*Routledge Frontiers in Project Management*

# THE FRONT-END OF LARGE PUBLIC PROJECTS

## PARADOXES AND WAYS AHEAD

Edited by
Terry M. Williams, Knut Samset and Gro Holst Volden

# The Front-end of Large Public Projects

Large public projects represent major complex investment and whilst there has been much written about how to develop, manage and deliver such projects, practice still does not match up with expectations. In this book, researchers from the Norwegian Concept Research Programme explore the paradoxes between theory and practice in collaboration with experts in the field of project governance.

This book delves into the reality of large public projects, to show how they can be managed effectively and efficiently, recognising the realities of their context. It offers a range of practical conclusions as to the paradoxes of the governance and management of public projects. The international spectrum of authors draw their examples from the UK, Norway, Canada, France, Australia and the Netherlands.

Bridging the gap between research, theory and practice, this book will benefit academics and researchers in the field of project management and corporate governance as well as those in the practice of public project governance, civil servants and industry practitioners.

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## Routledge Frontiers in Project Management

*Edited by Darren Dalcher*

Project management has become a key competence for most organisations in the public and private sectors. Driven by recent business trends such as fewer management layers, greater flexibility, increasing geographical distribution and more project-based work, project management has grown beyond its roots in the construction, engineering and aerospace industries to transform the service, financial, computer, and general management sectors. In fact, a Fortune article rated project management as the number one career choice at the beginning of the 21st century. Yet many organizations have struggled in applying the traditional models of project management to their new projects in the global environment.

Project management offers a framework to help organisations to transform their mainstream operations and service performance. It is viewed as a way of organising for the future. Moreover, in an increasingly busy, stressful, and uncertain world it has become necessary to manage several projects successfully at the same time. According to some estimates the world annually spends well over $10 trillion (US) on projects. In the UK alone, more than £250 billion is spent on projects every year. Up to half of these projects fail! A major ingredient in the build-up leading to failure is often cited as the lack of adequate project management knowledge and experience. Some organizations have responded to this situation by trying to improve the understanding and capability of their managers and employees who are introduced to projects, as well as their experienced project managers in an attempt to enhance their competence and capability in this area.

*Routledge Frontiers in Project Management* provides short, state of play, guides to the main aspects of the new emerging applications including: maturity models, agile projects, extreme projects, six sigma and projects, human factors and leadership in projects, project governance, value management, virtual teams, project benefits.

**The Front-end of Large Public Projects**
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# 1 Introduction

*Gro Holst Volden and Knut Samset*

## 1.1 Paradoxes in front-end management

The traditional focus of the project management community has, by and large, been restricted to what is termed 'the iron triangle' of cost, time and scope (Morris 2013). The iron triangle is an example of reductionist thinking where project performance is reduced to the 'simple' measures related to project implementation only. In recent years, many authors have argued the need for a wider, strategic view on projects, as the purpose of projects is essentially to deliver benefits and create value for the funding entity, for users and/or for society at large (Morris 2013; Samset & Volden 2016; Williams & Samset 2010; Zwikael & Smyrk 2012). The focus of this book is on large *public* projects, where a broad societal perspective on project outcome is particularly relevant – large public projects being tools for policy development.

In line with such a broad interpretation of project success, there is an increasing recognition of the strategic role of the front-end phase in shaping the success of projects. The front-end phase is here defined as the period from when the initial idea is conceived to when the final implementation decision is made, during which it is still possible to make major changes or terminate the initiative at an affordable cost. Williams et al. (2019) refer to a number of studies which argue the case for using more resources in the front-end phase in order to improve project and portfolio success.

It is a paradox in itself that this crucial phase of the project lifecycle is not better understood. An extensive literature review on the front-end phase of projects found that the literature on front-end management is fairly sparse, and that this phase is still not well understood (Williams et al. 2019). For example, it is not clear who the key players are at this stage, and how management competencies should be improved. There is not even consensus as to whether the front end is part of the project lifecycle, or a separate undertaking that precedes the project. What seems clear, though, is that those who initiate the project are most likely from outside the project management community. Initiators of public investment projects might be politicians, the responsible ministry or agency (governing organisation), user groups or other stakeholders at local level.

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There is clearly a need to understand how projects materialise from some initial conceptual idea or consideration. Whether actively encouraged or unexpectedly apparent, all projects are the result of some form of ambition and consideration. The front-end phase can be seen as the result of two processes that run in parallel: the analytic and decision-making processes. Williams et al. (2019) note that two key terms in this phase are 'strategy' and 'context'. They suggest that the greater the maturity of the governing organisation in dealing with projects, the more structured and well-defined the management of the front end is likely to be. But there is still a gap in the literature. Much work has been done regarding project management, as well as on strategy formation at the organisational level, but little on how these two come together – which is, obviously, during the front-end phase.

Samset and Volden (2016) presented research findings based on longitudinal research on the front-end management of major public investment projects in Norway. The authors argued that many challenges and weaknesses need to be overcome to achieve project success such as the absence of a realistic goal or purpose, lack of competence among planners, hidden agendas, processes driven by needs other than those of society at large, unrealistic and inconsistent assumptions and how to secure essential planning data and adequate contract regimes. More importantly, there was a tendency to ignore the crucial assessment of problems, needs, opportunity space and the choice of conceptual solution to the problem at hand, and instead jump directly to more detailed, and often quantitative and data-intensive, analyses of only one specific preconceived or preferred conceptual solution.

These challenges and weaknesses were framed by the authors as ten paradoxes that overlap to a varying extent. Paradoxes are here understood as situations with a counter-intuitive result, at least in the broad societal perspective. This paper was what initiated the collective work on this book. It is referred to as the 'paradoxes paper' throughout the book. The full paper is included as an appendix at the end of the book.

In short, the paradoxes are:

1 **The success paradox: success is measured in operational terms only, rather than the wider, strategic perspective**. Projects that are completed with considerable cost overrun and behind schedule generate negative media attention and even public inquiries, irrespective of whether they are relevant and good value for money. By contrast, projects may avoid negative attention if completed on budget, regardless of their strategic success.
2 **The paradox of the significance of front-end management: less resources are used up front to identify the best conceptual solution (project governance) than to improve performance during implementation (project management)**. The choice of conceptual solution often originates in the mind of an individual, based on intuition

and experience, rather than systematic analysis of problems, needs, requirements, etc. By contrast, comprehensive planning and analysis is associated with the project once the choice of concept is made.

3 **The paradox of early information overflow: decisions are confounded by masses of detailed information rather than carefully selected facts and judgments to highlight the essential issues**. The priority should be to establish an overall perspective based on a targeted search for information. Experience shows that large amounts of detailed data at an early stage may result in what is referred to as 'analysis paralysis'. Instead of opening up the opportunity space, it may, in fact, lock decisions into an initially preferred concept.

4 **The paradox of the unexplored opportunity space: the choice of conceptual solution is made without systematically scrutinising the opportunity space up front**. There is much evidence to suggest that in many cases the chosen concept is not necessarily the most effective solution to the initiating problem. In many cases, the process started out with a predetermined solution, without exploring other options. This is referred to as path dependency.

5 **The paradox of strategic alignment: strategy and alignment of objectives are highlighted as essential, but in many cases the internal logic of causality and probability of realisation are erroneous**. Alignment of objectives is the exercise of defining the causal link from the project outputs to outcome and long-term benefits of the project. Unfortunately, this is not always done. Objectives are missing or unclear, and there may be design faults at different levels, such as too many, overly ambitious and even conflicting goals.

6 **The cost estimation paradox: effort is made to get the final cost estimate (the budget) right, while early cost estimates are treated superficially**. The 'real decision' is made at an early stage, based on initial estimates that are often substantially underestimated. There is much to suggest that this may result in the approval of projects that otherwise should have been rejected at an early stage.

7 **The paradox of disregarded analyses of costs and benefits: detailed estimation of cost and benefits is commonly done up front, but disregarded by decision-makers**. Substantial amounts of resources are devoted to cost-benefit analyses, especially for transport projects. However, the estimated value for money had no significant impact on the selection of projects in Norway. On the contrary, many unprofitable projects were realised. Obviously, decision-makers emphasise other aspects, but these are not included in the analyses.

8 **The paradox of 'predict and provide': the tendency is to choose a 'predict-and-provide' strategy rather than explore alternative solutions**. A variant of Paradox 4 ('opportunity space') is that in the case of congestion problems, need is often defined narrowly as the need

to increase capacity. While excess demand for public services and infrastructure is to be expected when offered free-of-charge to citizens, in some cases, there may be goals for a different development. Project owners need to clarify the needs and goals that should apply to the project.

9 **The paradox of perverse incentives: availability of public funding with no financial obligations for the beneficiaries may cause perverse incentives and result in counter-productive projects**. Different actors may have vested interest in certain projects being chosen, with no incentive to opt for the most socially beneficial or cost-effective alternative. This may result, inter alia, in supersized projects, positively biased business cases and the selection of projects that turn out to be complete failures.

10 **The paradox of myopic decisions: long-term viability is the intention, but the planning horizon is too short, resulting in sub-optimal choices**. The study of project appraisals shows that needs and benefits are often assessed in a short-sighted and static perspective; trends are extrapolated without discussing alternative scenarios; and significant risk factors, such as political risk, are not identified and discussed. Such practice may lead to decisions that society will regret in the future.

The overall picture is that there are certain recurring deficiencies in analytic as well as decision-making processes, and that the potential for improvement is considerable. In fact, the 'paradoxes paper' found that flaws in both processes may be correlated, and further that projects with many such deficiencies in the front-end phase tend to end up being less relevant to society.

In a subsequent doctoral thesis, Volden (2019) discussed possible explanations for the observed paradoxes. Planners and analysts, who are often engineers and economists, may be hesitant to question fundamental issues that can be considered part of what is conceived as the political sphere. We have all heard analysts say, "We produce analyses, not guesswork", implying that they are more comfortable working with tangible measures and clearly defined tools and methods than with multidimensional and qualitative assessments of success criteria that may be unclear and even disputed. There may also be cognitive shortcomings to innovative thinking, to applying long-term perspectives and to planners' understanding of fundamental uncertainties. Another quite likely explanation is that project initiators (who often commission the analyses) see it in their interest to explore only one specific conceptual alternative, and restrict the terms of reference accordingly. Or even worse, they do not endorse an early project appraisal at all.

Perverse incentives can be found at different administrative levels in society, and may cause other paradoxes discussed in this book. We have seen this in Norway, in the case of roads, hospitals, universities, sporting events, etc., where the local administrative level has been a key promoter, often in collaboration with other stakeholder groups and even members

of parliament. This is a country where the local democracy stands strong, while at the same time local government is financially weak and dependent on the national government to finance local infrastructure. This may have given rise to serious problems with adverse incentives on the part of local initiators.

From this previous work, some key improvement measures are highlighted:

- The business case should be presented to decision-makers early enough to prevent premature lock-in to an unjustified concept.
- Incentives for project initiators ought to be brought in line with society's interests as much as possible. Adverse incentives relating to discretionary assessment and approval processes need to be dealt with.
- Analyses should be transparent and overseen by independent experts.

The funding entity (which, in the case of state-funded projects, is the government on behalf of all tax payers) should put in place a set of processes, systems and regulations up front, in order to ensure project success, strategically as well as tactically. This is referred to as project governance (Williams & Samset 2012), and is closely related to the topic of the present book. In fact, front-end paradoxes and project governance need to be understood and discussed together. Project governance should potentially be essential to overcome the front-end paradoxes. However, in order for the project governance framework to be effective, we first need to fully understand the paradoxes and how they work in different contexts.

## 1.2 Aim of the book and introduction to each chapter

The 'paradoxes paper' was our first probe into the matter. The paper defined a set of paradoxes to highlight various deficiencies in the front-end phase. However, we did not provide a thorough explanation of the paradoxes, the relationship between them or how to overcome them. Further, the findings were mostly based on Norwegian experiences. With the present book, the intention has been to investigate front-end paradoxes further – from different angles and with experiences from different countries, with the aim to achieve a deeper – and, hopefully, more generic – understanding, and to identify effective remedies or solutions.

The authors are all major experts in the field of front-end management and project governance. The book consists of six main chapters and a concluding one, which are briefly introduced below. Readers will learn about front-end paradoxes in various case projects from the United Kingdom, Australia, Canada, the Netherlands and Norway. The chapters and cases vary in terms of context (country, sector, etc.), their theoretical approach and the type of paradoxes they focus on. Together, they cover all ten paradoxes, and further develop the ideas about paradoxical dilemmas in front-end management and governance.

### *1.2.1 Understanding project success*

Chapter 2 is written by Professor Terry M. Williams from the University of Hull, who is also director of the Risk Institute.

This chapter sets the scene for readers by contemplating what is meant by 'project success', both in tactical and strategic terms. The logic is that the strategic success criteria should be considered first, with more attention being devoted later to tactical criteria as the project gradually takes shape. However, according to Paradox 1, 'the success paradox', in practice, minds tend to be focused mostly on efficiency targets. Williams discusses how this is related to difficulties in understanding what 'strategic project success' actually is, being a multifaceted, often difficult to measure and possibly a contested term. The chapter was also inspired by the related Paradox 10, 'the paradox of myopic decisions', that is, that projects are assessed from a short-term perspective – people want to be able to decide immediately if a project has been successful or not, without taking the time to wait for the verdict of history.

Chapter 2 offers advice as to which issues need to be considered when defining a project's strategic success, and illustrates the effects of governance mechanisms, and various analytic tools and practices that may be helpful in this phase. The discussion is based on literature and examples of good practice from the United Kingdom and elsewhere.

### *1.2.2 How to construct an effective front-end phase*

Chapter 3 is written by Professor Ofer Zwikael and Dr Alicia Gilchrist from the Australian National University.

They discuss the essential logic of the front-end phase and how this phase should be designed. It is assumed in the literature that the front-end phase begins with an idea, which, in turn, is triggered by a problem or an opportunity. Yet, there is not a simple answer to what it takes to come up with a good project idea. In practice, there is often pressure to 'be seen to be doing something' with the problem at hand, and a tendency to jump to the seemingly best solution, without exploring options.

Chapter 3 is particularly inspired by Paradox 2, 'the significance of front-end management', Paradox 4, 'opportunity space', and the related Paradox 8, 'predict and provide'. The Australian Defence Force, with its rigorous and advanced front-end phase, is used as a case study throughout the chapter, and recommendations are offered based on experiences from this sector.

This chapter may thus assist practitioners in constructing an effective front-end phase that will facilitate the achievement of strategic objectives. There are also implications for the literature in providing suggestions as to how common front-end paradoxes may be resolved.

### *1.2.3 The front end as seen from a social practice perspective*

Chapter 4 is written by Professors Monique Aubry and Serghei Floricel from The University of Québec in Montréal (UQAM), Canada.

This chapter relies on the notion of 'project representation'. A representation is a perceptual, conceptual and social construction which uses words, signs and drawings to describe the project and its context. The authors apply a social practice perspective to shed light on paradoxes and other difficulties in the front-end phase. According to this perspective, the development of a project representation is not seen as a 'best option waiting to be selected', but as a fragile, temporary outcome of multiple efforts. Processes are always emergent and follow multiple logics.

The authors discuss four trade-offs relevant to the development of project representations. These trade-offs are then used to suggest explanations for Paradox 2, 'the significance of front-end management', and Paradox 4, 'the opportunity space'.

This chapter advances our understanding of front-end dynamics, as a process situated in time and having its own temporal logics. The focus on representations from a practice perspective will help readers grasp why front-end activities are rarely a linear unfolding process. The authors use several empirical vignettes from projects currently being developed in Quebec to demonstrate their points throughout the chapter.

### *1.2.4 Exploring the cost estimation paradox*

Chapter 5 is written by Dr Richard Kirkham from the University of Manchester, United Kingdom.

This chapter looks at the process of cost estimation in the early phases of projects. Early cost estimates are often inaccurate and unreliable, some of the reasons being optimism bias and other cognitive issues that come into play. Others are incomplete information and availability of data. We also see projects being approved with no clear and realistic scope or objectives – in which case it is quite common that cost estimation will be insufficient as well.

The author discusses a series of interrelated problems and possible solutions from the perspective of major project delivery in the United Kingdom. The chapter is inspired by Paradox 6, 'the cost estimation paradox' – that is, the focus on getting the final cost estimate right, while treating earlier cost estimates superficially. The discussion also touches on other related paradoxes, including Paradox 7, 'the paradox of disregarded analyses of costs and benefits'. It is noted that government projects are truly uncertain in the front-end phase, and that the naïve desire for commitment to early, often deterministic, estimates is in itself a paradox.

The chapter makes a significant contribution to understanding fundamental difficulties relating to cost estimation at the front end of projects.

### *1.2.5 Incentives and politics*

Chapter 6 is written by Professor Bert van Wee from Delft University of Technology in the Netherlands.

The main topic of this chapter is Paradox 9, the 'perverse incentives' paradox. The discussion centres around a case project, the Betuweroute, a rail freight line connecting Rotterdam Harbour with the hinterland. This project had a very long front-end phase, with Rotterdam Harbour as the key promoter, in search of enhanced competitiveness relative to other harbours in France, Belgium and Germany. Other arguments were also raised in the process, not least environmental concerns, and notions that the project would be good for the economy. But in the end, the project experienced a large cost overrun, had negative effects on the environment and was not economically viable.

The chapter reviews the front-end phase to explain what went wrong. It shows how the Betuweroute was a classic example of a project driven by perverse incentives, van Wee arguing that a fundamental problem is the way such projects are financed.

The author also discusses how Paradox 9 is related to all of the other paradoxes and suggests that understanding the 'perverse incentives' paradox may be helpful in understanding, and hopefully overcoming the others as well.

### *1.2.6 Learning from past mistakes and successes*

Chapter 7 is written by Professor Knut Samset and Dr Gro Holst Volden, the previous and current director of the Concept Research Programme at the Norwegian University of Science and Technology (NTNU).

The authors argue that paradoxical dilemmas, such as those discussed in this book, could have been avoided if planners and managers were better at learning from experience. The striking absence of ex post evaluation of public projects was, in fact, discussed in the initial 'paradoxes paper' as the 11th paradox.

Researchers at NTNU have, since 2012, conducted ex post evaluation of some of the largest public infrastructure projects in Norway, to determine their success ex post, tactically as well as strategically. The authors discuss some experiences with these evaluations and argue that there is much to learn across project types and sectors. Some are better at benefits management, others at cost control and still others at handling unintended consequences. They also discuss how ex post evaluation may contribute to learning and improvement, depending on the results and recommendations being perceived, understood and used.

The chapter ends with a discussion on how ex post evaluation can be helpful in overcoming each of the ten paradoxes.

## 1.3 Conclusion

The concluding chapter is written by Professor Terry M. Williams, who pulls the threads together from the previous chapters. In so doing, he includes Paradox 3, 'early information overflow', which is implicitly discussed in all

chapters. Further, he discusses how the paradoxes are not ten independent entities, but are related causally.

The chapter takes a cross-chapter view, and brings together thoughts on seven ideas that crop up in most, if not all, of the chapters:

- the problem or need that triggered the project idea;
- the jump to an early project solution;
- stakeholders and consultation;
- information generation and flow in the project;
- accountability for the results of the project;
- and reflecting back on a project.

The authors hope that this book will help decision-makers as well as the public to understand the decisions being made at the front end of major public projects, so as to avoid some of the behavioural traps, to make better decisions in paradoxical situations and to plan and deliver projects that actually provide our countries with the benefits they are supposed to, both efficiently and effectively.

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# 2 Project success

*Terry M. Williams*

## 2.1 The nature of project success

This book concerns the development, management and delivery of large public projects, with the acknowledgement that, often, this is not as successful as we would wish. Before we can investigate the issues around this, however, we need to consider what makes a 'successful' project? What are we trying to achieve by carrying out all these projects? This is important not just for an academic discussion of the projects but because any party trying to make a project 'successful' will be aiming for whatever is their definition of 'success'. This chapter will therefore first look at the academic background to this question, dividing the idea of success into strategic and tactical success. It will then look at the various paradoxes that accompany major public projects as criteria for success are developed.

Project management was originally developed to achieve the successful delivery of large, complicated projects where the definition of what needed to be done, and why, was fairly clear. The so-called bodies of knowledge, the best known of which is the PMBOK (Project Management Institute 2017), were developed with the accumulated knowledge from successfully achieving well-defined projects that were large, complicated and demanding. Barnes (1988) famously said (of construction projects) that "the client's objectives are always a combination of the objectives for performance of the completed scheme, for achieving this performance within a named cost or budgetary limit and for getting the project into use by a target date" (p. 69). The threefold criterion of success – meeting cost, schedule and performance targets – has, in the last 50 years, been widely used as a standard project management success criterion, often called the 'iron triangle'. Project managers are commissioned to go and work on their projects, and come back with them delivered to the specified iron triangle targets.

