norway, which researches large government projects. The projects within the programme's research portfolio have all been subjected to a stage-gate project planning and delivery model with mandatory decision points, external quality assurance, and requirements regarding how mature projects must be before they can receive government funding. Most of our advice, based on Norwegian data, overlaps with academic and consultancy reports based on data from other countries, which is reassuring.

We also contribute to theory by demonstrating the need to learn through continuous data collection from completed projects. Much of the academic literature has focused on projects that have gone wrong, such as experiencing cost overruns. However, governments worldwide deliver a welter of projects yearly – most of which are probably completed pretty much as planned. Volden and Welde (2022) suggested that there may be a bad news bias in the academic literature on project performance. Collecting data from these and disseminating experiences needed to improve future project performance should be at the heart of the practical project literature.

The advice is empirically based on a large number of completed projects. A potential weakness is that past projects and experiences do not necessarily provide the best recipe for all future problems. Most Norwegian government projects have traditionally been based on conventional procurement strategies such as design-bid-build contracts. The construction industry, in particular, is increasingly basing project delivery on utilising the competence and skills of contractors through alliancing and contracts aimed at balancing the incentives of different parties (Walker et al., 2022). Another look at the issues discussed in this chapter in light of potential lessons in a few years may be in order.

Ex-post evaluation is essential for collecting empirical data on project performance to provide lessons from what has worked well and less well, improve future appraisal, and develop more successful projects. Both front-end activities and activities relating to project delivery, operation and evaluation should be included in a standardised governance framework that ensures quality at entry, supports the selection of projects, and ensures that responsibility for the realisation of benefits is allocated throughout the project life cycle.

## References

Ahiaga-Dagbui, D.D. and Smith, S.D. (2014). Rethinking construction cost overruns: Cognition, learning and estimation. *Journal of Financial Management of Property and Construction*, 19, pp. 38–54.

- Andersen, B., Samset, K. and Welde, M. (2016). Low estimates – high stakes: underestimation of costs at the front-end of projects. *International Journal of Managing Projects in Business*, 9, pp. 171–193.
- Bakke, C., Johansen, A., Mahmood, K.M. and Grenland, S. (2019). Feeble Project Mandate equal higher cost? *Procedia Computer Science*, 164, pp. 433–440.
- Bénabou, R. (2013). Groupthink: Collective Delusions in Organisations and Markets. *Review of Economic Studies*, 80, pp. 429–462.
- Berg, H., Holgeid, K., Jørgensen, M. and Volden, G.H. (2021). *Hvordan lykkes med digitalisering? En undersøkelse av nyttestyring i IT-prosjekter i offentlig sektor* [How to succeed with digitalisation? A study of benefit management in public IT projects]. Concept-rapport nr. 64. Trondheim: Ex ante akademisk forlag.
- Beste, T. and Klakegg, O.J. (2022). Strategic change towards cost-efficient public construction projects. *International Journal of Project Management*, 40, pp. 372–384.
- Cicmil, S. and Braddon, D. (2012). Fading glory? Decision-making around the project – how and why ‘glory’ projects fail. In: Williams, T. and Samset, K. (eds.) *Project Governance: Getting Investments Right*, pp. 221–255. Basingstoke: Palgrave Macmillan.
- Dysert, L.R. (2006). Is ‘estimate accuracy’ an oxymoron? *AACE International Transactions*, EST.01. Available from: [https://www.costengineering.eu/images/papers/Is\\_Estimate\\_Accuracy\\_an\\_Oxymoron.pdf](https://www.costengineering.eu/images/papers/Is_Estimate_Accuracy_an_Oxymoron.pdf) (accessed 24 August 2022).
- Dysert, L.R. and Elliott, B.G. (2020). Early conceptual estimation methodologies. *AACE International Transactions*, EST-3423. Available from: <http://cog-estimating.com/uploads/1/3/2/8/132807526/wp-earlyconceptualestimatingmethodologies.pdf> (accessed 24 August 2022).
- Edkins, A., Geraldi, J., Morris, P. and Smith, A. (2013). Exploring the front-end of project management. *Engineering Project Organization Journal*, 3, pp. 71–85.
- Ewerhart, C., and Fieseler, K. (2003). Procurement Auctions and Unit Price Contracts. *The RAND Journal of Economics*, 34, pp. 569–581.
- Flyvbjerg, B. (2013). Quality control and due diligence in project management: Getting decisions right by taking the outside view. *International Journal of Project Management*, 31, pp. 760–774.
- Flyvbjerg, B. (2021). Top Ten Behavioral Biases in Project Management: An Overview. *Project Management Journal*, 52, pp. 531–546.
- Flyvbjerg, B. and Budzier, A. (2011). Why your IT project may be riskier than you think. *Harvard Business Review*, 89, pp. 23–25.
- Flyvbjerg, B. and Gardner, D. 2023. *How Big Things Get Done*. London: Pan MacMillan.
- Flyvbjerg, B., Bruzelius, N. and Rothengatter, W. (2003). *MegaProjects and Risk: An Anatomy of Ambition*. Cambridge, UK: Cambridge University Press.