As projects in the real world have developed, certain problems have been encountered with this definition. Some projects deemed successful according to this criterion did not seem, on the face of it, to be successful. The Zwentendorf Nuclear Power Plant (EVN 2020) was the first commercial nuclear electric-generation plant, built in Austria. Construction began in April 1972

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and was completed in four years; however, a referendum was held on 5 November 1978, in which a slim majority voted against starting the reactor up, so it has never operated as a nuclear reactor. An "on-shore torpedo battery built in rock on the northern coast of Norway in 2004" – huge and complex, accommodating 150 military personnel – was "officially opened as planned and without cost overrun. However just one week later it was closed down by Parliamentary resolution" since the concept of permanent torpedo batteries was obsolete (Samset 2010, p. 13). On the other hand, projects such as the Sydney Opera House or the Scottish Parliament, famously over-budget and late, but producing iconic buildings, might be considered unsuccessful according to the 'iron triangle' definition, but are successful in other, perhaps more important ways.

Projects are not set up simply to achieve the project itself – they are set up for a purpose. Morris, in much of his work (e.g. Morris 2009), shows how corporate and business strategy is implementation by the use of projects. This is particularly true in the domain of public projects, the subject of this book. Tony Meggs, then chief executive of the UK's Infrastructure and Projects Authority (which oversees all UK major government projects), wrote in his blog that

> The vast majority of government policies are delivered through the implementation of a project or programme of some description. These projects and programmes span a wide range … [but] have one thing in common: if the projects are not successfully implemented, then the policy objectives are not delivered.
>
> (Meggs 2018)

Clearly the definition of success therefore needed to broaden out to include the underlying strategic aim of a project. Is it useful? Does it do what we set out to do? Over time, therefore, many authors have come to distinguish between what might be termed the tactical success ('project management success' or 'efficiency' success of a project: did it fulfil the immediate specification as set out at the start of the project?) and the strategic success ('project success' or 'effectiveness success': did it provide the outcome and benefits envisaged?). This recognition of the twofold nature of the concept of project success is becoming widely recognised and will be used in this chapter.

Even then, this idea of 'strategic success' is not necessarily well-defined, for a number of reasons, and we will look at six particular issues, all of which will be touched upon later in the chapter.

First, major public projects have a long lifespan, so 'success' can be regarded with a shorter or longer-term view. Perhaps the most influential definition of project success looking specifically at this was developed through work with the U.S. Agency for International Development, then the United Nations,

and OECD (Samset 2010, Chapter 2). This characterised project success as having five dimensions, starting with the immediate project, working through its immediate benefits, and through to the wider and longer-term aspects (see Table 2.1).

This definition has proved useful for looking at major public projects. Zwikael and Meredith (2020) came up with a similar, three-stage definition, but focusing on different viewpoints: project management success, the performance of the project manager in achieving the project plan; project ownership success, the project owner's performance in realising the business case; and project investment success, the investment performance of the project for the funder.

One curious feature of taking a shorter or longer-term view is that stakeholders' view of 'project failure' is not a simple inverse of their view of 'project success'. Chipulu et al. (2019) found that stakeholders' assessment of project 'success' appeared more focused on project effectiveness, but when assessing project 'failure', they appeared more focused on efficiency. A cursory reading of the newspapers reflects this in the public discourse: reports of 'project failure' often focus on projects running out of control in terms of budget and time, whereas reports of 'project success' rarely talk about budgets or timescales, but rather the project output (e.g. the building or system produced). This is in the public view – discussions of, say, National Audit Office assessments in this chapter show a more balanced view.

Particularly in public projects, there is a wide range of different stakeholders, all of whom will have quite different perceptions of what constitutes project success, so our second point is the need to recognise these. There is a plethora of literature on stakeholders, but it is, perhaps, particularly within public projects that the range of stakeholders and heterogeneity of their views on project success is so clear. Politicians, public opinion, local residents, business, regulators, NGOs – the list of influential stakeholders can be considerable. The literature also shows the importance of recognising

*Table 2.1* Successive success criteria (Samset 2010)

| *The Project* | | | | *Short-Term* |
|---|---|---|---|---|
| | 1 | Efficiency | Was the project well managed? | |
| | 2 | Effectiveness | Were the goals achieved? | |
| | 3 | Relevance | How useful was the output to the organisation? | |
| | 4 | Impact | Was the goal appropriate to the organisation's purpose? | |
| | 5 | Sustainability | Are the benefits sustainable in the longer term? | |
| *Wider concerns* | | | | *Longer-term* |

and bringing together these views: a poor common understanding across the range of project stakeholders can impact upon benefit realisation (O'Leary 2012) in any project. In complex infrastructure projects, Wahab (2011) shows the importance of reconciling perceptions of benefits across often disparate stakeholder groups during the design process. Having said that, a comprehensive literature survey in Davis (2014) shows little commonality between the definitions of success among senior management, project teams and project recipient stakeholders. We will look at some examples of stakeholder views in this chapter.

Much of the literature covers the idea of comparing the costs of a project, and the benefits that accrue from that project – the simplest view being a straightforward 'cost-benefit analysis'. For some straightforward projects, this might be quite appropriate, but, as our third point, for most major public projects, the different types of benefits (or disbenefits) that might result from a project will not be easily quantifiable. Even where a benefit may be measurable, it might be difficult to turn that metric into a financial figure. For this reason, in many domains, governments suggest standard financial values for particular measurable benefits – transportation departments, for example, will often give financial value to reducing journey times by x minutes, or even a value for loss of life. Williams et al. (2020a) describe how countries such as the UK, Australia, Canada and Norway, and bodies such as the EU have detailed rules for quantifying benefits, generally emanating from their finance ministries.

The combination of disparate measures calculated in terms of finance raises a number of issues, such as the accounting conventions used, interest rates, how to evaluate through-the-life impact of a project and so on. Moreover, for important public projects, some of the benefits or disbenefits might be simply subjective and unmeasurable – such as 'social cohesion', 'visual amenity' or even 'national security'. Here attempts to measure the effect, let alone monetise it, might have little prospect of giving helpful advice. However, the idea of 'social impact bonds' is a useful development where a desired outcome is clear and measurable, but not obviously monetisable, for example reducing recidivism (see UK Government 2017). But for many projects, these might be some of the most important aspects. It is here that the differing views between different stakeholders discussed above can particularly become an issue. We will explore some examples in this chapter.

We need to decide where the 'impact' of a project finishes. Our fourth point is that often a project has little effect until it goes into an operational delivery phase, and it is only then that benefits can be 'harvested'. This could be citizens using a system, or a piece of infrastructure. A road project might facilitate local development – but only if the local authority or local business takes up those opportunities. Sometimes, in itself, a project might not be providing a benefit, but enabling others to achieve a benefit – in this sense, the 'success' of projects will be dependent upon changes in the behaviour

of citizens, business, government agencies, civil servants or other relevant stakeholders.

Fifth, projects in a typical management environment can often be said to be "complex, ambiguous, confusing phenomena wherein the idea of a single, clear goal is at odds with the reality" (Linehan & Kavanagh, 2006). We have already pointed to the multiplicity of stakeholders, who might hold different views on what constitutes project 'success'. Also, we have pointed to the multiplicity of different success criteria, some of which might be measurable on the same scale, particularly if they can be expressed in some (perhaps proxy) financial terms – many of which will be incommensurable, or perhaps even unquantifiable. A project may be aiming for a number of targets. Furthermore, these are often not separate goals but a complex web of causally related factors. A simple example is shown in Williams (2016), which, for a small set of projects in a small company, shows how success factors contributing to project performance combine in complex interactions, demonstrating causal paths from root causes to different but related success criteria. Even for this small example, final project success criteria, including, as well as the 'iron triangle' parameters about the final product (defects on building handover and in use and life cycle performance), stakeholder satisfaction (customers, users, community and subcontractors), project management success (health and safety) and the production of a legacy rather than just a building – and the causal chains leading to these – were complex and interlinked.

Finally, for public projects, the surrounding environment can be turbulent and changing. The conventional approach to managing projects assumes that a project is defined, and then carried out according to its original target and specification. 'Project management' is difficult to envisage with constantly changing targets. This has long been recognised for projects in general:

> The Cartesian clarity of inner structures clashes with the increasing porosity of projects to complex contexts that they seek to deny.… The risk, in short, is that the idealistic 'island of order' may suddenly turn into a more realistic, very classic, 'iron cage'.
>
> (Malgrati & Damiani 2002)

For public projects, this turbulence is especially noticeable. Political landscapes change. Major projects, particularly military or infrastructure, can take many years, whereas election cycles might only be four or five years, with a new government having quite different goals. Even if the government stays the same, in the UK, strategic spending reviews, which define the objectives and thus the scale and nature of public service investments, take place every two to five years. Public opinion can be very fickle, and can influence the political motivations behind a project. Sometimes requirements change because technology has moved on (e.g. greater use of driverless cars may have a significant impact on the benefits expected by some transport infrastructure projects – but again this is subject to the vagaries of public acceptability).

Sometimes, initial assumptions are simply wrong as decision-makers model how the world might change over the course of a project.

In these circumstances, the idea of specifying a set of well-defined project goals which remain constant is not practical. Cicmil et al. (2006, p. 679) contrast "traditional approaches based on rational, objective, and universal representations of the project with a phronetic [practical wisdom] analysis of the ambiguous, fragmented and political reality of project situations". Chapter 4 discusses the conceptual implications of undertaking a project front-end and show the development, over time, of circumstances and project work. Indeed, one of the current authors has written of "project organizations, as imperfect and fragile representations that chase a shifting nexus of intractable human, social, technical, and material processes" (Floricel et al. 2016).

Given this academic introduction to the idea of 'project success', this chapter will explore how these ideas actually turn out in practice in some major public projects, touching on many of the reasons why defining project success criteria is not clear-cut.

The chapter will look at the various stages of a project. We first explore what strategic success means and how targets are developed, then consider tactical success, taking a look at how this all evolves during project execution; we then look at the issues of success definition and project assessment after the project. As we explore the examples of projects, we will be looking at the realities of public projects and the environments in which they are born, developed and executed.

## 2.2 Strategic success in public projects

This section will take these considerations and look at what 'strategic' benefits mean in major public sector projects – what do we want out of our public projects, how is this defined, and how do projects arise out of these considerations?

### *2.2.1 What should happen*

As discussed in the previous section, the starting point is not the project, but the policy purpose set out by the government – as described in the Tony Meggs quote above (Meggs 2018). In the same blog, Meggs talks about the search for "a seamless flow and inter-connectivity between policy conception, policy development, and policy delivery", this last increasingly through the medium of the project, as the public sector becomes increasingly projectified (e.g. Godenhjelm et al. 2015, in the EU). So how does this work out in practice?

In the UK (this author's home country), each government department sets out a 'single departmental plan', in which the Department sets out objectives and how they will be achieved. We are shortly to look at a transport case-study, so as an example, the UK Department of Transport sets out its plan

as a public document (Department of Transport 2019) with six overarching objectives (supporting the creation of a stronger, cleaner, more productive economy; helping to connect people and places; balancing investment across the country; making journeys easier, and so on). Some of these objectives are easier to quantify than others – some being more contested than others, and we shall see some examples. These departmental plans are supposed to set the foundation for the department's programme portfolio – its individual programmes and the desired outcomes from projects – and the project outputs that should provide those outcomes. This is laid out in the UK's 'Green Book' (HM Treasury 2020), the 'bible' for appraising and evaluating major UK projects. Of course, it is not practical that all projects are proactively prompted by the departmental strategic objectives – some will be initiated by practical events or political motivations – but this does give a basis by which we can see how projects fit into the overall strategy. This type of process is explored in more detail (from an Australian viewpoint) in Chapter 3.

Practically, governments are gradually developing systems by which the outputs likely to accrue from projects are identified, quantified and linked to these strategic priorities. This is sometimes badged as 'benefits management'. A major PMI study looked at these systems in eight countries/intergovernmental organisations (IGOs) and found developments in all but one. Indeed, all of the other seven countries had explicit discussion in their documentation linking project and national/government departmental goals – so at least the methods espoused and encouraged by the governments recognise this link. Schemes differed because of the nature of the countries/IGOs. The World Bank could be more integrated and focused. The physical size and federal structures of Canada and the US possibly explain the limited mandatory federal direction: perhaps benefits are better determined at the state/province/local level. Australian state jurisdictions similarly have autonomy. Norway has a centralised method, but its size allows some informality, since people in the profession often know each other. The UK has traditionally had a separation between policy and delivery (although this is now decreasing). The EU is not one state, but a collection of states, so some parts of the process are carried out at state level. Work in four of these countries is reported in Williams et al. (2020a), showing Benefits Management frameworks being used throughout, sometimes tailored to particular sectors (the transport and civil infrastructure sectors seemed particularly advanced). Some of these were advisory, except where they were mandated for the specific purpose of preparing business cases for final approval. It was noticeable that as projects progressed from approval through execution, the focus on benefits declined, as we will discuss below.

However, as discussed in Section 2.1 above, 'identifying and quantifying benefits' is too simplistic. There is a high degree of heterogeneity in public project benefits. Simple financial or economic benefits are more straightforward to recognise. A starting point is a classification system for benefits, since public projects in particular are undertaken to achieve a wide range of

financial and social benefits; the PMI Benefits study found many of these in practice (financial/non-financial; direct/indirect; a UK quadrant system; a Canadian five-stream system), but it was not clear how well-used these were (again, unless mandated for project approval). However, when we seek to improve the lives of the citizens of a country, we are in territory that is subjective and contested. Identifying benefits is therefore a process that needs to engage a wide range of stakeholders – which we will discuss below. The PMI study also showed that while some saw stakeholder engagement as an essential ingredient in benefits identification, for others it was more of a cosmetic process, as it was unclear whether it affected project decision-making.

Methods for quantifying benefits – an important ingredient for making out a business case for a project – appeared in the PMI study to lack standardisation. Methods, sophistication of the processes and the degree to which the different methods were mandated all varied widely between different parts of government, although these again seemed particularly well developed in the transportation sector. Many benefits of public projects are difficult to define, let alone to quantify, or monetise; certainly a complete financial measurement of expected benefits is not usually a sensible aim. Current government systems seem unlikely to be sufficient to measure many of these different types of benefits. Not surprisingly, the PMI study showed that a strong emphasis was put on easy-to-measure benefits, and those clearly and unambiguously linked to departmental strategic benefits. However, government projects span many types of project for which the main benefits are not quantifiable or monetisable, and it is not yet clear how these should be incorporated into a coherent government decision-making process.

### *2.2.2 An example: the A303 project*

An example shows some of the different types of benefits, and some of the stakeholders involved. Stonehenge is a 4,000-year-old monument in the south of the UK, consisting of a ring of standing stones, each around 13 feet high and weighing around 25 tons. It is an iconic symbol of ancient Britain, a UNESCO World Heritage Site, and attracts many thousands of visitors, particularly at pagan festival times of year such as the summer solstice. There is a major road from the main part of England towards the holiday destinations of the south-west passing near Stonehenge, the A303. This has just one lane in each direction, and has long been recognised as a traffic problem, exacerbated by sightseers within their cars. It is generally felt to be a road that does not work, either for drivers, or for local residents, nor for travellers and holidaymakers.

So there is a clearly recognised road-transportation problem. But equally clearly, this is not matter of a simple road upgrade. The nature of the World Heritage Site makes this a sensitive project, with many from across the UK seeing the site as part of their essential cultural heritage. The local villages, communities and groups also have strong views about the amenity and travel

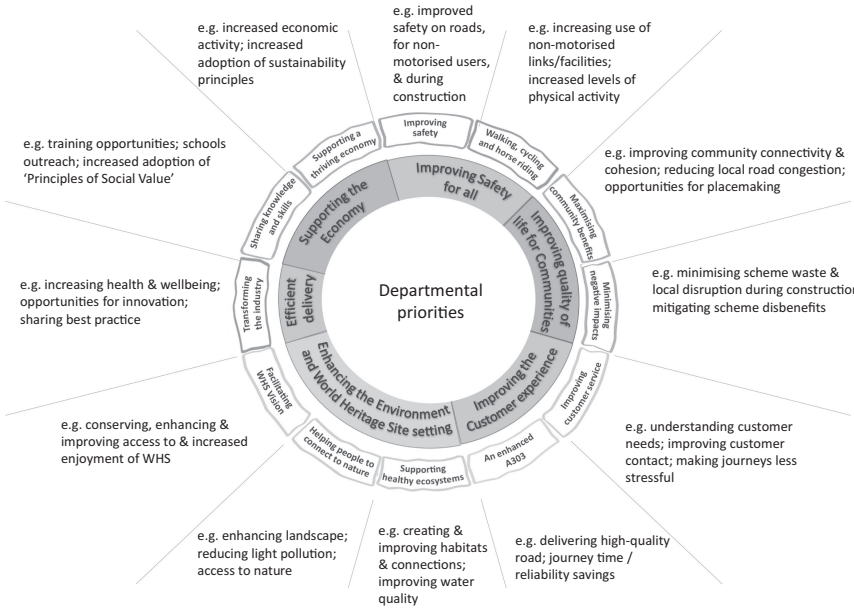


*Figure 2.1* Benefits of the 'A303 project'. A summary of a map provided by Highways England (private correspondence with the author).

around the locality. Moreover, it is a sensitive environmental area in terms of biodiversity, wildlife populations and movements (including a very rare UK bird, the stone curlew), air quality and noise.

After much consultation and options analysis by Highways England (the agency responsible to the Department of Transport), a scheme including a 2-mile tunnel to remove traffic on the A303 from the Stonehenge landscape was finally approved by the UK Secretary of State on 12 November 2020. More details can be found in their booklet (Highways England 2019).

As can be seen from the description above, the benefits of this project and the criteria by which its success will be judged are wide and heterogeneous – indeed, the priority attributed to each is expected to evolve at different points of the project lifecycle. A sophisticated analysis was carried out by Highways England to identify, and where possible start to quantify these criteria. As well as identifying benefits, this will enable a robust scheme evaluation plan to consider the impacts of the scheme beyond its traditional transport and safety benefits.

Figure 2.1 gives a map showing a much simplified version of this analysis, displaying the diversity of benefits. Here we can see, in the innermost part of the map, the fundamental Highways England departmental priorities leading to six diverse domains of benefit. Consideration of these domains leads to 12 more specific areas in which those benefits will be realised. Each of these

areas is specified by multiple specific goals, each of which needs to be measured: some might be straightforward to measure, such as road reliability or travel times; some will require customer surveys, such as enjoyment of the World Heritage Site (WHS); some might require considerable thought to measure, such as community cohesion. However, having this map accepted as part of the scheme gives an important basis to considering what the scheme is there for, and how successful it is.

### *2.2.3 Some conceptual issues*

While the A303 project is a fine example of good practice in defining and starting to metricise benefits, there are a number of conceptual problems in this area which come up, as well as the problems that arise because we are dealing with individuals, stakeholders, companies and politics. Some of these conceptual issues are straightforward to contemplate, although that does not make the questions any easier to answer.

One problem noted in Section 2.1 comes when the organisation responsible for executing the project is not the same as the organisation responsible for realising or 'harvesting' the benefits from the project. We will re-visit this issue, and the problems of accountability this raises in practice in Sections 2.4/2.5.

Another conceptual issue comes when we look at the set of different 'benefits'. Generally these are considered individually and then put into a list. However, it is clear that often they are interlinked, and achievement of one will help (or hinder) achievement of the others. You only need to look at Figure 2.1 to see some interlinkages. Samset and Volden's 'Paradoxes' paper notes an analysis of 17 Norwegian projects:

> A project strategy will always be a hierarchy of goals that are interlinked in cause-and-effect chains that illustrate the ambition levels for a project, as well as their realism. Objectives were analysed in terms of their internal causality, and ambition.
>
> (p. 305)

This helps to show both the interrelationship and also sometimes the distance between the project and the mooted benefit. Perhaps the most well-known structured method to bring these relationships out is the World Bank's Logframe methodology; their Results Framework (Roberts & Khattri 2012) develops causal links from strategic objectives to project outcomes.

A further issue was noted in Section 2.1: when would be an appropriate time to establish expected benefits? Benefits and disbenefits during the project period can be assessed during and at the end of that period. However, what about (to take the A303 example) economic activity, or health and wellbeing? Some of these might not be known for some considerable time after the project – others might have an immediate increase but then decline

back into life-as-usual (perhaps 'the increased use of non-motorised transport' mechanisms). There might be immediate requirements to assess the 'success' of the project, but time needed to properly assess the longer-term benefits (this also plays into Samset and Volden's Paradox 10, 'the paradox of myopic decisions', as discussed below).

Another danger in assessing the benefit of a project is that it can ignore the wider portfolio of the government department. Programmes and projects rarely sit on their own, but contribute to the overall portfolio of programme activity in a Department, as stated in the Green Book discussed above. The UK has been building two aircraft carriers as a major element of their military defence. When the UK National Audit Office (2020b) reviewed the project, it found that the two carriers had been built, jets to go on the carriers received to schedule, and most of the surrounding infrastructure completed. However, an aircraft carrier does not act in isolation, and the report stated that the Ministry of Defence was,

> … making slower progress in developing the crucial supporting activities that are needed to make full use of a carrier strike group, such as …. In addition, it has not established a clear view on the future cost of enhancing, operating and supporting Carrier Strike, which creates the risk of future affordability pressures. The Department will not achieve value for money from its investment to date unless it … ensures cross-command coherence and collaboration to develop the full capabilities of Carrier Strike.
>
> National Audit Office (2020b, p. 11)

We cannot evaluate the usefulness of an individual project without considering its place in the portfolio of the Department's programmes.

### *2.2.4 A more fundamental conceptual issue*

But there is a more fundamental conceptual issue, which is that often a 'benefit' is not a well-established, black-and-white concept. The meaning of a benefit can be variable, and it can change over time. Impact can be multiple and equivocal, since it is valued in different (and often conflicting) ways. A continuation of the PMI study (Williams et al. 2020b) looked at case studies of three UK public projects, to consider the meanings of 'benefit', benefit changes, the effects of changes and tools for capturing change: the A303 project above, transformation in the Department for Work and Pensions, and Digital Health. This led to a number of recommendations to capture the sometimes elusive nature of 'benefits', including: defining processes to define 'benefits' terms; communicating with stakeholders in terms to which they can relate, particularly for societal benefits; developing tools that recognise the impossibility of capturing a 'true' permanent benefit and create a communicative space for discussion; processes to recognise changes to benefits;

the use of narratives as a useful means of expressing benefits; and avoiding over-reliance on quantifiable benefits. The work for the A303 project, in particular, showed the wide variety of ways in which stakeholders benefit, the wide definition of benefits, the communicating of benefits (see below), and also the change over time of the benefits, as understanding of what can be achieved evolved, together with the perception of benefits, while the 'core' benefits remained fairly stable.

### *2.2.5 Estimating*

While there is not time to explore this in detail, it needs to be noted that the identification and quantification of likely project outcomes is undertaken by individuals, with their natural biases. Flyvbjerg (notably Flyvbjerg et al. 2003) has written extensively about the tendency towards 'optimism bias' and also the less savoury deliberate 'strategic misrepresentation' or 'gaming': over-estimation of project benefits (and under-estimation of costs) for the sake of achieving project approval. This will be covered more in Chapters 5 and 6, and in the next sub-section, as we look at setting tactical success criteria. However, it is worth noting that in the study of many countries' systems by Williams et al. (2020a), all governments' guidance recognised the issue, practitioners saying they considered the tendency when putting project proposals together. It seemed that only the UK required a specific approach to quantifying optimism bias, the Green Book requiring a contingency to be placed on estimates, calculated using Reference Class Forecasting.

While there has been considerable analysis of project databases to try to detect 'optimism bias', one clear problem with looking at individual cases is the natural change in circumstances between making estimates when devising a project, and the realisation of the project. For example, the UK Home Office undertook a major project moving to a new headquarters (described in Klakegg et al. 2009). While the building process was generally a success, the subsequent parliamentary enquiry concluded that "There is evidence of optimism bias in PFI projects for departmental accommodation …. The Home Office assumed that staff numbers would be reduced due to outsourcing, efficiency gains, and changes to working practices. Instead, numbers increased dramatically" but then adds "numbers increased dramatically … as the Home Office took on new responsibilities, although the total increase is not fully explained by these new functions". So it is often difficult to compare planned benefits with the actual outcome.

### *2.2.6 Stakeholders*

A practical problem is the number and range of stakeholders in public projects, who should be consulted to identify the diverse project outcomes and benefits – some of which might be unknown to the government department at the outset. The PMI study (Williams et al. 2020a) showed that stakeholder

engagement and discourse were increasingly used in benefits identification, drawing attention to methods such as 'benefits workshops' to capture some of this discourse. This was generally seen as vital for ensuring buy-in for projects, but some warnings were raised: questions about whether this was seen as 'public relations' – perhaps a way of legitimising a project – or whether the results were acted on; concerns about delaying projects; conflicts between stakeholders, particularly where there are different 'tribes' who might not understand each other.

The public communication that contributed to Figure 2.1 in the A303 project above was widespread, both for communicating the project benefits and for gathering stakeholder input. It was clear that stakeholders benefited in a wide variety of ways, since the project created a large spectrum of opportunity for both human and non-human actors. It is to be hoped that this will continue, as the perception of wider and societal benefits changes over time, as cultural attitudes change, along with technology changes.

Another example is given in the vignette "Ensuring the train arrives on time! Resolving some of the uncertainty" in Eden et al. (2005). This was an airport passenger transport system, a driverless train (innovative then) planned to move passengers both between terminals and the city at a major airport. Stakeholder analysis for this project, which was about to start, showed important aspects to consider included (for example) the views of the immediately local community, who had already experienced considerable construction disruption (and were unlikely to benefit significantly from the longer-term use of the airport); safety of local drivers, as the permanent way was built on stilts above roads that continued to operate; the views of local politicians and their relationship to the authority which owned the airport; the views of users who would transit into the city, and so on – aspects which should have been uncovered during the strategic development of the project.

The nature and involvement of stakeholders will be explored further in Chapters 3–6.

### *2.2.7 Contractors*

It is worth noting briefly that public projects are generally executed using the private sector. This can be simply by defining a project and then passing it over to the public sector to carry out. In this case, the private sector company acts according to the expectations laid out in the project contract with the government department. This will be touched on again in Section 2.4, but it is worth noting at this point that striving to achieve project outputs might not be – indeed, probably will not be – the same as striving to achieve the strategic success objectives of government departments. It is here that the delivery mechanism becomes important, to align the motivations of the contractor with the public sector partner. This is particularly relevant when, as discussed above, the success criteria of the public sector changes. When the Channel Tunnel shuttle wagons were being built (Eden et al. 2005), a major fire in

London (as well as the sinking of a ferry) meant that the priorities of the government focused much more on fire safety, and the legislation was changed. This occurred in the middle of the project, meaning that the contractor – at that point aiming for the project outputs as defined in the original contract – had to make major changes to the product.

### *2.2.8 Politics*

A major effect limiting clarity on 'project success' and causing benefit definitions to be variable is the political nature of the environment which produces the projects.

There are many, many examples that could be discussed – perhaps in one sense any public sector project. There are many projects in many countries that have started as (sometimes vanity) projects for individual politicians, or announced by a politician unexpectedly leaving his/her Department suddenly to initiate a new project. On the other hand, many other projects which are seemingly part of normal government business can be motivated or changed by political effects. One example might be the UK C-NOMIS system, an ambitious project planned to be a single offender management IT system across the prison and probation service. This is described in Klakegg et al. (2010, pp. 118–125), looking back to the project initiation and stating,

> this pressure on the prison system may have led to a 'political' agenda and thus political pressure to implement some kind of a solution, and then later on overlook warning signs. Furthermore, in this sort of environment, often individual characters can become important in starting the project off.

We will return to this example below.

As the 'Paradoxes' paper drily puts it, "While the analytical process is largely within the realm of the professional constituency … the decision still remains with the political level. And the processes and decisions at this level are not always rational" (p. 303). This can clearly be seen when the project is a significant investment (and particularly if it is high-visibility and high-reputation): Cicmil and Braddon (2012) refer to such projects as 'glory' projects: "… surrounded by an aura of glory through the rhetoric used to describe them – a narrated promise of extreme prosperity. They are often born out of vanity of human ambition …" (p. 221). They analyse one particularly large (and largely unsuccessful) IT project in the UK National Health Service, whose size and particularly advanced technological nature gave it a 'glory' aura, concluding (among many useful conclusions) that "On reflection, the project was approved without a rational reason or, perhaps, with seemingly irrational reasons".

Politics means that the view of project success criteria can change as public perceptions, or ministers, change. Perhaps more notably, the timescale over

which projects are viewed can be quite different for a minister, looking to public opinion and perhaps the budgetary cycle, or even the next election, or a government department which might be looking at the very long-term. Samset and Volden's Paradox 10, 'the paradox of myopic decisions', describes how short-term planning horizons are thus naturally brought to bear upon projects whose lifetime is likely to be decades. Processes within government departments, which have a long lifetime, should be designed to take the long view – but politicians who might have a short-term view have power over these decisions.

## 2.3 Developing tactical success criteria

Once the fundamental purpose of a project has been decided – what it is setting out to achieve – and quantified, the more immediate parameters of the project need to be settled. That is, we now need to consider the traditional 'iron triangle' tactical success criteria – timescale, project outputs, and crucially, in the public world, budget. This section will introduce the subject, which will be explored in its different aspects in more detail in Chapters 3–6.

### *2.3.1 Methods*

Unlike the process of defining project benefits discussed in Section 2.2, there is a longer history of developing processes for outlining well-defined quantified project proposals when seeking approval from government funders. These need at the very minimum to define the quantified project outputs, the way these will be achieved, the expected cost and timescale, and risks. Expected cost is, of course, essential in forming the basis of any cost-benefit conclusions.

A good example of what is needed when developing a business proposal is the UK's mandated model, the UK Treasury '5-case model', which is defined in the Green Book and supporting guides (HM Treasury 2018a, 2018b). This defines five dimensions of the case that needs to be made for the programme or self-standing project, starting with the view from the permanent organisation (the government department), gradually getting into the temporary project, then at the end stepping back to the permanent organisation level – see Table 2.2.

Clearly, this information is not available at the very start of project development, and Chapters 3 and 4 will look in detail at the logic and underlying theory of this process. There are generally now well-defined and mandated procedures in different countries to try to formalise the process. Klakegg et al. (2016) give some history of the project governance process in the UK, Norway and the Netherlands. Two examples show the current formal gradual refinement of the project idea.

*Table 2.2* The UK five-case model (from the Green Book)

| | | |
|---|---|---|
| Strategic case | Defining why this development or change is needed | See Section 2.2 |
| Economic case | Choosing the best option of how to proceed and its potential Value for Money | See Chapter 3 |
| Commercial case | The potential commercial arrangement to make the proposed project happen: procurement strategy, defined outputs, risk allocation and contractual issues | |
| Financial case | Within the proposed project/programme, affordability and funding | |
| Management case | Linking back to the permanent organisation: arrangements for delivery and monitoring; this should also include post-project evaluation | See Chapter 7 |

a The UK has a three-stage process (e.g. HM Treasury 2018b), covering:
   - the Strategic Outline Case, justifying the project, filling in part of the Economic Case and a start of the last three cases;
   - the Outline Business Case, which identifies the best project option and fills in most of the Cases, ready to move on to procurement;
   - the Full Business Case following commercial negotiations ready for formal signing of a contract.

b Norway has a two-stage process known as the 'QA' process, briefly described in Samset and Volden's 'Paradoxes' paper. Its two steps are: QA1, an externally reviewed project outline required before the Cabinet approves the pro-project process, then a fully worked-up externally reviewed proposal at QA2 required for parliamentary approval.

This is the formally mandated process. We will explore how this process works out in practice in the following four chapters, but we can note four issues that are already clear.

### *2.3.2 Estimation*

We have already noted the tendency for humans to be over-optimistic in their estimates both of the benefits of a project and in the cost/time, as discussed extensively by Flyvbjerg. For him, "The root cause of cost overrun is human bias, psychological and political" (Flyvbjerg et al. 2018, p. 183). His conclusions are therefore that "Cost overrun is best avoided by (a) Getting the front-end of capital investments right, including using reference class forecasting or similar methods to establish reliable, de-biased estimates of cost that fit the client's risk appetite…" as well as (perhaps more unarguable) "(b) Establishing an incentive structure … and (c) Hiring a delivery team with a

proven track record …" (p. 186). Much of this paper is one step in a heated exchange of papers with authors led by Love (specifically, Love & Ahiaga-Dagbui 2018), who strongly question the basis of Flyvbjerg's conclusions. One key issue here is where the 'original budget' is specified, as this is needed to consider whether there has been 'cost overrun': the long gestation period of public projects means that estimates can rise (or fall) during this period – we will look further at this in a few paragraphs. Another key issue is the role of the 'Hiding Hand' in projects, an idea, due to Hirschman, discussed at length in Ika et al. (2021) (with Love again and Pinto) pointing to "projects such as the Danish Great Bell Toll Bridge, the German Karlsruhe-Bretten Light Rail Line, the Sydney Opera House in Australia and the US Hoosac Tunnel, which all experienced significant cost overruns and yet exceeded benefit expectations". For them, "the Hiding Hand assumes we should not presume we already know what success is and how to measure it".

A pragmatic view notes the existence of both optimism bias, 'Strategic Misrepresentation' and the 'Hiding Hand', with candid and transparent conversations to ensure that these are looked out for and taken into account. As noted above, in Williams et al.'s (2020a) study of a number of countries, apart from the UK with its formal use of Reference class forecasting, there was recognition across countries of the issues, and clear attempts to take them into account, plus sensitivity analysis on cost and benefits.

Estimation is crucially dependent upon good data – but as Chapter 5's 'Conundrum 2' states, rarely does this exist upfront in a project. However, Samset would regard it as often a benefit rather than a problem, and Samset and Volden's Paradox 3, 'the paradox of early information overflow', shows how the over-abundance of information can be detrimental rather than helpful to making a mature project estimate (this is expanded upon in Williams & Samset 2010).

While estimation of time and cost is complex, a further complication in projects is the need to recognise the trade-off between these. Projects that need to be carried out quickly generally incur higher costs – and much more so if a project is accelerated mid-project. While this has been known for some time in the project world (e.g. Eden et al. 2005 and their 'amoebic' growth of project costs), it is becoming increasingly recognised in major public projects. Looking back on a number of projects, but specifically the UK's roll-out of Broadband, the National Audit Office (2020a) reported that "attempting to adhere to a fixed timeline, which later proves unachievable, can contribute to delays and cost overruns" (p. 39), pointing to similar effects in the UK project to roll out smart meters and the huge Crossrail infrastructure project.

### *2.3.3 Uncertainties and the nature of budgets*

As Chapter 5 notes in 'Conundrum 3', these large public projects are a complex undertaking, but budgets, particularly in public discourse, are presented as single, deterministic values. There are a number of problems with this.

First, making an estimate is a probabilistic exercise. The (epistemic) uncertainty is greatest at the start of the project front-end, when least is known about what is required and how the problem might be solved. The project definition is a gradual process of reducing the uncertainty in the estimate (see Figure 3 of the 'Paradoxes' paper) – but there still remains considerable uncertainty on the estimate even as the project starts. The Norwegian QA system referred to above requires explicit uncertainty statements to be formulated: at the QA2 point,

> budgets are based on formal uncertainty analyses and stochastic cost estimation. The recommended budget will commonly be close to the P85 level, and the recommended target cost for the responsible agency is normally lower and close to the P50 level.
>
> (Volden & Samset 2017, p. 97)

However, in most regimes, the public statement of budgets does appear to be generally deterministic.

Project budgets include contingency funds to cover uncertainties and risks, but the calculation and allocation of these funds has in the past been specific to any one project. This means that comparing cost overruns between projects is difficult. To take perhaps the most well-known example: the Apollo moon-shot programme, which "came in at $21 billion, only $1 billion over its initial estimate. Few know that the initial estimate included $8 billion of contingencies, a thing rare in itself. Very few public projects have even semiformal contingency budgets …" (Morris & Hough, writing in 1987). While contingencies are more formally calculated nowadays, there are different treatments in different systems. In the UK, for example, "Contingency provision … should be used to inform the approving authority of its potential liabilities. Government is self-insured and contingency should not be credited to the approved proposal" (HM Treasury 2020).

As well as being more informed as the process of estimation proceeds throughout the project front-end, the purpose of the cost estimates subtly changes. To put it crudely, the purpose of the very first estimate is to get approval for the project development process to be initiated. Once politicians have committed to a project, as Chapter 6 points out, it is sometimes difficult for them to change their mind without the risk of appearing inconsistent. The purpose of the final pre-project estimate is to get approval for the project to go ahead, but by becoming the project budget, it is also a target by which the project will be judged at the end – hence Paradox 6, 'the cost estimation paradox', which shows a focus on the final estimate while forgetting about the early cost estimates.

In a public project, where it is sometimes difficult to draw a boundary around the project to define what is 'in' and 'out', some growth in project estimates can be due to elements being included that it was not clear should be included at the start. A UK example was the 2012 London Olympics: bid at £2.4 billion in 2005 (apparently including considerable contingency,

*Table 2.3* Cost of Scottish Parliament building project

| | | |
|---|---|---|
| | Up to £40 million | Early thoughts |
| July 1998 | £50–£55 million | Design chosen although site unclear. Figure excludes, e.g. VAT and site acquisition costs |
| June 1999 | £109 million | Estimate at start of construction. Includes, e.g. fees, site costs, VAT, risk/ contingencies |
| November 2001 | £241 million | Official announcement taking into account increases in space and major design changes and fast working |
| February 2007 | £414.4 million | Final cost announcement |

perhaps aiming to win both the bid and public acceptance); a parliamentary announcement in 2006 set the budget at £3.3 billion, which by the following year had risen to £5.3 billion, including regeneration and infrastructure; then later the final budget, including contingency, security and tax, was set up to £9.3 billion. A final spent of £8.8 billion allowed a BBC headline to proclaim that the London 2012 Olympics was £500 million under budget(!).

Looking back at early cost estimates, their increase during the project front-end can be shocking. The 'Paradoxes' paper (Samset & Volden 2016, p. 306) gave an analysis of 12 Norwegian projects, where the first cost estimate of the project was compared to the final budget approved by parliament before the start of the project: the best of these showed an increase of 70%, while the worst increased by 14 times, and the average increase was 650%.

A well-known example in the UK is the Scottish Parliament building, a highly political project to bring a parliament to a devolved Scotland. The cost is summarised in Table 2.3. There are a number of different effects at play here: perhaps a deliberate playing down of the costs at the start to gain public acceptance for this political project; considerable uncertainty about what the project entailed – even its location; a perhaps more reasonable estimate at the start of the project, which included all relevant costs; considerable changes to the scope, which increased the project; and an undoubted lack of governance which enabled changes to get out of hand and for costs to overrun (a BBC report of evidence given to the official enquiry said that "The design of the [Scottish Parliament] building has been changed 15,000 times since the project began"). Some of this history is given in the report of the official 2004 Holyrood Enquiry (Fraser 2004).

It is important to disentangle these different types of effect as we look at project budget growth and overspend.

### *2.3.4 Strategic and tactical success*

We have looked at strategic and tactical success criteria separately. In a logical process, the strategic criteria will be considered first, as the 'project' gradually

takes shape (although in practice, a logical process is not always followed, and sometimes a solution is announced, and then a logic formulated around that solution – see Chapter 4). But even in a properly run project, front-end, strategic and tactical success criteria should be honed together as the front-end proceeds. Of course, the two are generally intimately related, and it is a trite observation that generally more output can be achieved with more time and a higher budget.

If a long-term rational view is taken of a project, it could be argued that the strategic achievements of the project are the more important aspect, particularly as public projects tend to have long timescales, sometimes many decades. However, in the public arena, in a democracy, a short-term – or even an immediate – timescale becomes more important. Hence Samset and Volden's Paradox 10, 'the paradox of myopic decisions': while the long term of the project is the more important, evaluations of projects happen, with opinions formed in a shorter timescale. The shortest term for an ex post project evaluation is immediately on project completion, where often the benefits of the project cannot be seen, indeed might not have yet been realised, whereas the cost and timescale are immediately visible. Also, remember our point in Section 2.1, that public opinion concentrates more on short-term efficiency metrics when looking at 'failure' (as compared to longer-term effectiveness metrics when looking at 'success'). In a slightly different context, a UK civil servant said, "You have to have a long-term strategy but unless it delivers short-term results no one will believe you" (Sir Michael Barber, head of the Prime Minister's Delivery Unit) (Barber 2007, p. 75). This effect will follow us as we move on through the project.

## 2.4 During the project

While this book is concentrating on planning and developing major public projects, it is important to consider how these ideas of 'success' permeate a project as it moves into execution – and indeed post-project evaluation – since good efforts at the start of the project might be nugatory if the execution of the project pulls in a different direction. We have to plan in good practice at the start of the project.

### *2.4.1 Concentration on the tactical*

Much study has shown one effect very clearly. During the start-up and development of a well-formed public project, there should be a lot of attention on the strategic aims of the project: what need it is fulfilling, why it is good for the country to try to gain the project outcomes. As discussed in the previous sections, increasingly formalised project approval procedures within countries have developed processes that require project sponsors to justify the project in terms that are in line with the strategic aims of the government or department. Finance departments or treasuries will not agree to projects being funded unless they are justified in terms of the (financial or

non-financial) gains that will be achieved. Projects should now be started with a clear vision of what the project is setting out to do and why.