- Flyvbjerg, B., Stewart, A., and Budzier, A. (2016). *The Oxford Olympics Study 2016: Cost and Cost Overrun at the Games*. WP 2016-20. Oxford, UK: Saïd Business School.
- Flyvbjerg, B., Ansar, A., Budzier, A., Buhl, S., Cantarelli, C., Garbuio, M., Glenting, C., Skamris Holm, M., Lovallo, D., Lunn, D., Molin, E., Rønne, A., Stewart, A., and van Wee, B. 2018. Five things you should know about cost overrun. *Transportation Research Part A: Policy and Practice*, 118, pp. 174–190.
- Hofbauer, J., Sanders, G., Ellman, J. and Morrow, D. (2011). *Cost and Time Overruns for Major Defense Acquisition Programs*. Washington DC: Center for Strategic and International Studies.
- HM Treasury and Cabinet Office (2011). *Major Project Approval and Assurance Guidance*.
- Hollmann, J.K. (2002). Best owner practices for project control. *AACE International Transactions* CSC.06. Available from: <https://validest.com/library.html> [accessed 24 August 2022).
- Hoque, J.M., Erhardt, G.D., Schmitt, D., Chen, M., Chaudhary, A., Wachs, M. and Souleyrette, R.R. (2022). The changing accuracy of traffic forecasts. *Transportation*, 49, pp. 445–466.
- Infrastructure and Projects Authority (2021). *Cost Estimating Guidance*. Available from: <https://www.gov.uk/government/publications/cost-estimating-guidance/cost-estimating-guidance> (accessed 6 July 2022).
- Kashiwagi, I. (2018). A global study on ICT project performance. *Journal for the Advancement of Performance Information and Value*, 10(1), pp. 8–27.
- Ika, L., Pinto, J. K., Love, P. E. D., and Pache, G. (2023). Bias versus error: why projects fall short. *Journal of Business Strategy*, 44(2), pp. 67-75
- Lovallo, D. and Kahneman, D. (2003). Delusions of Success: How Optimism Undermines Executives' Decisions. *Harvard Business Review* 81(7), pp. 56–63.
- Love, P. E. D. and Ahiaga-Dagbui, D. (2018). Debunking fake news in a post-truth era: The plausible untruths of cost underestimation in transport infrastructure projects. *Transportation Research Part A: Policy and Practice*, 113, pp. 357-368.
- Love, P. E. D. and Ahiaga-Dagbui, D., Smith, S. D., Sing, M. and Tokede, O. (2018). Cost profiling of water infrastructure projects. *Journal of Infrastructure Systems*, 24, 04018023.
- Love, P. E. D., Sing, M.C.P., Lavagnon I. and Newton, S. (2019). The cost performance of transportation projects: The fallacy of the Planning Fallacy account. *Transportation Research Part A: Policy and Practice*, 122, pp. 1-20.
- Love, P. E. D., Ika, L. and Sing, M. C. P. (2022). Does the Planning Fallacy Prevail in Social Infrastructure Projects? Empirical Evidence and Competing Explanations. *IEEE Transactions on Engineering Management*, 69, pp. 2588-2602.
- Odeck, J. and Kjerkevit, A. (2019). The accuracy of benefit-cost analyses (BCAs) in transportation: An ex-post evaluation of road projects. *Transportation Research Part A: Policy and Practice*, 120, pp. 277–294.