However, the emphasis on the strategic aims of the project often dissipates once funding has been granted and eyes external to the department have been taken off the project. A multi-country study by Williams et al. (2020a) discusses the emphasis on benefits identification "as a means of getting the project through the approvals process" and continues, "Consideration of benefits tended to fade once funding was achieved … there seemed to be a skew toward project delivery (particularly project-management success) rather than benefits after project sanction, excepting occasionally there was an increased focus on benefits at project closure as benefits were evaluated and reported" – although they do note exceptions (see below). As a UK parliamentary report quotes more informally,

> We also have the impression now where the emphasis … is on the delivery of the project as defined: getting it on time, on cost, as defined at the beginning, and the actual benefits that the project is there to deliver sometimes get – I will not say lost but there is less priority put on that than the actual delivery of the project.
>
> (House of Commons PACAC 2019)

Governance processes should try to minimise this effect, for example using formal reviews of projects. However, a detailed review of a major database of reviews of the biggest public projects in the UK, described in Vo et al. (2021), showed that of all the recommendations made, 70% addressed delivery issues and only 30% concentrated on the higher-level effectiveness success criteria. In keeping with Williams et al.'s findings,

> PVRs [independent reviews supporting project initiation] and project closure reviews had a slightly higher percentage of recommendations focusing on benefits, perhaps implying a skewed emphasis on benefits towards project initiation (to get projects started) and closure (to get projects signed off).

Vo et al. (2021) continued, "recommendations were much more linked to what was directly needed to get to the next stage of the project cycle, rather than project benefits". Chapter 4 will re-visit this tendency of assurance to focus on the process of completion against arbitrary budgets rather than the strategic aims of the project. Of course, we are again echoing Samset and Volden's first Paradox: the danger of measuring success in terms of tactical performance rather than achievement of the strategic aims of the project.

These dangers are there, even if the strategic benefits have been assessed thoroughly at the start of the project. If, however, the initial project logic itself is weak, it leaves the project in even more danger of not delivering a useful output. Returning to the UK C-NOMIS prison/probation IT

system described above (Klakegg et al. 2010), this was a project with ambitious strategic objectives to "Improve positive offender outcomes (i.e. reduce re-offending) … introduce more assertive case management … Integrate IT support … [and] improve means of monitoring compliance". Clearly, a major project, developing a major business change to end-to-end supervision of the individual offender. However, as reported by the National Audit Office (2009), the team "treated C-NOMIS as an IT project rather than a major IT-enabled business change programme" – which meant that they "did not get to grips with the business changes required to design and implement a single offender database across both services". Furthermore, even within the narrow confines of an IT project, as a good example of Samset and Volden's Paradox 4, 'opportunity space',

> there were …. Other possible solutions not explored fully …. There is no evidence of the team considering factors such as the nature of supporting infrastructure and the existence of common levels of service, which should have informed the selection of the technical solution.

Initially, the project had an approved lifetime cost of £234 million to 2020. By six months before the original planned completion date, £155 million had been spent, the project was two years late, and estimated lifetime project costs had risen to £690 million. The project was then halted.

To give a balanced view, we should remember the issues discussed towards the end of Section 2.1: public projects live in a world of turbulence, and if they reacted to every change in government viewpoint or public opinion or whim, then management of the project would be impossible. The discipline of project management is there to try to bring order within the chaos, but a project impervious to the strategic aims of its owner risks losing its way and becoming one of those projects successful in 'efficiency' terms, but useless, like the on-shore torpedo battery or Zwentendorf Nuclear Power Plant, discussed at the start of the chapter.

### *2.4.2 Organisation and roles within the project*

Within the project, there is an increasing emphasis on the use of methods to maintain attention on the strategic aims of the project, generally coming under the heading 'Benefits Management'. Williams et al. (2020a) sets out these ideas in various countries and shows the increasing interest as attention shifts from 'project management' to the strategic aims of projects. This study also identifies common barriers to this approach, such as lack of senior management buy-in, lack of a benefits culture and the lack of any requirement for benefits oriented ex post analysis, as well some enablers to the approach such as increasing stakeholder engagement and clarity in accountability.

Of course, many national project structures now generally include some system of in-project reviews, designed to bring an 'outside view' to the

project. In the original UK system, there is a clear system of 'Gateways 1–5' during the project; however, this is overlaid by the ability to carry out a 'Gateway 0' at points during the project, designed to take a step back and consider the continuing relevance of the business need and alignment of the project with that need (see the comparison in Klakegg et al. (2016) of the UK, Norway and Netherlands systems). Interestingly, the 'exceptions' to the phenomenon of fading interest in strategic success during a project noted earlier included, among others, "projects that had to go through the NSW's ICT gateway process or the UK IPA assurance process …" (Williams et al. 2020a).

At the highest level, in many jurisdictions, projects are undertaken by a separate body to the government department. In the UK,

> Major government infrastructure projects in the UK are most commonly started, approved, funded and overseen by a sponsoring Department of State ….They are normally delivered through arms-length bodies (ALBs) of a range of forms …. It is the delivery organisation's job to take the requirements of the sponsor, turn them into specifications, contract for their delivery and secure the intended outcomes to time, quality and cost through their private sector supply chain.
>
> (Department of Transport and IPA 2019)

Further,

> This separation of functions allows Departments to specialise in government policy and legislation whilst the delivery organisation focuses on project delivery through its contracted supply chain and advisors. This division has significant advantages but can also create boundary issues and sometimes cultural challenges between the organisations. …. Different sorts of issues can arise through the project lifecycle.

The report goes on to identify 24 lessons drawn from a number of case studies on how to sponsor such projects.

One straightforward method which seems to have worked well within one of these arms-length bodies, Highways England, is for a project to have two directors reporting to the officer accountable for the project: a project director responsible for the delivery of the project in traditional terms and a sponsorship director (Highways England 2018) responsible for realising the benefits of the project. The creative tension between these two appears to lead to a concentration on *both* aspects of success. Our statement of this sponsorship director role actually downplays it. For Highways England, sponsorship directors,

> act as a conscience and guide to delivery teams. While operating outside direct day-to-day delivery activities, they provide strategic oversight and retain accountability for the business case and outcomes, whilst ensuring

> assurance throughout the project lifecycle …. Above all, a sponsor must always maintain an unremitting independent focus on the true reasons and benefits for which the project is being undertaken and how these can be achieved.
>
> (Highways England 2018, p. 6)

The effective analysis of the A303 project above is an example coming from this organisational structure.

### *2.4.3 Other actors*

A project does not sit in a vacuum, looked after by the government department, with no influence from the outside.

First, a project is generally prosecuted through a private sector partner. As mentioned in Section 2.2, in terms of tactical success, the contractor will be aiming for the success criteria laid out in the contract for the work. At a strategic level, the company will not have the same aims as the government department. On the other hand, a company will not be subject in the same way as the government department or arms-length body to the vagaries of public opinion or politics.

The difference in lack of strategic alignment is illustrated by two examples. The first is the long and sorry story of the NHS IT project analysed by Cicmil and Braddon (2012) (see Section 2.2), concentrating on the "small number of key suppliers, each of whom had a different business agenda to be pursued and objectives to be gained from their involvement in the project". The second is the Acela programme in the US: Amtrak was going through fundamental financial issues with questions about their strategic direction during the Acela programme, causing huge disruption to the programme, and eventually the train manufacturer sued Amtrak,

> seeking to recover $200 million in damages …. Designs have been modified literally thousands of times …. Amtrak scheduled multiple public relations visits to a test track; those visits disrupted operations in a quest to hype Amtrak's bright future and minimize public recognition of deficiencies in train design and program administration.
>
> (Vranich et al. 2002)

Understanding these differences in strategic aims is even more important in larger projects where consortia of companies are involved, or where companies interact, since projects do not exist in a vacuum. Gil and Pinto's (2018) analysis of four major UK projects (HS2, London Crossrail, London 2012 Olympics and Heathrow T2) talks about the projects being set within "London's megaproject ecology".

Second, the public will often have a crucial role, particularly for a public project ultimately reporting to politicians. Their involvement will depend

upon the type of project. Any infrastructure project will involve local and other interested people: the A303 project described above consulted with a wide range of interests. There is a general move within democracies to consult and involve the public. Gil and Pinto (2018) continue by saying that large infrastructure projects, in contrast to more technologically complex settings such as aeronautical projects,

> are socially complex but not so technologically complex that planning choices cannot be comprehended by multiple heterogeneous stakeholders. The fact that many actors can grasp what the issues are and what is at stake exacerbates the interdependency with the environment. Hence, a choice to set up a polycentric system responds to growing calls in the environment for organizations to adopt more collaborative and inclusive decision-making processes.

Public opinion can be fickle, and the mood on particular investments is affected by media reporting. More fundamentally, public attitudes to criteria can change over time, such as to the environment, climate change, air pollution, crime, social cohesion or (remembering the A303 example) heritage: even a good decision-making process at the start of a project can become out of date if the public opinion weightings of these criteria change over time. In addition, as Chapter 5's 'Conundrum number 4' will discuss, during a project the public sometimes focus on efficiency measures, particularly cost, rather than the benefits of the project, so the pressure we have discussed to meet efficiency targets is to some extent driven by the public through parliamentary processes.

This is overlaid by the temporal cycles of government: four-yearly elections, annual budgets and regular spending reviews. These are asynchronous with the sometimes long project lifecycle, adding to the turbulence around the project as strategic and spending priorities frequently change.

All of these effects mean that an important role for project sponsors is to keep the public 'on side' during a project, particularly as the environment changes, and there is a constant need to re-translate the project in terms the public will understand – assuming, of course, that it is still relevant to the needs of the country, as discussed above.

### *2.4.4 A final note: accountability*

We have discussed at length the various parties who take some degree of responsibility for a project – but who at the end is accountable for delivering the outcome that caused the project to be set up in the first place? In the UK system, it is the 'senior responsible owner', a clearly defined role (Infrastructure and Projects Authority 2019) who "is accountable for ensuring a programme or project meets its objectives, delivers the projected outcomes and

realises the required benefits", and for the most major projects (i.e. those in the Government Major Projects Portfolio),

> as well as being accountable to their own organisation's management, also has personal accountability to Parliament for the implementation of the government's policies as assigned to them by the relevant accounting officer. This accountability is recorded in the senior responsible owner's letter of appointment.

This seems very clear. However, while a project manager's efficiency targets are generally explicit and unambiguous, we have seen over this chapter that there are a number of issues that make the achievement of strategic objectives much less clear and more contested. As we look in the next section about reviewing the project ex post, we shall see how difficult it often is to be able to say definitively "this project did (or did not) achieve its aims".

## 2.5 Post project

Just as we turn at the end of a project to look back to the original definitions of success, to judge how well we have done, so we must look back at our original definitions of success in the earlier sections to consider what a post-project evaluation of success means.

Having said that, the evidence suggests that there is a lack of ex post evaluation in practice. The review of Williams et al. (2020a) suggests less activity than might have been hoped for, for various reasons. 'Lessons learned' or post-project reviews looking at the project management and efficiency measures are becoming at least not unusual, but this is not the same as an evaluation which considers the effectiveness or benefits of the project. However, Williams et al. (2020a) do note some exceptions: National Audit Offices certainly look at the value of projects, and public scrutiny of public expenditure is perhaps increasing the appetite for such reviews.

That said, as we commented at the end of the last section, there are a number of issues that need to be taken into account when taking a view on a delivered project.

First and most simply, public projects often have long lifespans, and the world – particularly the political world – will change during the lifetime of the project. This means that the value of the project objectives laid out at the start of the project might have changed. There might be governance questions – why did we not halt or change this project mid-stream? – but it will not be unusual for a simple comparison of planned outcomes and actual outcomes to founder on the passage of time.

A second point particularly applies to projects in IT, transformation or the military. At the point that an IT or transformation project finishes, the project output (say, an IT system) generally has reaped no benefits at all: it

passes to the department and gets used, entering 'business as usual'. For our purpose of looking at project 'success', this raises two issues. First, if a senior responsible owner has passed an output over to the sponsoring department, how can he/she be responsible for the use that is made of the system? Indeed, second, if it is just part of 'business as usual', where is the need to monitor it? A review by the National Audit Office (2018) of projects which had left the Government Major Projects Portfolio said,

> There is a varied picture as to whether projects have delivered successfully after they leave the Portfolio. Once projects leave the Portfolio, the Authority is no longer responsible for monitoring progress in delivering benefits, it is up to sponsoring Departments to provide this oversight.

Indeed, for four projects,

> it was unclear what had been delivered because Departments had stopped monitoring them, due to either a change of policy or because the Department had decided to deliver them in different ways, which resulted in project teams being disbanded and so Departments were unable to answer … questions.

Whyte and Nussbaum (2020) looking at mega-projects such as Heathrow Terminal 5, the London 2012 Olympics, and London's Crossrail, focus on this boundary between 'the project' and 'operations', and see an array of problems which can occur, proposing for example "strategies for mobilizing artifacts, procedures, soft landings, and tests" (p. 506).

Moving beyond this question of project handover, our third point is that sometimes it is not even fully in the Department's hands to realise the benefits of a project.

Some projects, such as new public-facing IT systems, will depend upon public take-up. This chapter, for example, is being written in the UK during the Covid-19 pandemic. The government decided to offer its citizens a 'phone app' for contact tracing, local area alerts and venue check-ins. A first version was abandoned in May 2020 due to technical failings; the trial of a second app (based on Apple and Google's technology) started in August 2020 and was launched across England and Wales on 24 September. There was widespread scepticism about whether it would be used, but the government was able to announce by late December 2020 that the app had been downloaded 20.9 million times (UK Government 2020) – an apparent success (although it does not necessarily show whether citizens actually use the app).

Some projects facilitate access to benefits, but these will not be realised unless other bodies take them up. Transport infrastructure is a clear example of this. An ambitious plan was devised in the UK to develop infrastructure to link the cities of Oxford and Cambridge. While essentially an infrastructure development plan, a report by the National Infrastructure Commission (2017) describes essential development and governance proposals to facilitate

bodies getting together from Oxford and Cambridge and towns in between, such as Milton Keynes, to build on the development; however, any nationally commissioned infrastructure work would not achieve its planned benefits if the local authorities did not take up the opportunities provided.

Benefits can be even further from the immediate purview of the 'project'. In the example in Chapter 5, the UK Ministry of Justice has as its main strategic aim 'A prison and probation system that reforms offenders'. Part of this development is a 'Prison Estate Transformation Programme'. A key aim of the programme will therefore be to develop the prison estate in such a way as to reform offenders and reduce re-offending. The logical inference would be that when re-building an old prison, a strategic project target would be a reduction in eventual reoffending rates. But in this, as in all of the cases described here, the 'success' of the project will be dependent upon changes in the behaviour of citizens, business, government agencies, civil servants and other relevant stakeholders (see the discussion on social bonds above).

Fourth, a key difficulty in evaluating a public project with a long life cycle aiming to bring economic benefits is the challenge of distinguishing benefits that arose from the specific project being considered from macroeconomic and other trends. The question of what improvements arose from the existence of the project, and what would have happened had the project not been undertaken (let alone if the project had not been undertaken, but the money spent elsewhere), is often impossible to answer convincingly. Some jurisdictions we have surveyed do not generally try to do this, because of the contested nature of any answer that might arise. The project business case should have tackled this to some extent, but this disentanglement is clearly difficult. The problem is made more complex by raising the issue of when post-project benefits should be assessed: the quicker the assessment, the easier it will be to see the immediate effects of the project, but a longer-term is needed to understand whether the project was worthwhile. This is reflected in Samset and Volden's Paradox 10: "projects that are meant to last for decades and sometimes centuries may have significant impact on economic, environmental, and social development, yet they are still assessed in a short-term and static perspective" (p. 309) – because the public sector wants to know whether the project was worthwhile, without waiting for the long-term perspective that history provides.

So, fifth, it is historical reflection and public opinion that provides the long-term judgement on projects, particularly as the emergent and fluid nature of benefits diverge from the pre-defined project. Projects that are seen as a failure at the time in almost every way, such as the London Millennium Dome, can be seen later to be a success (with, as always, the focus on longer-term success criteria while the 'iron triangle' fades into history).

## 2.6 Conclusion

As we go on to explore the development of major public projects in practice, this chapter has tried to set the scene by considering what we mean by 'project success'.

At the most basic level, we have distinguished between tactical project management efficiency success and strategic project output effectiveness (and longer-term) success. We have seen Samset and Volden's paradox that, in practice, minds tend to be focused more on efficiency targets than the effectiveness targets that were the reason for the project – also when the public thinks about 'failure' rather than 'success'. Particularly once a project has been approved and is underway, attention drifts away from the strategic aims to the delivery of the pre-defined output, sometimes only drifting back when the project is near completion.

As we try to define a project's strategic aims, we have seen that many are contested and difficult to quantify. In public projects, there is often an array of different stakeholders, with different objectives and different ways of talking about aims and objectives. Even for quantifiable outcomes, we have seen different reasons for drawing up budgets and the effects of human bias, politics and interests in drawing up estimates, which will be discussed further in Chapter 5. We have seen how the very idea of a project 'benefit' is fluid, so we need to take a more fundamental look at the project front-end; Chapter 4 will re-visit this.

We have seen how projects, designed to be self-contained with clear targets, sit in an environment which is inescapably turbulent, subject to political influences and often working on different (shorter) timescales than the project. Chapter 6 will look further at politics and incentives. We have seen some of the difficulties in comparing ex-ante estimates with ex post out-turns, and we have noted Samset and Volden's paradox about looking at very long-term projects in terms of their immediate value; this will be considered further in Chapter 7.

The following chapter will now look at the logic of the front-end and describe an effective front-end process.

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# 3 The logic of the project front-end

*Ofer Zwikael and Alicia Gilchrist*

## 3.1 Introduction

> Although the front end has been shown to be critical to the strategic success of the project, this phase of the lifecycle is not well understood.
> (Williams et al. 2019)

The first phase of a project is known as the 'front-end' or initiation (e.g. Zwikael & Meredith 2019), followed by the planning, execution and finalisation phases (Besner & Hobbs 2006). The front-end phase begins with a problem or an opportunity formulated into a business case, and ends when it is approved or rejected by a funding entity (Edkins et al. 2013; Kock et al. 2015; Verworn et al. 2008; Williams & Samset 2010). The purpose of the front-end phase is to select the best project idea, define the objectives of the project, assess its feasibility, and set the project up for tactical and strategic success (Williams et al. 2019). Decisions made during the front-end impact the project's outcomes and key stakeholders (Morris 2013; Pinto & Winch 2016). An effective front-end can help mitigate risk, improve cost and schedule performance, and enhance project value generation (Chenger & Woiceshyn 2021; Edkins et al. 2013; George et al. 2008; Kolltveit et al. 2004; Williams et al. 2019). Conversely, an ineffective front-end may result in poorly defined project requirements, an ineffective project prioritisation and selection process, and, ultimately, approval of a project that is sub-optimal and will not deliver the anticipated benefits.

However, there is little consensus within the literature as to which activities should be accomplished during the front-end, and how the activities should be ordered (Edkins et al. 2013). This lack of clarity may be a result of confusion as to where the boundaries of the front-end lie – is it a phase of the project or does it occur before a project formally commences? (Williams et al. 2019); confusion as to who is accountable for the front-end; the inherently 'fuzzy' and developmental nature of the front-end (Kim & Wilemon 2002; Takahashi et al. 2018); variability in front-end activities between industries and projects (Chenger & Woiceshyn 2021); and the high risk of lock-in,

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whereby decision-makers unofficially commit to a project before a formal decision is made (Cantarelli et al. 2012). This lack of clarity may, in part, be a reflection of the project management literature and bodies of knowledge, which place heavy emphasis on the planning and execution phases of a project but tend to overlook the front-end phase (Edkins et al. 2013). Following the lack of consensus in the literature, and the growing importance of management of the front-end phase in research and practice, our first research question is, *How should an effective project front-end phase be constructed?*

Although what constitutes an effective front-end phase is unclear or 'fuzzy' (Chenger & Woiceshyn 2021), it is accepted in the literature that this phase begins with an idea (Verworn et al. 2008) and that the idea for a new project is typically generated by a problem or an opportunity (Baker et al. 1967; Samset & Volden 2016; Williams et al. 2019; Zwikael & Smyrk 2019). We consider a good project idea to be one that is likely to contribute towards the achievement of organisational outcomes by enhancing strategic performance. Yet *how* a good project idea is generated is unknown. This research gap is important because strategic project failure can often be "traced back to decisions in the earliest phases, when the initial idea was conceived and developed" (Edkins et al. 2013; Samset & Volden 2016, p. 301). Therefore, our second research question is, *How are good project ideas generated?*

Samset and Volden (2016) identified ten paradoxes that are found to occur within the front-end of a project. Of these ten paradoxes, four are of particular relevance to this chapter – they are known as 'the paradox of the significance of front-end management', 'the paradox of the opportunity space', 'the paradox of strategic alignment' and 'the paradox of "predict and provide"'. We examine these paradoxes to highlight key problem areas within the front-end phase and to contribute towards their future resolution by investigating effective front-end management. Subsequently, we address a third research question: *How can effective front-end practice contribute to the resolution of common front-end paradoxes?*

Our research addresses the three research questions and contributes to the knowledge by investigating advanced project practice. This chapter details the front-end process followed by the Australian Defence Force (Defence) to generate new project ideas, prioritise them and select the projects most likely to achieve the strategic objectives. Defence presents an ideal case study, as the front-end of a Defence project is rigorous, protracted and advanced – and continues to mature (Department of Defence 2020a). Furthermore, large Defence projects outperform private similar size sector projects that are less complex (Cook & Unewisse 2020). Using document analysis and a hypothetical case study of a Defence project, this chapter advances the project management literature by extending our knowledge of the front-end process through an in-depth investigation of what is widely considered to be an effective front-end process.

The remainder of the chapter is structured as follows. In the next section, we discuss four common front-end paradoxes. In Section 3.3 we review the

project front-end literature. Our methodology is then detailed in Section 3.4, before we present our findings in Section 3.5. Our findings and their theoretical and practical implications are discussed in Section 3.6, before we conclude the chapter in Section 3.7.

## 3.2 Project front-end paradoxes

How the objectives of the front-end phase should be achieved to produce the best outcomes for the project and key stakeholders is not well understood in the literature. This is evidenced, in part, by the presence of the four paradoxes discussed in this section. It is also demonstrated by the linkages between decisions made during the front-end phase and the explanations that are most often provided for project failure (Caldas & Gupta 2017; Kock et al. 2016; Williams et al. 2019). In this section, we discuss each of the four paradoxes and consider the various reasons as to why each of the paradoxes may persist.

### *3.2.1 Paradox of the significance of front-end management*

The critical role of the front-end phase in affecting the outcomes of a project is widely acknowledged and yet this phase is "unclear and poorly understood" (Williams et al. 2019, p. 1140). As a result, the project management literature does not sufficiently consider the larger context in which the project is "idealized, validated, and shaped by multiple stakeholder forces" (Pinto & Winch 2016, p. 238). As Samset and Volden (2016) point out, this presents a paradox, known as the 'paradox of the significance of front-end management', as it is during the front-end that the opportunity to reduce project risk and uncertainty is greatest. This paradox can be partly explained by the uncertainty that characterises the front-end (Kolltveit et al. 2004), the risk that any investment in this stage may be lost if the project does not go ahead (Morgan 1987) and the lack of understanding as to what should be done during the front-end phase (Pinto & Winch 2016).

### *3.2.2 The paradox of the opportunity space*

Once the trigger for a project has been identified, an idea can be generated to respond to the problem or opportunity in the form of a project. At this stage, the project champion should, ideally, generate a number of different ideas to create a range of options. Zwikael and Meredith (2018, p. 485) define the project champion as the person "who leads the development of the business case and typically presents it to the funder for approval". The project funder is the "person with the authority to approve the project and commit resources for its execution" (Zwikael & Smyrk 2015, p. 854). Samset and Volden (2016, p. 302) identified a paradox that often occurs during this activity, which they labelled 'The paradox of the opportunity space' whereby "the choice of conceptual solution is made without systematically scrutinizing the opportunity

space up front". According to this paradox, project champions often systematically select particular ideas and avoid others – even when there are more rational choices available.

This paradox is evidenced through a case study by Samset et al. (2014), which found that 11 of 17 major public projects already had a choice of concept when the front-end commenced. Samset et al. (2014, p. 474) concluded that the "final choice of concept is determined more by decision makers than by analysts, and will often be the result of policy and preferences more than objective reasoning". There are a number of explanations as to why the paradox of the opportunity space exists, including bounded rationality, the tendency of discipline experts to focus on particular aspects and overlook others, political pre-determination, experiences and preferences of the decision-makers, traits of the organisation, and a high level of project specific detail involved in the analysis (Samset et al. 2014).

### *3.2.3 The paradox of "predict and provide"*

The paradox of the opportunity space is closely related to another paradox found to occur during the front-end known as 'The paradox of "predict and provide"' whereby the tendency is to choose a "predict-and-provide strategy rather than explore alternative solutions" (Samset & Volden 2016, p. 308). The authors illustrate this paradox with an example: when responding to a capacity problem, planners are more likely to select solutions that increase capacity rather than to explore the opportunity space and consider alternatives, such as how to solve a congestion problem. They attribute this paradox to the decoupling of needs and benefits analyses from the most pressing political priorities and goals, and suggest this occurs due to conflict or complexity arising between the two. This paradox may also be attributed to path dependence (Arthur 1989; David 1985), which infers our "choices are conditioned by decisions we have made in the past, and that these decisions create increasingly constrained processes that cannot easily be escaped" (Aaltonen et al. 2017, p. 749). An alternative, contrasting perspective known as 'path creation' was proposed by Garud and Karnoe (2001) to address a limitation of path dependence, which is that it does not account for the role of human agency in forging new paths (Aaltonen et al. 2017).

### *3.2.4 The paradox of strategic alignment*

To effectively evaluate and prioritise a project idea, and for the selected project idea to be developed in an effective project, it is necessary to clearly articulate the objectives of the idea, and for the objectives to be in alignment with the organisation's strategy (Patanakul & Shenhar 2012). Project-strategy alignment should persist throughout the lifecycle of a project. However, in practice, strategic project goals are often not realised. In addition, while widely recognised as important, project strategy management which "systematically

relates project definition and development to corporate goals and strategies" (Morris & Jamieson 2005, p. 16) is not often used in the practice of project implementation (Patanakul & Shenhar 2012). This is supported by Young and Grant (2015), who found that in 'normal environments' only one in five strategies were positively impacted, while in highly collaborative environments where the strategic goals were stable, two in five strategies were positively impacted. The authors recommend future research to explore how projects can better contribute to strategy.

Samset and Volden (2016, p. 304) consider this a paradox as "strategy and alignment of objectives are highlighted as essential concerns, but in most cases the internal logic of causalities and the probabilities of realization are erroneous" (Samset & Volden 2016, p. 304). The authors labelled this 'The paradox of strategic alignment'. One explanation for this paradox may be that projects often lack shared objectives and agreement on the objectives, having too many goals, or too many unrealistic or overly ambitious goals (Samset and Volden, 2016). In addition, the changing environment makes project-strategy alignment, if obtained, difficult to maintain throughout the project's development.

## 3.3 Project front-end activities identified in the literature

A comprehensive review of the literature was conducted using the Scopus database. The literature search was confined to journal articles published between 2009 and 2021 to capture the latest research. We used the key words 'project management', and 'front-end' or 'initiation', and further confined the search to articles' title, abstract or keywords. Each article was scanned to confirm its relevance to this research. This process reduced the number of articles from 183 to 32. We then examined each article to identify activities, stages or steps associated with the front-end phase of a project. Our analysis of the literature suggests that the logic of the front-end involves four key activities: (1) project trigger identification, (2) project idea generation, (3) business case development and (4) business case appraisal. These activities are presented in Table 3.1 and further discussed in this section. To provide a theoretical basis to the front-end project activities identified in the literature, we aligned these four activities with Mintzberg et al.'s (1976) three-phase executive decision-making process presented in the strategy literature – these phases appear in the last column of Table 3.1. We conclude that the decision-making phase of opportunity/problem identification is equivalent to the front-end activities of project trigger identification and idea generation; the solution development decision-making phase is equivalent to the project business case development; and the selection phase is similar in nature to the appraisal of the project business case. Therefore, we argue that the proposed project front-end process is well aligned with the strategy management literature.

*Table 3.1* Project front-end activities

| *Decision-Making Phases (Mintzberg et al. 1976)* | *Project Funding Decision-Making Activities* | *Description* | *Key Steps* |
|---|---|---|---|
| 1. Opportunity/ problem identification | 1. Project trigger identification | The identification of a problem or opportunity | • Trigger identification<br>• Trigger confirmation |
| | 2. Project idea generation | The generation of an idea to respond to a project trigger. | • Idea definition<br>• Idea assessment<br>• Idea prioritisation<br>• Project idea conceptual approval |
| 2. Solution development | 3. Business case development | The development of a business case for a new project | • Definition<br>• Analysis<br>• Packaging |
| 3. Selection | 4. Business case appraisal | Decision-making regarding the proposed business case | • Business case presentation<br>• Business case assessment<br>• Project funding approval<br>• Next steps decided |

### *3.3.1 Project trigger identification*

The first front-end project activity is project trigger identification. A new project is triggered by a stimulus which is most often a problem or an opportunity (Baker et al. 1967; Williams et al. 2019; Zwikael & Smyrk 2019). How a project idea is triggered is important because a new project idea should be guided by the anticipated effect rather than the present undesired situation (Williams & Samset 2010). Thus, the trigger for a project idea should determine the anticipated effect. However, according to Zwikael and Smyrk (2019, p. 4), "although it is necessary to align projects with organizational strategy, not all projects that an organization funds arise directly from the demands of a strategic vision". The authors argue that projects can be triggered as either (1) deliberate strategy implementation projects that implement an organisation's strategy, (2) emergent strategy projects that are triggered by opportunities to enhance performance and shape the organisation's strategy or (3) imposed projects that are demanded by external factors, but do not necessarily align with an organisation's strategy. A lack of integration between a project and organisational strategy is linked to project failure (Kock et al. 2016). This research supports Samset and Volden's (2016) paradox of strategic alignment.

Identifying the trigger, and understanding the effect required in response enables the generation and prioritisation of project ideas, an assessment of the alignment between the project's goals and the organisation's strategic

objectives, and an assessment of the overall value of the project to the organisation. However, how an organisation can identify project triggers most effectively and comprehensively is not explicated within the project management literature "contexts where exploration of the unknown and highly uncertain is required to identify high-risk, high reward project opportunities" (Chenger & Woiceshyn 2021, p. 176). Furthermore, the implications of an imposed project that does not align with an organisation's strategy are also poorly understood.

### *3.3.2 Project idea generation*

The second activity to occur during the front-end phase is project idea generation. There are five reasons why the project idea generation process should be understood. First, strategic project failure has been linked to the conception and development of the initial idea (Edkins et al. 2013; Samset & Volden 2016). Second, project ideas tend to survive the ensuing prioritisation and selection process, regardless of how poor they may be (Samset & Volden 2016); therefore, it is critical that the idea generated at the very start of the front-end process is the right one (Kock et al. 2015). Third, understanding the idea generation process can ensure that the trigger and the anticipated effect are clearly defined, that the anticipated effect is triggered by the problem or opportunity, and that the two are not conflated. Fourth, once a process is known, it can be improved.

Finally, while it is necessary to execute the front-end of a project effectively, it is also necessary to understand how a project came to be "idealised, validated and shaped" during the front-end so that its execution can be situated within the project's larger context (Pinto & Winch 2016, p. 238). This situational awareness can facilitate the project's effectiveness by contextualising the project manager's knowledge of the project specifications and customer needs (Morris 2013). Knowledge of how a project idea was generated can situate the project within its larger context by providing information as to how it was idealised, validated and shaped.

There are several reasons as to why a poor project idea might survive the project appraisal and selection process, and receive funding. Sleesman et al. (2012) conducted a meta-analysis and presented a comprehensive overview of the determinants that provide an explanation as to why escalation of commitment to losing courses of action occurs. They found the reasons individuals may continue to invest in an idea, regardless of how poor it might be are either project-related (such as decision risk and opportunity cost information), psychological (such as sunk costs and ego threats), social (such as resistance to others' decisions) and/or structural (such as agency problems). Cantarelli et al. (2012) describe the unofficial commitment to a project before a formal decision is made as 'lock-in'. This desire to commit may stem from several sources of pressure, such as fear of being 'overtaken' by competitors; fear of missing a window of opportunity; the need to respond to a threat; pressure to respond to senior members' demands to find a solution to an ongoing and expensive

problem; the pressure to perform and 'be seen to be doing something'; or to the mistaken belief that the best solution has been found, and therefore further testing and analysis of alternatives solutions would be a waste of resources and time. The project idea generation literature supports Samset and Volden's (2016) paradox of the opportunity space and paradox of predict and provide. If an idea is not generated by an appropriate mechanism, then it is more likely to be a poor one.

A project idea can emerge "from many different quarters such as a prospective funder, a business unit manager, a services department, an employee, an external consultant or even a supplier" (Zwikael & Smyrk 2019, p. 194). While the literature acknowledges the critical importance of idea generation or project 'ideation', the concept has been given little attention within the project management (Pinto & Winch 2016) and new product development literature (Joachim & Spieth 2020; Kock et al. 2015). According to Chenger and Woiceshyn (2021), the literature focuses on the evaluation and selection of projects, while 'little is said' about how new project concepts, opportunities or ideas are identified or generated during the front-end. Instead, the authors (p. 176) state it is widely assumed that "staff scout for opportunities, screen them through formal project management processes, and present those selected to the executive decision makers, who typically are not involved in generating project ideas" – an assumption that does not apply to projects in high-risk, high-reward contexts. Thus, project contexts such as the Defence may warrant their own investigation into the project idea identification and generation process.

### *3.3.3 Business case development*

The development of a business case is the third project front-end activity we identified within the project management literature. A business case contains the information needed to assess whether a project is worth the investment of its funding organisation (Zwikael & Meredith 2019). Because it is not always appropriate for the person who came up with the original idea for a project to lead the business case development, this activity will often be driven by someone else, who is identified as the project 'champion' (Zwikael & Smyrk 2019, p. 191). If the champion lacks the technical skills and time required to write the business case, someone else, such as the project-owner-designate or the project-manager-designate can be appointed to assist with that work.

The business case includes information regarding the expected deliverables, estimated duration of project execution, its cost, cash flow, risks, communications strategy and governance structure. The benefits the project is expected to generate for its funding organisation and key stakeholders is another important piece of information included in the business case. As both the strategic and tactical performance of a project is evaluated to determine whether the project is a success, a project should be effective, relevant and sustainable (Samset and Volden, 2016) – it should deliver benefits and value.

The benefits and value a project is intended to provide need to be set in the business case. Zwikael et al. (2018) argue that project target benefits need to have three characteristics to be well-defined and effective in generating value: (1) specificity, for example, target benefits have a specific target value, (2) attainability, for example, the organisation has the capacity to realise the target benefits and (3) comprehensiveness, for example, target benefits reflect the views of key stakeholders.

#### *3.3.4 Business case appraisal*

The final project front-end activity we have identified within the literature is the appraisal of the business case. Once the business case has been assembled, it is presented to the potential project funder (the entity or entities with the authority to commit funds to the proposed project). The funder assesses the business case and determines one of three potential outcomes: (1) the business case is accepted and the project is funded, (2) the business case needs to be reworked and resubmitted or (3) the business case is rejected. Ultimately, appraisers (the project funder) assess the document to determine whether the project offers an appropriate trade-off between return and risk, and to assess how the project ranks against other projects competing for investment funds (Zwikael & Smyrk 2019). The project is the responsibility of the project owner, once the project has been formally approved (Williams et al. 2019; Zwikael & Meredith 2018).

### 3.4 Methodology

To investigate the logic of the front-end phase and address the research questions, we adopt a qualitative approach. We selected this approach as our research investigates activities within the front-end phase that are not yet well understood, such as project trigger identification and project idea generation. Our research is guided by a critical realism ontological perspective in which an entity can exist without someone directly "observing, knowing and constructing" it (Fleetwood 2005, p. 199). Instead, an entity can exist and be studied via its causal efficacy (Danermark et al. 2002). Qualitative methods have been used previously to study the front-end of projects, for example through interviews (Edkins et al. 2013), literature reviews (Williams et al. 2019) and 'cased studies' (Samset & Volden 2016).

#### *3.4.1 Data collection*

We collected data using document analysis. Document analysis is a systemic procedure used to review or evaluate documents (Bowen 2009). As Merriam (1988, p. 118) states, document analysis can be used to "uncover meaning, develop understanding, and discover insights". First, we identified publicly available Defence documents published for the purpose of explicating the

front-end phase of the 'capability lifecycle'. We then applied content analysis to identify and understand each of the steps in the front-end phase of a Defence project (Bowen 2009). As most Defence project related data is classified, we developed a hypothetical Defence project case study to describe and explain the Defence front-end process in context. Once the steps had been identified, we compared them with the four front-end activities identified in the project management literature to ascertain the strengths and limitations of each.

### *3.4.2 The Australian Defence Force case study – context*

Defence offers an excellent case study for other project industries to learn from, as it delivers large, complex acquisition and development projects, managed by highly trained professionals, in one of the most advanced project environments in the world. We also selected Defence for analysis as the front-end phases of large, complex projects are less well understood than those of small to medium-sized projects (Williams et al. 2019). In particular, our research focuses on the Defence's Force Design Division (FDD). Force Design supports the Vice Chief of the Defence Force (VCDF) as the Joint Capability Authority responsible for determining the preparedness requirement for the Joint Force. This division was established as an outcome of the 2015 First Principles Review (FPR) for the purpose of producing a permanent Force Design function (Department of Defence 2015).

## 3.5 Findings

In this section, we first discus each of the steps Defence follows during a project front-end phase. We then use a hypothetical Defence project to demonstrate each of the steps in practice and define key Defence terms. Each of the steps in the Defence front-end process is then linked to the four front-end activities we identified in the literature (Table 3.1).

### *3.5.1 The front-end phase of a Defence project*

The Defence front-end phase is designed to support Defence's strategic objectives, which are "to ***shape*** Australia's strategic environment; to ***deter*** actions against Australia's interests; and to ***respond*** with credible military force, when required" (Department of Defence 2020b, p. 1). We viewed the front-end phase of a Defence project as being relevant for this chapter because it delivers large, complex acquisition and development projects, managed by highly trained professionals, in one of the most advanced project environments. Therefore, we argue that the front-end project literature can benefit from analysing the Defence front-end phase. The Defence front-end process consists of 11 clearly defined and interdependent steps. These steps are discussed next and illustrated with a hypothetical project example. Our analysis

is generalised where appropriate to enhance the applicability of our findings and conclusions to organisations outside Defence.

The capability lifecycle (CLC) is the process used by Defence to link "strategic direction, developing concepts, defining requirements, acquisition, introduction into service, sustainment, upgrade and disposal of major capital assets (equipment, facilities and ICT)" (Department of Defence 2020a, p. 3). The cycle consists of four phases: (1) Strategy and Concepts, (2) Risk Mitigation and Requirements Setting, (3) Acquisition and (4) In-Service and Disposal. Using the front-end process discussed in the project management literature, the first two CLC phases constitute the front-end of a Defence project. As a result, a Defence project begins with a discussion around Strategy and Concepts and ends when government approval to commence the project is granted. A Defence project is defined as "a unique, transient endeavor, undertaken to achieve planned objectives" (Department of Defence 2020a, p. A-7).

A complex Defence project needs to pass through three approval submission gates – Gate 0 (Defence Investment Committee approval; occurs at the end of the first CLC phase), Gate 1 (government approval; occurs in the middle of the second CLC phase), and Gate 2 (government approval; occurs at the end of the second CLC phase). All major projects (exceeding $20 million) require government approval. The Defence CLC's gates are similar to the Norwegian Quality Assurance regime in the front-end of major public projects (Samset & Volden 2016). However, the Norwegian model has two review gates, whereas the Australian model has three for very large projects. Further, whereas in Defence, one of the three gates is internal to Defence, the review gates in Norway are only external. The first Norwegian gate is called 'Quality Assurance 1' (QA1), when the conceptual solution goes to Cabinet for approval to commence work on a pre-project, and the second is called 'Quality Assurance 2' (QA2), when then project is submitted to the parliament for approval and funding.

The front-end phase of a Defence project can be further broken down into 11 steps: (1) identify change, (2) qualify risk, (3) prioritise risk, (4) develop options, (5) test options, (6) identify offsets, (7) test portfolio options, (8) SMART buyer framework, (9) contestability framework, (10) risk mitigation and requirements setting and (11) additional risk mitigation and requirements setting. 'Options' are referred to as project ideas or alternatives in the literature. Steps 1 through to 9 constitute the first phase in the Defence front-end ('Strategy and Concepts' phase), while steps 10 and 11 make up the second phase ('Risk Mitigation and Requirements Setting' phase). During the second phase, risk is reduced and requirements are defined so that investments are defensible and a contract can be entered into. The first seven steps in the front-end form the Defence Capability Assessment Program (DCAP). FDD activities are conducted primarily through the DCAP.

Next, we define key Defence terms, discuss each step in the Defence front-end process and provide a hypothetical case study to illustrate each of the

steps. Our hypothetical project involves the development of a jet, labelled the 'Blue Jet Project'.

***Step 1: Identify Change***. The purpose of the first step in the front-end of a Defence project is to identify change through an assessment of the environment. This involves assessing internal and external inputs to the organisation. Inputs may include changes to strategic direction, technology, partner concepts and developments, identified gaps and opportunities, government and industry assessments, budget and deficiencies, as well as threats. Defence defines a threat as "an uncertain event, trend or condition that may result in negative outcomes" (Department of Defence 2021a). This step also identifies which Force Packages are affected by the change, to what extent and at what time. Force packages are "a mix of capabilities over a 20 year period" (Department of Defence 2020a, p. 16). A capability is defined as "The power to achieve a desired operational effect in a nominated environment within a specific time and to sustain that effect for a designated period" (Department of Defence 2020a, p. A-2).