- Odeck, J. and Welde, M. (2021). Cost overruns of transportation infrastructure projects. In: Vickerman, R. (ed.) *International Encyclopedia of Transportation*, pp. 483-489. UK: Elsevier.
- Odeck, J., Welde, M. and Volden, G.H. (2015). The Impact of External Quality Assurance of Costs Estimates on Cost Overruns: Empirical Evidence from the Norwegian Road Sector. *European Journal of Transport Infrastructure Research*, 15, pp. 286–303.
- Olsen, O. E. and Lindøe, P. (2004). Trailing research based evaluation; phases and roles. *Evaluation and Program Planning*, 27, 371-380.
- Park, J. E. (2021). Curbing cost overruns in infrastructure investment: Has reference class forecasting delivered its promised success? *European Journal of Transport and Infrastructure Research*, 21, pp. 120–136.
- Pfeifer, S. and Warrel, H. (2021). MoD's poor practices blamed for project cost overruns and delays. Available from: <https://www.ft.com/content/9da15fa5-da6c-4b44-ad9a-7b121f80415c> (accessed 5 July 2022).
- Project Management Institute (2021). *A Guide to the Project Management Body of Knowledge: PMBOK® Guide*. 7th ed. and *The Standard for Project Management*. Project Management Institute.
- Rigsrevisionen (2019). *Budgeteringen av Vejdirektoratets vejprojekter* [The budgeting of the Road Directorate's road projects]. Copenhagen: Rigsrevisionen.
- Sager, T. (2016). Why don't cost-benefit results count for more? The case of Norwegian road investment priorities. *Urban, Planning and Transport Research*, 4, pp. 101–121.
- Salci, S. and Jenkins, G. (2016). *Incorporating Risk and Uncertainty in Cost-Benefit Analysis*. MPRA Paper No. 74161. Available from: <https://mpra.ub.uni-muenchen.de/74161/> (accessed 24 August 2022).
- Salling, K.B. and Leleur, S. (2011). Transport appraisal and Monte Carlo simulation by use of the CBA-DK model. *Transport Policy*, 18, pp. 236–245.
- Samset, K. (2010). *Early Project Appraisal: Making the Initial Choices*. London: Palgrave Macmillan.
- Samset, K. and Volden, G.H. (2016). Front-end definition of projects: Ten paradoxes and some reflections regarding project management and project governance. *International Journal of Project Management*, 34, pp. 297–313.
- Samset, K. and Christensen, T. (2017). Ex-ante project evaluation and the complexity of early decision-making. *Public Organization Review*, 17(1), pp. 1–17.
- Samset, K. and Welde, M. (2019). *Mandater for konseptvalgutredninger. En gjennomgang av praksis* [The terms of reference document for conceptual appraisal: A review of current practice]. Concept-rapport nr 58. Trondheim: Ex ante akademisk forlag.
- Samset, K. and Volden, G.H. (2022). Closing the loop. Ex ante and es post evaluation in order to learn from mistakes and successes. In: Williams, T.M., Samset, K. and Volden, G.H. (eds.) *The Front-end of Large Public Projects. Paradoxes and Ways Ahead* (ch. 7). London/New York: Routledge.

- Solberg, H.A. and Preuss, H. (2007). Major sports events and long-term tourism impacts. *Journal of Sports Management*, 21, pp. 213–234.
- Terril, M. (2016). *Cost Overruns in Transport Infrastructure*. Carlton, Victoria, AU: Grattan Institute.
- Volden, G.H. (2019). Public funding, perverse incentives, and counterproductive outcomes. *International Journal of Managing Projects in Business*, 12, pp. 466-486.
- Volden, G.H. and Samset, K. (2017). Governance of Major Public Investment Projects: Principles and Practices in Six Countries. *Project Management Journal*, 48, pp. 90–108.
- Volden, G.H. and Welde, M. (2022). Public project success? Measuring the nuances of success through ex-post evaluation. *International Journal of Project Management*, 40, pp. 703–714.
- Walker, D.H.T., Vaz-Serra, P. and Love, P.E.D. (2022). Improved reliability in planning large-scale infrastructure project delivery through Alliancing. *International Journal of Managing Projects in Business*, 15, pp. 721-741.
- Wikipedia (2022). *Law of the instrument* [online]. Available from: [https://en.wikipedia.org/wiki/Law\\_of\\_the\\_instrument](https://en.wikipedia.org/wiki/Law_of_the_instrument) (accessed 26 July 2022).
- Welde, M. and Odeck, J. (2017). Cost escalations in the front-end of projects – empirical evidence from Norwegian road projects. *Transport Reviews*, 37, pp. 612–630.
- Welde, M. and Dahl, R.E. (2021). Cost Escalation in Road Construction Contracts. *Transportation Research Record*, 267, pp. 1006–1015.
- Welde, M. and Klakegg, O.J. (2022). Avoiding Cost Overrun Through Stochastic Cost Estimation and External Quality Assurance. *IEEE Transactions on Engineering Management*. DOI: 10.1109/TEM.2022.3173175
- Williams, T.M. (2022). Project success. In: Williams, T.M., Samset, K. and Volden, G.H. (eds.) *The Front-End of Large Public Projects: Paradoxes and Ways Ahead* (ch. 2). London/New York: Routledge.
- Williams, T.M., Samset, K. and Volden, G.H. (2022). *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*. London/New York: Routledge.
- Worsley, T. (2015). *Ex-Post Assessment of Transport Investments and Policy Interventions: Prerequisites for Ex-Post Assessments and Methodological Challenges*. ITF Roundtable Reports, No. 162. Paris: OECD Publishing.
- Zwikael, O. and Smyrk, J. (2012). A General Framework for Gauging the Performance of Initiatives to Enhance Organizational Value. *British Journal of Management*, 23, pp. 6–22.
- Zwikael, O. and Gilchrist, A. (2022). The logic of the project front-end. In: Williams, T.M., Samset, K. and Volden, G.H. (eds.) *The Front-End of Large Public Projects: Paradoxes and Ways Ahead* (ch. 3). London/New York: Routledge.