*Blue Jet Project*: A new intelligence report suggests a major threat – the development of a military jet plane by another country that can fly faster than any military jet owned by Defence.

***Step 2: Qualify Risk***. The second step involves conducting an impact assessment of the changes so as to qualify the risk in relation to Defence's ability to achieve its strategic objectives. Risk is defined by Defence as "possible events that, if they occur, will impact on corporate goals and strategic objectives" (Department of Defence 2019, p. 22). Risk may be viewed negatively as a threat or positively as an opportunity. Risk is qualified and risk statements are developed using the Australian Defence Force Risk framework, which is based on likelihood and consequence (Department of Defence 2019). This step enables Defence to understand the accumulation of risk and opportunity to offset it.

*Blue Jet Project*: It was determined that the risk posed by the faster jets and their ability to exceed existing and planned Defence jet capabilities was extremely high.

***Step 3: Prioritise Risk***. The third step involves a series of workshops to prioritise the risks and opportunities resulting from Step 2 before they are presented to senior decision-makers for consideration and direction. Optimising the effectiveness of the prioritisation and selection process is crucial as financial constraints prohibit all risks from being mitigated.

*Blue Jet Project*: The risk posed by the faster jets was prioritised as greater than any other risk identified elsewhere and it was determined that this risk *must* be addressed.

***Step 4: Develop Options***. Once the risk has been determined, Defence conducts a gap analysis between the current force and the future force. This leads to the generation of project options. These options may be to adjust resourcing levels to a Force Package, add new capabilities to a Force Package, substitute new Force Packages, or build new Force Packages. In addition,

the Services and other Groups independently identify, prioritise and select options they wish to develop to address their specific requirements. Once the Services and other Groups have identified the options they would like to be developed, and have independently completed their prioritisation and selection processes, the proposed options are submitted to FDD, which then works collaboratively with the Services to identify, prioritise and integrate new options that work across, or enable the Joint Force. The criteria used in Force Design's prioritisation process have a whole of Defence rather than single Service focus. Each option is assessed in terms of cost and industry implications.

*Blue Jet Project*: Three options were developed to respond to the risk posed by the faster jets, and to particular Force Packages. 'Capability Option A' proposed a new capability, as an air-based technology that would allow Defence to neutralise the risk posed by super-fast jets – specifically, the development of a new jet that can exceed the speed of the other country's jets, thereby allowing our jets to shoot their jets down. When considering a capability option, Defence considers all of the associated Fundamental Inputs to Capability (FIC). An FIC is defined as,

> a standardised set of nine resource and organisational enabling inputs, designed to enable the effective generation of Defence capabilities. The nine Fundamental Inputs to Capability are organisation, command and management, personnel, collective training, major systems, facilities and training areas, supplies, support and industry.
>
> (Department of Defence 2020a, p. A-4)

In our case, a major system that makes up a part of Capability Option A is the Blue Jet Project on which this hypothetical case study is based. Additional FIC would include the recruitment of pilots, engineers and ground staff to operate, maintain and support the jets, and the training facilities to train the pilots to fly the new jets. Another option was to upgrade existing missile Defence systems against the threat the faster jets posed (Capability Option B), while a third option was to develop a new technology that would allow Defence to remotely take control of the faster jets if they were to enter sovereign airspace (Capability Option C).

***Step 5: Test Options***. The fifth step involves testing each capability option to assess its feasibility and value, and in particular how it would address the prioritised risks. The analysis is conducted, in part, using experimentation and war gaming. Each capability option is tested against Australian Contingency Context Scenarios (ACCS) which are derived from Defence's strategic objectives (Department of Defence 2021b).

*Blue Jet Project*: In this case, Capability A performed well during experimentation and war gaming. It was valued more highly than the alternative two options (Capability B and C) developed as potential responses to the risk posed to Defence by the faster jets.

***Step 6: Identify Offsets***. During this step, offsets that can be made within the existing budget to accommodate new or additional investments are identified. This step also involves identifying the risks to the organisation should an existing project be rephrased/re-scoped or divested, given that each project within the budget addresses one or more risks.

*Blue Jet Project*: A new Defence project that was about to be approved was identified as a potential candidate for re-structuring and rephrasing, which would free funds for the Blue Jet Project.

***Step 7. Test Portfolio Options***. The seventh step involves identifying the net effect of proposed new investments offset in terms of the remaining risk resulting from the revised portfolios. Project portfolio management is a "dynamic activity through which an organization invests its resources to achieve its strategic objectives by identifying, categorizing, monitoring, evaluating, integrating, selecting, prioritizing, optimizing, balancing, authorizing, transitioning, controlling, and terminating portfolio components" (Project Management Institute 2017).

*Blue Jet Project*: The portfolio options, which included Capability A (among existing capabilities), were tested against the remaining risk resulting from the revised portfolios.

***Step 8: SMART Buyer***. The SMART buyer framework is an analysis and risk-based decision-making framework, which is facilitated by an Independent Assurance Review (IAR) team. The purpose of this step is to understand the circumstances that led to the project and identify the 'drivers' or triggers. For example, there are a number of acquisitions drivers, such as needs, technology, security and financial drivers. There are also sustainment drivers, such as support to operations, in-service considerations and commercial drivers. Once a 'drivers profile' has been developed, analysis and decision-making takes place to then produce tailored approval, asset management, governance and management, and commercial strategies for inclusion in the Project Execution Strategy (PES) submitted at Gate 0 (Ryan & Soutberg 2020). SMART buyer workshops are conducted with key stakeholders during this step to "develop an improved understanding of a project's risk profile at workshops facilitated by experienced and independent Defence personnel and industry experts" (Department of Defence 2017, p. 125).

*Blue Jet Project*: The proposal for the Blue Jet project was submitted to SMART buyer for review. The proposal was included in a risk and drivers workshop, strategy development workshop and 'red team review' before receiving approval from the Delivery Group Division or branch head to proceed to the next step. The SMART buyer team provided an improved understanding of the Blue Jet Project's risk and drivers, and developed tailored strategies.

***Step 9: Contestability***. During this step, Contestability Division checks if the proposal aligns with strategic and resource guidance, and if it can be implemented as proposed. In addition, Contestability Division checks to see if the risk assessments and treatment strategies are appropriate, if the basis for the decisions made is acceptable, and if the cost and schedule estimates are acceptable. The SMART buyer framework and the contestability framework

are applied three times during the front-end phase at Gates 0, 1 and 2 (Ryan & Soutberg 2020).

*Blue Jet Project*: Contestability Division reviewed the Blue Jet Project proposal against the criteria listed above. As the proposal was found to align with strategic and resource guidance, have appropriate related assessments and strategies, be the basis for decisions, have acceptable cost and schedule estimates, and confirmed that the project could be implemented as proposed, Contestability Division approved the project for consideration at the next Gate.

*Gate 0.* The portfolio options are submitted to the Defence Investment Committee for consideration. If approved, the selected portfolio receives pre-Gate 1 funding.

***Step 10: Risk Mitigation and Requirements Setting.*** Risk reduction activities include modelling and simulation, commercial risk assessments, risk reduction studies and trade-off studies. The purpose of the requirements setting phase is to define exactly what is to be acquired to provide a clear basis for public expense, the requirement to enter into a contract and to confirm that what has been delivered is acceptable.

*Blue Jet Project*: During this step, risks associated with the Blue Jet Project would be identified and reduced where possible using the risk reduction activities stated above. For the Blue Jet Project, the risks may include insufficient pilots to fly the jets, no instructors within Australia to train the pilots and/or no available space to store the jets when not in use. When setting requirements, the specific requirements for the Blue Jet Project would be identified, such as the number of jets and trained pilots required, the location the jets would need to be stored at when not in use, the storage and maintenance requirements for the jets, and the amount of fuel the jets would require to operate for a given period.

*Gate 1.* The project is submitted to government for consideration. If approved, the project will receive pre-Gate 2 funding.

***Step 11: Additional Risk Mitigation and Requirements Setting.*** Additional risk mitigation and requirement setting activities take place after Gate 1 and prior to Gate 2. These include further requirements setting (moving toward contract ready specifications), commercial risk assessments and trade-off studies. Funds are committed incrementally during Step 10 and 11 in relation to the degree of risk and uncertainty, as well as the definition of the requirements.

*Blue Jet Project*: Further requirements setting, commercial risk assessments and trade-off studies were conducted on the Blue Jet Project. Funds were incrementally released to the project during the Risk Mitigation and Requirements Setting phase in accordance with the degree of risk and uncertainty, and definition of the project requirements.

*Gate 2.* The project is submitted to government for consideration. If approved, the project will receive funding for acquisition. The front-end phase then concludes, and responsibility is handed over to the Capability Acquisition and Sustainment Group (CASG) to deliver the approved project.

### *3.5.2 A comparison of the Defence process with the project management literature*

Table 3.2 shows how each of Defence's 11 steps detailed above fit within the four front-end activities we identified within the literature (Table 3.1). This analysis also shows how the Defence process may contribute to the project management front-end literature by expanding and enriching each of the four activities. The Defence front-end steps are included in Table 3.2 below, along with a brief description of the associated front-end activity identified within the literature. The Defence front-end phase could significantly enrich and expand the front-end activities identified in the literature, and provide a framework for effective front-end practice.

## 3.6 Discussion

The front-end of a project is a decision process. This decision process "commences with the identification of a stimulus for action and ends with the specific commitment to action" (Mintzberg et al. 1976, p. 246). This chapter explores the front-end phase of a project. We reviewed the relevant literature, conducted a qualitative investigation involving document analysis to reveal the front-end phase of Defence projects and presented our findings using a hypothetical case study. Defence presents an ideal case study for the project management literature, as the front-end of a Defence project is rigorous, comprehensive, protracted, advanced and well-documented. We then compared knowledge of the front-end project phase from the project management literature with the Defence front-end project phase.

Our findings and their implications are discussed in the following four sub-sections. In Section 3.6.1 we address research question 1 (*How should an effective project front-end phase be constructed?*). In Section 3.6.2 we respond to research question 2 (*How are good project ideas generated?*). Next, we address research question 3 (*How can effective front-end practice contribute to the resolution of common front-end paradoxes?*) in Section 3.6.3. Our implications for project management practice are then discussed in Section 3.6.4.

### *3.6.1 An effective project front-end phase*

In this section, we draw on the findings presented in Section 3.5.1 to present an effective project front-end phase that may assist project management practitioners to construct the front-end phase of a project. This phase is mapped in Figure 3.1. It expands each of the four activities identified in the literature (see Table 3.1) into 12 separate steps, which include: (1) two businesses cases – an initial business case and a detailed business case – rather than the one referred to in the literature, (2) two approval gates – a conceptual approval gate (following the initial business case) and a funding approval gate (following the detailed business case) – as opposed to the one recommended in the literature, and (3) two detailed processes for front-end activities that are not

*Table 3.2* A comparison of Defence and project management literature front-end processes

| *Defence Front-End Steps* | *Description* | *Project Management Literature Front-End Activities (see Table 3.1)* |
|---|---|---|
| 1. Identify change | *Identify change in the environment and determine how the Force Packages are affected by the change* | *Activity 1 – Project trigger identification* |
| 2. Qualify risk | *Develop risk statements for each of the identified relevant changes using the Australian Defence Force risk framework* | |
| 3. Prioritise risk | *Workshop to prioritise risks* | |
| 4. Develop options | *Build Force Package options sets by increasing resources, adding new capabilities, substituting Force Packages or building new Force Packages* | *Activity 2 – Project idea generation* |
| 5. Test options | *Test options to confirm how they address risk and identify best value for money treatment options* | |
| 6. Identify offsets | *Identify offset strategies for new investments* | *Activity 3 – Business case development* |
| 7. Test portfolio options | *Test options to confirm net positive impact* | |
| 8. SMART buyer | *Analysis and risk based decision-making framework* | |
| 9. Contestability | *Check proposal aligns with strategic guidance and resource guidance, and can be implemented as proposed* | |
| Defence Investment Committee Decision (Gate 0) | | |
| 10. Risk mitigation and requirements setting | *During this stage, risk is reduced and requirements are defined so that investments are defensible and a contract can be entered into* | |
| Government Decision (Gate 1) | | |
| 11. Additional risk mitigation and requirements setting | *Additional risk mitigation and requirement setting activities* | |
| Government Decision (Gate 2) | | *Activity 4 – Business case appraisal* |

clear in the project management literature – the project trigger identification process and the project idea generation process. We have identified eight implications for practice stemming from the recommended front-end process shown in Figure 3.1. These implications are discussed in Section 3.6.4.

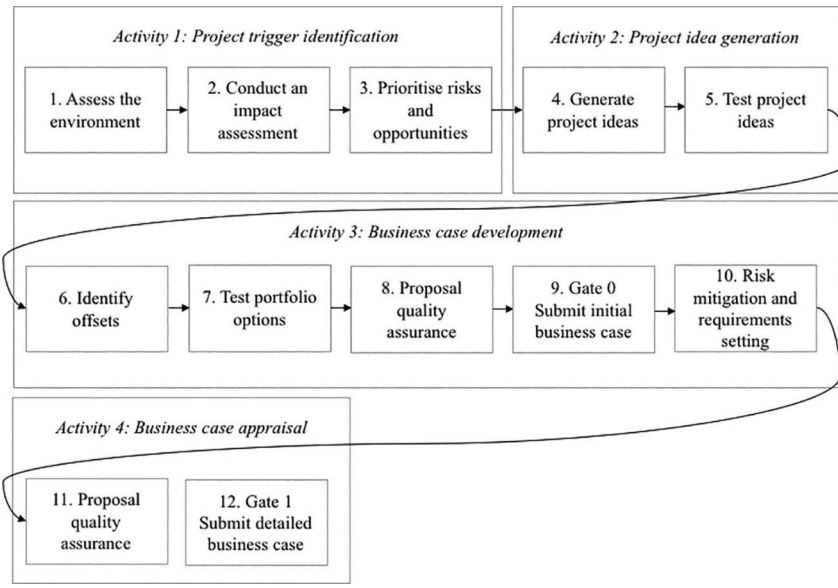


*Figure 3.1* The proposed project management front-end process.

Earlier research has identified a lack of a structured framework, unclear definition of roles and activities, and ineffective communication channels as major challenges facing the front-end planning process (Oh et al. 2016). By mapping the front-end of a project, this research assists people involved with the front-end phase to overcome these challenges by providing guidance as to which activities should occur and when. This would enable the assignment of roles with clear accountabilities and responsibilities, and support the construction of communication channels.

### *3.6.2 Project idea generation*

This section discusses the findings presented in Section 3.5.1 in order to respond to our second research question – *How are good project ideas generated?* In Defence, project options are developed and tested by involving each of the seven steps in the DCAP. However, we found that in Defence, project options are primarily developed through a five-step process: (1) identify change, (2) qualify risk, (3) prioritise risk, (4) develop options and (5) test options. Each step builds on the one that precedes it.

The front-end of a project is triggered by the identification of a problem or opportunity by the project funder (Zwikael & Smyrk 2019), although *how* exactly this trigger should be identified to enhance the effectiveness of project idea generation is unclear. In Defence, project triggers are identified through an assessment of change in the environment at Step 1. The environment

consists of all internal and external inputs to the organisation, such as changes in strategic direction, technology, partner concepts and developments, identified gaps and opportunities, government and industry assessments, budget, deficiencies and threats.

A new project idea should be guided by the anticipated effect rather than the present undesired situation (Williams & Samset 2010). Thus, the trigger for the generation of the idea (Step 1 – identify change) is important, as it determines the anticipated effect (Step 4 – develop options). The anticipated effect may be viewed through the lens of the 'Now-No-Yes' (2NY) scenario map (Zwikael & Smyrk 2019, p. 27), where three alternative states are compared. First, the 'Now' scenario, which is described as "the way the world is shaped today in terms of selected variables of interest" is analysed in the Defence process in Step 1 (identify change). This step analyses the current state and how various changes may impact it. Second, the 'No' scenario is "the way the world will be shaped in the absence of the project" (Step 2 – qualify risk), that is, the state Defence will be in if the threat is materialised without an appropriate response. Third, the 'Yes' scenario, which is "the way the funder wants the world to be shaped as a result of the project" is analysed as the anticipated effect (Step 4 – develop options), that is, the state Defence will be in if they respond to the threat through the development of a new project.

Good ideas are generated when a decision-making framework is followed that ensures the options generated and tested are clearly linked to the initial trigger for the project (Step 1 – identify change), are motivated by a qualitative and quantitative understanding of the risk to the organisation (Step 2 – quality risk), have been prioritised against other risks and opportunities that can impact the organisation (Step 3 – prioritise risk) and, notably, have had not one, but a wide range of alternative ideas developed (Step 4 – develop options). It is then important to test the option to confirm how it will address the risk and fit within the organisation's wider project portfolio(s) (Step 5 – test options).

Engaging in an extended project idea generation decision-making framework such as this one can reduce the likelihood of various cognitive factors impacting project idea generation such as cognitive biases, lock-in, path dependence, political pressure and strategic misrepresentation, and increase the likelihood of generating a good project idea. The Defence's five-step project options development and testing process also helps to ensure the project trigger (step 1 – identify change) links to the organisation's strategic objectives (step 2 – qualify risk) and to the project outcomes. These linkages support the project proposal by providing evidence of the value of the project. This, in turn, should positively impact project investment decision quality.

### *3.6.3 Resolving common front-end paradoxes*

This section further analyses the findings presented in Section 3.5.1 in response to our third research question – *How can effective front-end practice contribute to the resolution of common front-end paradoxes?* The Defence front-end

phase may contribute towards the resolution of the four common front-end paradoxes discussed in this chapter. The occurrence of the first paradox, 'the paradox of the significance of front-end management', may be lessened by the findings presented in Section 3.5.1, as this section contributes to project management knowledge by detailing how an effective front-end phase should be constructed, considering the larger context in which the project is "idealized, validated, and shaped" (Pinto & Winch 2016, p. 238). This reduces the uncertainty typically associated with the front-end (Kolltveit et al. 2004), reduces the risk of unnecessary investment in the front-end (Morgan 1987) and ensures that the front-end is not overlooked due a lack of knowledge – what the objectives of the front-end are, and how they can best be achieved (Pinto & Winch 2016).

The findings presented in Section 3.5.1 may also contribute to the resolution of 'the paradox of the opportunity space'. Specifically, the detailed, five-step project ideas development and testing process increases the likelihood that multiple project ideas will be generated based on a specific relevant change in the environment, rigorous assessment of the impact of the change to strategic objectives, and prioritisation of the impact before undergoing testing and experimentation. Therefore, it is less likely that the project idea eventually approved will be as a result of the factors that may explain the paradox of the opportunity space, such as bounded rationality, political pre-determination, experiences and preferences of the decision-makers or the tendency of discipline experts to focus on particular aspects while overlooking others.

Section 3.5.1 may also have implications for another common front-end paradox – The paradox of 'predict and provide'. There is a tendency for planners to select the most obvious solution. If usage is exceeding capacity, increase the capacity. This is perhaps the easiest and most straightforward response to a problem. This paradox is attributed, in part, to a decoupling of needs and benefits analyses from the most pressing political priorities and goals. The Defence front-end process supports linkages between the original trigger for a project, strategic objectives and the approved project. Specifically, these linkages are supported by following a clearly defined sequence of steps that ensures each stage of a project's development is logically connected to the preceding step. The solution can then be directly linked to the problem and strategic objectives. Furthermore, the Defence process involves a step where alternative project ideas should be developed. Options should be explored by a work group consisting of individuals with expertise in the area, but also with an understanding of the organisation's existing project portfolio/s and knowledge of the organisation's strategic objectives, and the broader political and financial landscape.

Finally, the Defence front-end process involves an extensive, rigorous quality assurance check by an independent group of experienced experts to ensure the linkages between the project trigger, strategic objectives and proposed project solution are clearly defined and supported with evidence. This occurs before the proposed project is submitted for consideration at Gates 0, 1 and 2.

The fourth and final front-end paradox that we believe our findings have implications for is the 'paradox of strategic alignment'. The Defence front-end process can contribute to the resolution of this paradox by ensuring the objectives and benefits of a project are clearly articulated in key front-end documentation using effective frameworks. The Defence process can also help to ensure a project idea is aligned with strategic objectives by including a step that involves testing an idea against a scenario which reflects Defence's strategic objectives. Finally, an explanation for the paradox of strategic alignment may be that projects often lack shared objectives and agreement on the objectives, and have too many goals, or too many unrealistic or overly ambitious goals. This problem is largely avoided by Defence, as the front-end process is mostly carried out by FDD – a group who sits between the services and government to ensure the project ideas sent to government for consideration reflect the objectives of the whole of Defence, rather than one particular service. This group shares an understanding of the business objectives as well as commitment towards business outcomes and the plans for achieving them.

### *3.6.4 Implications for project management practice*

Our research has several implications for project management practice. These implications have been presented in Table 3.3. This table provides the front-end activity identified in the literature, a limitation in the literature associated with this activity, relevant findings from the Defence case study and the implications of these findings for project management practice.

## 3.7 Conclusion

The project front-end is considered unclear or 'fuzzy'. Little is known within the project management literature and bodies of knowledge about the process organisations should follow to achieve the objectives of the front-end. To respond to this gap in the literature, we conducted a qualitative investigation using document analysis into what is widely considered to be an advanced and effective project front-end practice – the front-end of Defence's capability development lifecycle. We used a hypothetical case study to present our findings, and then compared the Defence project front-end with the project management literature to enhance research knowledge in this area. Finally, we explored common paradoxes associated with the front-end phase and considered how the Defence project front-end process may contribute towards the resolution of these paradoxes.

Our research contributes to project management practice by enriching and extending the front-end phase with important insights from Defence. Specifically, the implications are for project management practitioners, assisting them to construct an effective front-end phase that will facilitate the achievement of front-end objectives. Implications are also for the literature and practice in providing suggestions as to how common front-end paradoxes

*Table 3.3* Implications for project management practice

| *Project Management Activity* | *Project Management Limitation* | *Defence Finding* | *Implication* Organisations could consider … |
|---|---|---|---|
| Activity 1. Project trigger identification | A formal framework for qualifying the impact posed by a change in the environment to an organisation could not be found | Defence uses the Australian Defence Force Risk Framework to develop risk statements for each relevant change identified in the environment | Developing a framework to qualify the impact to the organisation associated with each project trigger identified in the environment |
| | There is a tendency to focus on threats and problems rather than opportunities when identifying project triggers | Defence considers the impact of all changes in the environment and assesses their potential impact – both positive and negative | Placing greater emphasis on opportunities within the project environment as a trigger for projects. |
| | The implications of an imposed project that does not align with an organisation's strategy are not well understood | Defence situates its project within the context of its FIC and Force Packages. This enables Defence to understand the impact of a sub-optimal project | Situating projects within the larger organisational context to better and more quickly understand the implications of a project |
| Activity 2. Project idea generation | When generating project ideas there is a tendency to focus on new projects | Defence generates a range of project ideas in addition to adding new projects, including expanding an existing project, merging project(s), substituting one project for another or delaying a project | All of their project options in addition to new projects |
| | The literature does not explicate how project ideas are generated. | Defence follows a five-step process when developing and testing project options. | Following a five-step process to generate and test a project idea:<br>1. assess the environment,<br>2. conduct an impact assessment,<br>3. prioritise risks and opportunities,<br>4. generate project ideas and<br>5. test project ideas |

| | | | |
|---|---|---|---|
| Activity 3. Business case development | There is a tendency to evaluate a proposed project's merit in insolation without considering the broader organisational portfolio/s that the project will sit within | When testing a project option, Defence also tests different portfolio options to confirm the net positive impact | Testing the impact of a project option on the organisation's existing portfolio/s to confirm the net positive impact |
| | A project is often developed, tested and selected in isolation without considering all the input the project will require to operate | Defence considers all of the FIC elements, which are the resources and organisational enabling inputs required to enable the effective generation of a capability such as training, management, personnel, systems and industry | All of the resources and organisational enabling inputs required to enable the effective generation of a project |
| | During the front-end, the life of the project after completion or the realisation of benefits is often not factored into decision-making | Defence considers the entire project lifecycle (from the identification of a trigger through to disposal) when making decisions during the front-end | The entire project lifecycle when making decisions during the front-end |
| Activity 4. Business case appraisal | The front-end phase includes only one business case | Defence submits three business cases including an Initial Business Case (IBC) at Gate 1 and a Detailed Business Case (DBC) at Gate 2 | Submitting the project funder an initial business case to seek for a conceptual approval before investing resources in developing a detailed business case |
| | An independent, in-depth, quality assurance assessment of the project proposal prior to appraisal is rarely undertaken | The SMART buyer framework and contestability framework is used in Defence to conduct a rigorous, independent quality assurance assessment of each project proposal prior to submission at Gate 0, 1 and 2 | Obtaining an independent review of the project proposal prior to submission to assess its quality |

may be resolved. Finally, implications are for organisations, assisting them to achieve a competitive advantage through the generation of better project ideas than their rivals.

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# 4 Undertaking the project front-end

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## 4.1 Introduction

Over the last two decades, several scholars have shown the critical importance of front-end activities for project success, but have also pointed to the irregular, intractable nature of these activities (Miller & Lessard 2001; Samset & Volden 2016a; Williams et al. 2019). The results raise doubts about the dominant prescriptive models for front-end activities, which depict them as a hierarchical sequence of rational decisions (e.g. Kerzner 2017). Similar prescriptions have already been implemented in the governance frameworks of countries such as Norway and the UK, despite a lack of theoretical and empirical grounding, and limited ex post validation of underlying models (Ahlemann et al. 2013; Klakegg et al. 2008; O'Leary & Williams 2008; Volden 2018). Based on a process-based theoretical perspective, and using several empirical vignettes from projects currently being developed in Quebec (Canada), this chapter attempts to shed new light on the front-end difficulties of major projects. While we believe that prescriptive approaches provide an invaluable project analysis and development tool, we want to give those considering front-end activities an understanding of why these prescriptions are seldom implemented as intended. In particular, we present reasons for two of the paradoxes highlighted by Samset and Volden (2016a), in which time plays a subtle but crucial role. The first, 'the paradox of the significance of front-end management' (Paradox 2), contrasts the critical importance of the front-end with the limited resources dedicated to this stage of the project relative to the execution stage, while the second, 'the paradox of the opportunity space' (Paradox 4), deplores the selection of conceptual solutions without first systematically exploring the opportunity space.

In prescriptive models inspired by decision theory (Keeney et al. 1993; Savage 1972) and other general normative theories, such as rational systems design (Pahl & Beitz 2013; Suh 1998), front-end processes remain outside time, based on the implicit assumption that their own dynamics should not impact results. With these models, time is a concern only for the ability to foresee future evolutions, as longer term predictions are typically deemed more uncertain, and to account, for example through Bayesian probability

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updating, for incoming information, such as the results of drilling on a prospective site (Caron et al. 2016; Fye et al. 2013). With these exceptions, time should have no impact on front-end evaluation outcomes. The temporal unfolding of the process itself, for example its timing, duration or stoppages, should not affect results apart from the interval required for knowledge production activities and uncertain events to take place. Yet studies of megaprojects' front-end inspired by political science, including Bert van Wee's study in Chapter 6, suggest that the moment of, say, path announcement relative to the political calendar, especially in light of previous promises, may have a significant impact on decision-makers' assessments and choices. Moreover, announcements are events in themselves, which, contrary to what normative models suggest, make a difference in the world, and may change the perceived value of the project (Neelawala et al. 2015). But even stoppage periods, in which no activity is performed and no relevant events occur, seem to have a significant impact on the understanding and evaluation of projects (Dimitriou et al. 2013). The process itself appears to have its own temporal logics, beyond the time it takes to produce knowledge and to let relevant uncertainties play out.

To advance our understanding of front-end dynamics, as a process situated in time and having its own temporal logics, we combine the view of projects as a phased decision process (Samset & Volden 2016a) with a social practice perspective on the complex activities occurring in this front-end stage (Floricel et al. 2014). The latter perspective suggests that any seemingly stable feature of the world is achieved through many diverse and sustained efforts of the interested actors (Nicolini 2013). This means, for example, that a project in development is not just a solid best option waiting to be selected but a fragile, temporary outcome of multiple, often uncoordinated and perhaps contradictory efforts (Floricel & Piperca 2016). These efforts are themselves situated in time, and intertwined with multiple material and social processes, among which is the development of various objects, particularly of project representations (Nicolini 2013). Because prescriptive models put project representations at their core, particularly alternatives or solutions, assessments of their expected benefits and costs in various scenarios of future evolutions, as well as probability distributions over these possible outcomes, our analysis of the front-end process will focus on the temporally situated practices that develop and use representations of the future project, of its context and of its implementation.

## 4.2 On representations

From our perspective, a representation is a perceptual, conceptual and social construction that uses words, signs and drawings to refer to and relate in a particular way selected elements of the project and of the surrounding world (Floricel et al. 2011). For major projects, representations include a wide range of interrelated objects, such as pathway maps, concept descriptions, artistic

renderings, technical drawings, cost/benefit assessments, implementation plans, contracts, organisational charts, financial proformas and so on. Technical design scholars depict the process as the gradual cognitive construction of a representation of the objects to be executed (Visser 2006). The logic of this construction appears to favour an evolution from abstract and schematic forms, such as flowcharts to increasingly detailed and concrete depictions, such as 3D CAD drawings (Chandrasegaran et al. 2013). One way construction activities are situated in time is that advances rely upon and embed in their outputs the accumulating knowledge about the object and its context (Floricel et al. 2011). However, unlike rational prescriptions for systems design, and even more than bounded rationality models with their satisficing, a practice perspective considers that "processes are always 'emergent' and follow multiple logics" (Lanzara 1999, p. 335).

One logic refers to the temporal vagaries with which evidence comes to the attention of designers and to the improvisational, bricolage-like nature of representation construction. Because there is no rule for translating an abstract diagram into concrete forms, the process requires creative jumps which depend on what evidence seizes first and most forcefully, the individual and collective attention, which available concrete solutions capture the imagination at any given time, how ensembles fit together, and so on (Garud & Karnøe 2003; Miner et al. 2001). The practice view goes one step beyond the logics of knowledge production and its relation to representation construction by looking at representations as concretely captured on external supports, from paper to computer screens, as tools and even as front-end actors in their own right (Blomquist et al. 2010). The speed of representation construction, including the ability to integrate various perspectives, and also the ease of subsequent changes depends on the material nature and the affordances of these supports. Paper sketches and simple mock-ups are easier to build and give more flexibility for a broad solution exploration, while sophisticated technologies such as Building Information Modelling (BIM) require additional preparation, but enable a more precise evaluation of design decisions (Boland et al. 2007). Representations also differ in the potential to become focal points for individual cognition, integrating the inputs of participants with different disciplinary backgrounds (Ewenstein & Whyte 2009; Knorr Cetina 1997).

In addition, external representations are a key instrument for communicating about the project and eliciting assessments from decision-makers and stakeholders. But contrary to economic and political science models depicting these actors as rational and calculative, perhaps evaluating the project in light of alternative, political markets, practice-centred views consider a broader range of cognitive, emotional and social reactions triggered by representations (Floricel & Brunet 2019). Some properties of representations enable project misrepresentation, while reactions include the escalation of commitment (Winch 2013). Yet, while some reactions appear irrational in light of normative models, advances in neuroscience suggest, for example, that emotions are

essential in making effective decisions in a complex world (Hodgkinson & Healey 2011). In other words, the very possibility of cold, calculated decisions may be just another rational myth, and following this approach may even be counterproductive in some conditions. From this viewpoint, representations and the reactions they trigger may be an effective way to probe and decide on projects. Moreover, external representations may not only depict and help evaluate the project and its context, but by illuminating and constraining the project and the surrounding world in a particular way, they would also create a particular future (Comi & Whyte 2018). The material and visual turn in organisation science even suggests (Boxenbaum et al. 2018) that they inspire and enable actors in a non-trivial way to schedule activities, organise efforts and resource commitments and allocate responsibilities and risks.

This brief review suggests that representation construction has its own particular dynamics, influenced by multiple inherent temporal logics, and by tensions between production activities and representation uses, as well as between the evolving interests of various actors and organisations (Smith & Lewis 2011). Focusing on the construction of representations and their roles sheds new light on the dynamics of front-end, particularly on the forces that push towards *and* against engaging in and deepening the solution exploration and evaluation effort. In our view, a focus on representations from a practice perspective helps us to grasp why front-end activities are rarely a linear unfolding process, why they go through several stop-and-start periods or follow iterative sequences, and why 'project history' leaves a mixed legacy for implementation activities and the final project. The next section discusses four trade-offs that emerge around processes of representations construction, as seen from a practice perspective. Trade-offs are a privileged locus for studying paradoxes, and analysing them advances our understanding of the two front-end paradoxes mentioned at the start of this introduction. Each trade-off is illustrated by two vignettes (numbered one to eight) from the recently completed or ongoing front-end activities of major projects, all in the province of Quebec (Canada). Data were obtained from public publications, mainly project websites, newspapers and governmental publications. The chapter ends with lessons for those undertaking front-end activities and creating governance frameworks for major projects.

## 4.3 Four representation-based trade-offs in the front-end

Governance frameworks and organising practices recognise that developing a project representation is a gradual process, notably by tying in key decisions with respect to preliminary approval, full commitment and contractor selection to specific, increasingly higher percentages of completion of the project design and engineering. However, these prescriptions do not fully account for the fact that drawings and other project representations are also tools used in social practices as epistemic objects, symbolic artefacts, future-making tools and boundary objects. Considering these concurrent roles, representations

become an excellent way of studying the complexity of interactions in the project front-end, suggesting the following four trade-offs.

### *4.3.1 Knowing versus exploring trade-off*

This trade-off refers to the compromise between exploring a broad variety of opportunities, options and solutions, and producing reliable knowledge regarding the potential of each of these options. Knowledge production about a project is conditioned by its definition, which goes hand in hand with the elaboration of increasingly detailed representations of the project and its context. Without defining what objects the project intends to execute, exactly where, when and how, developers cannot produce the concrete knowledge needed for a precise and reliable evaluation of its perspectives. The lack of concrete knowledge forces evaluators to rely on generic knowledge from past similar projects, which only supports approximate evaluations, for example through parametric estimation methods (Karaca et al. 2020). The relation between representation development and knowledge production is also influenced by several other logics. Specific uncertainties requiring additional knowledge production – known unknowns, so to speak – only start to be understood specifically as the project gets defined; before producing a representation of the particular form, technical solution or implementation mode of a project, the issue is, rather, ambiguity (Floricel & Miller 2001; Pich et al. 2002). Project definition and representation progress as new knowledge about these uncertainties comes in (Morris 2013), but, in line with the practice view, the evolving project representation is an epistemic object, whose particular form conditions the specific ways in which participants with various disciplinary and organisational backgrounds integrate their knowledge, understand the project and identify areas for which incomplete knowledge requires additional studies and tests (Ewenstein & Whyte 2009). In turn, representation production processes are temporally situated, emergent and improvisational, conditioned by the affordances of material supports, arbitrary bursts of creativity, by the length of gestation periods for reconceptualisation, and the particular sequence of serendipitous encounters with actors, ideas, information, concrete forms and so on. While the project representation may go through several iterations, some of which bring significant changes, the process is also increasingly path dependent, as understanding and debates centre more and more around one core project option (Hellström et al. 2013). Accumulated concrete knowledge is generally bound to a specific solution for which it was produced and cannot be redeployed for evaluating alternative solutions.

This trade-off provides a direct account for Paradox 4, namely, selecting a conceptual solution without a systematic exploration of the opportunity space. This space does not sit out there waiting to be explored; in addition to imagining opportunities, in itself a serendipitous process, concrete representations have to be carefully and painstakingly built for every opportunity

that is seriously considered. Without a representation that reveals unknowns and complexities and guides specific knowledge production, evaluations are highly uncertain. Also, the produced knowledge is solution-specific. Therefore, any additional option considering calls to restart the representation and knowledge production processes means significant delays to investigate an opportunity whose value is very uncertain, given the scarce knowledge available about it. This trade-off also provides an indirect account for Paradox 2, namely, the low investment in the front-end relative to execution. Front-end actors may understand the tenuous nature of knowledge production processes, and its dependence on the emergent and temporally situated representation development process, which means that the eventually selected option may not be any better than others abandoned earlier. They also understand that deepening the front-end study and evaluation may be useless, as some uncertainties cannot be reduced prior to execution, for example prior to digging on a particular site, which may first require the acquisition of the respective rights which, in turn, may be conditioned by the approval of a project solution. Therefore, front-end decision-makers may prefer to quickly select a solution based on 'secondary' factors such as political attractiveness and regulatory compliance, and then make sure it is developed and implemented in the best possible way (Doloi 2011). This way of acting may be particularly attractive in conditions of project complexity and pressure to accelerate project delivery.

### Vignette 1: A swift decision-making process on reusing existent infrastructure

The first vignette refers to the first phase of a major urban public transportation system project, which aims to give Montrealers modern, rapid and accessible public transport: the Réseau Express Métropolitain (REM). This automated light rail system (the first one in Quebec), 67 kilometres long, with 26 stations, links the downtown, the airport and the Greater Montreal area. New lines complement and are integrated with the existing transportation systems as well as with sustainable mobility partners. At the moment of writing, the estimated cost is 6.3 billion CAD (700 million over the initial estimation). Feasibility studies were initiated in 2015, and construction started in 2018. Progressive opening is expected to begin in 2024 (two years later than the initial expected operation date).

Outside the technical aspects, a major characteristic of this project is its financial model and governance approach (Schepper 2017). As in many other countries, infrastructure investments in Quebec have significantly increased over the last decades, mainly due to ageing infrastructures and fundamental changes in society. After the PPP

experiments, the Quebec Government (as many other governments) was searching for alternative financial solutions, allowing private funds to contribute to the renewal and construction of new public infrastructures in conjunction with public interests. In this context, the Caisse de Dépôt et Placement du Québec – Infra (CDPQ Infra) was created in 2017 by a special law in Quebec legislation (Gouvernement du Québec 2017a). The realisation mode was defined as an innovative model based on the direct involvement of CDPQ Infra in all phases of the project, from the initial idea to the operation, and not only as a funding partner: "CDPQ Infra acts as a principal contractor for major infrastructure projects. We are responsible for all phases of a project: planning, financing, execution and operation" (CDPQ Infra 2021).

We found in the design phase of this project a good illustration of the trade-off to be made between knowing and exploring regarding the selection of path for the light rail section linking downtown to a north-west suburb, Deux-Montagnes. The design team quickly zoomed in on reusing existing infrastructure, mainly because this avoided politically sensitive expropriation, but also because it suited its strategy to accelerate the delivery of infrastructure.

Interestingly, this section of the line includes a 100-year-old tunnel under the Mont-Royal. The tunnel was constructed between 1912 and 1918, and was highly innovative at the time. The tunnel is two-way, approximatively 5 kilometres long and 180 metres deep. It was the property of the national train company, the Canadian National (Ville de Montréal 2021) and, as of May 2020, was used for passengers only from the north-east and north-west suburbs to downtown Montreal. A well-known problem with the existing tunnel is its uniquely small ventilation chimney (Montréal 2021). This is the reason why only electric locomotives were used in the tunnel. It is not surprising that part of the REM project included tunnel modernisation.

This solution of reusing existing infrastructures has three major impacts. First, it prevents thousands of passengers commuting every day between home and work. The service stopped in May 2020 and is planned to reopen with the REM in 2024. Meanwhile, a bus service has been put in place, with a much longer travelling time (BAPE 2016).

Second, there are security impacts (REM 2020). An explosion occurred only a few weeks after work started in the tunnel: old explosives from the time the tunnel was built were probably touched and exploded. Also, intrusive inspections revealed that the structural degradation of the tunnel was much more significant than anticipated due to the use of de-icing salt in a street above it. Salt infiltrations, year after year, due to waterproofing problems, have corroded the tunnel vault. At this point, several options were identified to correct the situation,

both for the tunnel and for the street infrastructure. The works will be realised from the interior of the tunnel to minimise the impacts on circulation.

Finally, the agreement signed between the government and CDPQ Infra confirmed the exclusive utilisation of this section of the line by CDPQ Infra which prevents other opportunities (ARTM 2018) such as the mooted highspeed train between Montreal and Quebec City, which is now almost impossible (Schepper 2017). Yet the impact will have long-term consequences on transportation development.

In this case, despite daily impacts on thousands of users in the short term, and the longer-term impact on future opportunities, the 'knowing' part of this trade-off clearly prevailed over the exploration part. Indeed, project definition and representation development moved swiftly to knowing without investing effort and resources to explore alternative representations of the project (Paradox 2) as confirmed in the environmental assessment: "The promoter did not perform a comparative assessment of various options allowing to improve services on the Deux-Montagnes suburban train line" (BAPE 2016, p. 9). The opportunity space was not systematically explored as the choice of reusing the existing infrastructure was made, resulting in a firm solid representation that will be difficult to change or adapt (Paradox 4).

### Vignette 2: The invisible nature of the underground infrastructure

Contrary to the first vignette, where a rapid convergence towards a solution leads to a rather positive result (as of now) in terms of advancing through the front-end towards execution, this second vignette describes a major problem that occurred with a municipal sewage collector dating back to 1930, right after site preparation works (Bisson 2014). This situation led to a two-year delay in completion and cost overrun of 60 million CAD.

Turcot Interchange constitutes a central mobility node in the Montreal area, used by 300,000 vehicles a day (Gouvernement du Québec 2021). The new infrastructure replaces the previous one, built in the 1960s, and described as an immense road spaghetti squeezed between train tracks, the St. Lawrence River (Canal Lachine) and residential areas. The new infrastructure includes four interchanges, three bridges, 145 kilometres of roads, 31.5 hectares of new green surface and 8.1 kilometres of cycle paths (Gouvernement du Québec 2021). One major challenge for the project has been maintaining traffic while constructing the new infrastructure and demolishing the old one. At the time

of writing this chapter, the project is almost completed, at a total cost of 3.67 billion CAD. The project included two phases. The first one, identified as a preparation phase and representing approximatively 20% of the overall budget, aimed to fix the underground infrastructure to facilitate the core work of the next phase. This phase was initially planned to run from 2010 to 2015, but was finalised only in 2019 (due to the problem with the sewage collector), with major impacts on the schedule and on the overall realisation strategy. Indeed, the second phase, which includes the main work on the interchange, was initially planned to follow sequentially the first one.

The situation of interest to illustrate the knowing versus exploring trade-off concerns the condition of the major wastewater collector. The collector is part of the city wastewater network, and is situated at 30 metres under an overpass which has to be demolished and rebuilt as part of phase 1. (Gouvernement du Québec 2015). In the design phase of the project, information from the city stated a fair condition for this collector. The only way to obtain accurate and reliable information would have been to get into the collector, which was not possible before starting the physical work. Moreover, there was no reason to doubt the condition of the collector. So, in the development phase, the search for new knowledge was held back by a seemingly certain representation of the project based on information from the city, and by the absence of collector deterioration signals (weak or otherwise). So, design and planning continued without seeking additional knowledge. The second phase of the project was planned to start immediately after ending the first phase. Hence any delay in the first phase translated automatically into a delay in the second phase. To add to the complexity, the types of contracts were quite different between the two phases, to address different markets. In the first phase, multiple conventional contracts were given to several local contractors following the usual bidding process. The specific contract for the overpass was attributed within the first phase at the end of 2013, for a start in April 2014. Conversely, in the second phase, only large consortiums submitted proposals for a contract of 1.6 billion CAD, attributed in December 2014.

Only in 2013, when preparation works physically began on the site, giving access to the collector, did the problem come to light. A significant crack was observed on the collector. The ministry decided against starting the demolition of the overpass and causing more damage to the collector. Different options were analysed to either repair or deviate the collector. By September 2014, the decision had not yet been made, and with the winter coming, repairing or deviating would have been impossible, leading to an additional delay of almost a year (Bisson 2014). This had impacts on the local population, as the works were announced and reported three times. Finally in 2015, the ministry made

the decision to deviate the collector for about 1 kilometre. This required complex works, including the use of a tunnel boring machine (Gouvernement du Québec 2015). The work on deviation effectively began in March 2015, and only in summer 2016 could the demolition and reconstruction of the overpass be started, two years later than initially planned (Bisson 2015; Gouvernement du Québec 2016). The additional 60 million CAD for the deviation of the collector included 10 million CAD in contractor compensation for delays.

In this case, for experts at the Quebec Ministry of Transport, the representation of this overpass had been clear enough with the available knowledge, and they had not seen a need for more exploration. Further exploration on the collector would have taken more time and added costs to the development phase, because of the difficult access to the collector. Moreover, the representation of this overpass included a strong artistic aspect: the new infrastructure was expected to be 'emblematic' of Montreal, with a cable-stayed bridge and high central mast, illuminated and recognisable for miles around (Bisson 2014). So, the attention of the experts might have been too focused on the visible part of the infrastructure which is attractive to the population, rather than on the problematic invisible infrastructure underground.

In this vignette, what is of interest to the knowing versus exploring trade-off is that exploring an invisible infrastructure such as the sewage collector was not needed to form the project representation: the knowledge provided by the city was judged as sufficient. Conversely, exploration took place on other elements of the project, such as the emblematic cable-stayed bridge, which was strongly visible. Consequently, representation of such an aesthetic element took importance over the invisible collector. Overall, exploration was not performed at the same level and with the same intensity for all project components and at all stages of the project. Instead, there were variations depending, up to a certain point, on the strength of their representation.

### *4.3.2 Pluralism versus support trade-off*

This trade-off refers to the compromise between allowing the broadest possible pluralistic front-end scrutiny to ensure that no aspect, interest and opinion is not taken into account, and maintaining the interest of core project supporters. A megaproject is a social and political endeavour as much as, or even more than a technical one. Undertaking the front-end is like crossing some sort of invisible boundary to enter a social arena in which project development and governance are submitted to close scrutiny. Best practice advises thoroughly investigating the needs of project users, and seeking feedback from the broadest possible range of stakeholders. Many such

recommendations have been included in regulatory frameworks, for example in the form of mandatory public hearings. But the social arena is a very different world from that of technical and economic evaluation, in which multiple stakeholders with pluralistic perspectives and competing interests create their own kind of uncertainty and complexity (Denis et al. 2007). While this scrutiny may prevent the emergence of acceptability issues in the later stages, the flurry of queries, suspicions, doubts and requests may be so intense that sponsors may have to bid farewell to their early visions. A new project representation will emerge and will be redefined as the front-end progresses (Cha et al. 2018; Morris 2013; Williams 2005). Moreover, several studies suggest that opening the project definition to a broader range of influences reduces its execution performance (Floricel et al. 2011) and results in a larger number of benefit-sharing and compensation claims (Gil & Pinto 2018).

The changing project concept and diminishing gain perspectives may turn away some early supporters. Similar concerns stem from the logics of externalising project representations. Best practice advises using various supports, such as material mock-ups and increasingly online, virtual and enhanced reality platforms to consult and even co-define the project with users and stakeholders. But once they are put out in the social arena, project representations become symbolic artefacts (Floricel & Brunet 2019). They acquire a life of their own, difficult to control by their creators, as concrete embodiments of stakeholder expectations and implicit covenants with project sponsors. A variety of interpretations accrue to them, which stakeholders manipulate to advance their own interests, using mass media to amplify their social and political impact. This has a direct impact on front-end dynamics. In addition to assessing, the earlier the better, whether a solution is socially acceptable, developing and releasing project representations signals commitment to a specific solution and helps rally a coalition of stakeholders that support this solution. But the same representations also provide a target for competing interests and ideologically inspired opposition. Therefore, sponsors may hesitate to unveil them or may tie their publication to certain dates or windows in the political calendar. They may also hesitate to develop and release more detailed representations because earlier, more ambiguous ones may look attractive to a broader audience. Any refinement of the project representation, for example defining the exact position of a transportation infrastructure or of a high voltage line may show some stakeholders that the project will directly touch their vital interests, and may trigger organised and even violent opposition.

This trade-off suggests explanations for both paradoxes addressed in this chapter. Presenting too many alternatives and evoking the possibility of multiple other opportunities may prevent the rallying of supporters around one option and may offer arguments for those opposing the project. Proactively developing detailed representations or presenting them at an inappropriate time is also likely to have a negative impact compared to a strategy of maintaining a degree of ambiguity until implementation begins.

**Vignette 3: The memory of a material representation**

This vignette builds on the Turcot Interchange project. The situation concerns an early mock-up representation for the interchange that featured a particular element. This representation was submitted to public scrutiny and was favourably received. But the element disappeared in the later representations because a change in concept rendered it useless. However, public expectations regarding the project continued to include this element, and so the presentation of the new version, without the element triggered an uproar.

The Turcot Interchange project was an example of the will to inform and listen to local citizens and communities. They put in place a communication website where up-to-date information was posted. They also organised regular meetings with citizens to answer their questions, and accepted being challenged at times. The existing Turcot Interchange was an ugly (but unavoidable) infrastructure for road transportation only. The intention behind the new project was not to replicate the actual infrastructure – just the contrary. The global approach was to adopt a modern view on this sort of unavoidable infrastructure in an ecosystemic understanding of its environment and sustainability. The project was seen as an opportunity to offer citizens a project to celebrate 'Montreal colors' (Gouvernement du Québec 2010), including public transportation, cyclists and pedestrians. In line with this approach, the 'Dalle-Parc' was included in the project. Dalle-Parc is a large overpass covered by vegetation for pedestrians and cyclists. Moreover, it creates a link between different neighbourhoods which are otherwise difficult to connect, and gives access to a green space and landscape. The Dalle-Parc represents a budget of 40 million CAD, approximatively 1% of the total budget for the Turcot Interchange project (CREMTL 2018).

Back in June 2009, a mock-up of the whole Turcot Interchange, including the Dalle-Parc was presented to the public in the Turcot neighbourhood and was made available for visiting (MTQ 2009) as well as accessing a numeric version included in the project plan in 2010. In terms of representation, the visualisation contributed to making the Dalle-Parc very realistic, although some referred to these representations as illusion! (Baillargeon 2010).

Afterwards, a long silence followed on the Dalle-Parc, and around 2015, some alarms were sounded when it was realised that it had suddenly disappeared from the plan (e.g. Champagne 2015). Questions were addressed to the ministry to understand why such a decision had been taken. Interestingly, meanwhile, organisational changes had taken place within the project team and at the ministry. For example, a new project director arrived in 2014. With all these changes, it was difficult

to trace back the rationale behind the decision-making on the Dalle-Parc at the ministry. A formal explanation reported that costs were the primary reason. Mobilisation of the population became strong enough to put pressure on the ministry: 6,562 signatures were obtained on a petition to get the Dalle-Parc back into the Turcot Interchange project (Le Devoir 2017). In June 2018, the ministry confirmed the reintroduction of the Dalle-Parc.

In this case, the trade-off between pluralism and support turned around a material representation, which became a unique social representation of what the Turcot Interchange project should be for the vast majority of stakeholders, such as citizens in neighbouring areas, cyclists, communities, environmentalists, Montreal City Hall and so on. The initial representation was left unchanged, while in parallel, the project evolved as another representation within the ministry. Support and engagement towards a solution without the Dalle-Parc became less possible. Hence the ministry agreed to reintroduce the Dalle-Parc (and to add a new budget for it) to gain support from a variety of stakeholders. From then on, a common representation of the project returned.

### Vignette 4: When the freedom of individual cars is put into question

This vignette reports a situation in which, among other battles surrounding the representations for a Quebec City public transportation system, environmentalist groups opposed the publication of an unfavourable public hearings report, fearing that it would jeopardise a project that could contribute to reducing greenhouse gas emissions. The report was eventually published, rejecting the solution proposed initially and triggering a reduction in project scope.

The cost of this structuring of the public transportation system in Quebec City is estimated at 3.3 billion CAD. Its development phase has given rise to multiple and divergent voices. The core of the transportation project is composed of streetcar (tramway) lines. Contrary to the first vignette, it was not a material representation of the streetcar which started and fuelled the controversy; it was, rather, the representation of the freedom associated with the use of individual car transportation: one might argue that Quebec City is a paradise for the individual car. The old part of the city is beautiful, and rich in patrimonial XVII Century buildings. Quebec City is also where the provincial government has its official offices. The population of the city is nearly 600,000 inhabitants compared with approximately 200,000 in the suburbs which have developed around the city (Ville de Québec 2021). Back in the

1950s and over time, several large avenues and highways were built to facilitate traffic circulation between the centre and suburbs. As in any cities, greater access resulted in more cars, nurturing a well-known vicious circle. In this context, it is not surprising that public transportation is rather limited, with poor bus services and a lack of connections between the different circuits (Ville de Québec 2021). Moreover, it causes tension between downtown residents, who push for more public transportation, and suburban residents, who push for more investment in road access. In other words, a conflict exists between environmentalists and proponents of individual cars.

With the economic and demographic growth (pre-pandemic), the situation had become unsustainable. Around, 75% of daily motorised trips at peak hours are done by car (Ville de Québec 2021). The city cannot build more and more roads downtown and break the historic profile of Quebec City. In this context, in 2010, the Mayor of Quebec initially proposed the idea of a public transportation project identified as the 'Public Transportation Structuring Network', in which the main component was a streetcar, well integrated within the overall transportation system in Quebec City. Since then, the project concept has wavered continually between including, or not, a streetcar, serving, or not, the suburbs, and so on. These fluctuations were dubbed a saga by Martin and Moala (2021). On top of this, a change of the party in power at the provincial government level stopped the support the project had enjoyed from the previous party in government. The culminating point (as of now) was the publication of the unfavourable public hearings report in 2020. The hearings followed an anti-streetcar manifestation (Béland 2020). In short, the prime ministry imposed its own view on the project, including a streetcar serving the suburbs.

This vignette illustrates the difficulty of managing the pluralism of perspectives on a project such as this one, while maintaining the support and engagement of crucial stakeholders. Overall, the project is still going on, but has had to face several oscillations and changes. Here, multiple oppositions exist among different groups. The most important challenge concerns the suburban residents who are resistant to abandoning their individual vehicles, and in so doing, are in opposition to the residents of the central city. With the change of party at a regional level, support for the project declined to a point that the prime minister took over the decision-making from the mayor of Quebec City. At the moment of writing this chapter, the story is probably not finished. As suggested in Paradox 2, there are consequent efforts and resources put in the front-end; knowledge is produced in a sort of back-and-forth process when solutions change and evolve. In doing so, the opportunity space is explored as different sets of stakeholders manifest themselves, describing a rather non-linear process.

### *4.3.3 Evaluating versus shaping trade-off*

This trade-off refers to the compromise between the efforts dedicated to produce a diligent, detailed evaluation of project solutions and perspectives, and the efforts committed to leveraging a particular solution in order to shape the future. Efforts dedicated to evaluation assume that the world has a given structure, and that additional knowledge production efforts can produce a more precise estimate of the benefits various solutions are likely to achieve in this world, and therefore would enable the selection of the best solution. On the other hand, shaping strategies assumes a fluid world, in which project outcomes depend to a large degree on sponsors' efforts to structure the context in ways that favour any solution that happens to be selected. Prescriptive models and practices are mostly on the side of evaluation diligence, particularly in public projects where it expresses fiscal responsibility. But even with producing the most thorough knowledge and the most detailed and impartial representations of the project and its environment, benefits and cost are still uncertain (Flyvbjerg et al. 2004).

As mentioned above, uncertainty may persist until digging and construction is well under way, because drilling and tests give only partial information on soil conditions and material properties, while mock-ups or digital representations do not provide stakeholders with sufficiently realistic grounds to assess the usability and usefulness of the project. More importantly, complexity and the unexpected problems and events it causes are inevitable in major projects (Floricel et al. 2016). So, projects are bound to confront the unknown and the unexpected (Loch et al. 2006; Piperca & Floricel 2012), and even the strongest knowledge production effort and most careful ex ante exploration, representation and comparison of alternatives cannot guarantee that the best option has been selected. So, instead of emphasising endless evaluation, which evokes a passive attitude that takes the surrounding world as given, project sponsors focus on shaping the world around them and making the project a compulsory passage point towards this future (Callon 1986). Instead of reflecting a given future, project representations become a future-making tool, involved in practices of "imagining, testing, stabilising and reifying, through which abstract imaginings of the future are turned into a realisable course of action" (Comi & Whyte 2018, p. 1955). Practices such as framing, rhetorically manipulating and promoting project representations transform these into roadmaps that induce and prepare people to change their life-paths and habits in ways that ensure the success of the future.

This trade-off also helps to account for both paradoxes addressed in this chapter. The relatively low investment in front-end activities suggests that sponsors may realise that endless debates over alternatives and evaluative refinements do not guarantee better choices and projects, but focus instead on preparing the conditions for successful implementation and stronger impact for the selected solution. As evidence for this trend, we can mention the idea of projects meant to have a structuring effect on the urban tissue, and the call to include much broader indirect economic and social effects in the

evaluation of their benefits (Prager 2019), which means that almost any project can be justified. This trade-off also elucidates the paradox of the limited exploration of opportunities. From a shaping perspective, a rapid selection and even lock-in on a solution, instead of being undesirable because the solution is possibly suboptimal, may in fact be desirable because it facilitates the structuring effect on the urban tissue and living patterns (Levin et al. 2012). Two vignettes will illustrate this trade-off.

**Vignette 5: A law to introduce an innovative governance framework and to avoid the usual governance practices**

We described above in Vignette 1 the rapid convergence on a path that largely reused existing infrastructure for the already mentioned REM in Montreal. This rapid convergence was only made possible by a series of efforts to impose this solution and remove any possible obstacles to its rapid execution. These efforts included a law giving special powers to project sponsors and the creation of special organisational structures to ensure the probity of contractors in the selection process and that a sufficient number of bidders would participate in the process.

Since 2008, and updated in 2010 and 2014, the Government of Quebec has adopted a governance framework for its major public infrastructures (Samset et al. 2016). The management of major infrastructure projects (over 50 million CAD) falls under the Law for Public Infrastructure (Gouvernement du Québec 2013) and must follow the requirements at each step of the framework as documented in the directive (Gouvernement du Québec 2016). However, the Law for Public Infrastructure leaves room for exceptions made by the government. This is what happened in the case of the REM.

The REM project opened for Quebec a new approach to financing and governing major public infrastructure investments. A new company was created by law (Gouvernement du Québec 2017a) as a subsidiary of the Caisse de Dépôt et Placement du Québec (CDPQ) which is responsible for the management and growth of the universal retirement Quebec pension plan (CDPQ 2021). The new subsidiary company name was CDPQ Infra. With this project, private (or quasi-private) money serves to develop, construct and operate the new infrastructure, not exactly as a PPP, but in an innovative governance approach, as the ownership of the infrastructure is kept under CDPQ Infra (CDPQ Infra 2021). In the commercial agreement with the Government of Quebec and l'Autorité Régionale de Transport Métropolitain (ARTM), CDPQ Infra has the monopoly on public transportation by tramway or light rail in the metropolitan area for 99 years (ARTM 2018).

With the special law, CDPQ Infra is allowed to manage the REM project outside the governance framework for major public infrastructure projects. The usual rules for bidders do not apply. Instead, specific governance structures and directives to protect confidential information have been put in place at CDPQ Infra for the selection process (CDPQ Infra 2018). These include the creation of an independent committee on the probity and integrity of the process, evaluation committees made up of experts, and a selection committee made up of three experts to select bidders, based on the recommendations of the evaluation committees.

As illustrated above in the first vignette, for the design team at CDPQ Infra, maximising the use of existing infrastructures dramatically accelerated the whole project despite criticism on its negative impacts. In this trade-off, we want to highlight specifically how a series of decisions and practices have imposed this solution, and at the same time, removed obstacles to rapid execution. The first aspect refers to the governance structure adopted by law, with the creation of the CDPQ Infra given complete independence in their approach to the management of the project. With the exception of environmental regulation (BAPE), there is no compulsory governance framework to follow. Moreover, in the commercial agreement, the Government of Quebec and the ARTM granted to CDPQ Infra a monopoly on collective transportation via tramway or light railway in the metropolitan area. This latter agreement removes any further discussion on reusing the existing infrastructure.

A second aspect of this project, aiming to accelerate the convergence towards solutions, is the contractual process. Current procedures for public contracts impose a strict procedure in order to minimise contractor fraud and collusion. This strict approach is recognised as being lengthy and bureaucratic, not encouraging a climate of confidence, and blocking contractors' attempts to innovate. The special law, 2017, c17 (Gouvernement du Québec 2017a) allows CDPQ Infra to use different procurement and contractual arrangements. The full bidding process required the consortiums to obtain a qualification before submitting their proposal. The project scope was split into two different calls for proposals: (1) EPC: infrastructure, procurement and construction, and (2) RSSOM: provision of rolling stock, systems, and operation and maintenance services (CDPQ Infra 2017). After the launch of the call for proposals to qualified consortiums, several delays occurred. The first delay occurred when the period for submitting a proposal was extended in order to give a chance for all qualified consortiums to submit. Five proposals were received, two on the former call for tenders, and three on the latter. When proposals received for the EPC package tender were analysed, CDPQ Infra was dissatisfied because costs were

significantly higher than expected. So, a second delay occurred when CDPQ Infra decided to engage in intensive discussions with the two consortiums to work out a better quality/price equilibrium. In fact, the decision was announced publicly a few weeks later. In total, it took almost two years between the announcement of this project in 2016 and the start of construction in April 2018.

In conclusion, from this vignette, one can observe the success in accelerating project delivery by making a rapid decision towards the solution of reuse of the existing infrastructure. Other options were identified, but not studied in detail. Instead of putting effort into the evaluation of options at the development phase (and developing knowledge from these evaluations), the rapid decision was able to shape the project by leveraging the use of existing infrastructure and interacting with contractors (developing knowledge from this shaping process). This vignette highlights specifically the role of politics and governance organisation in the shaping process. Without such mechanisms, it is doubtful that a swift convergence toward a single solution can be reached.

### Vignette 6: A lack of competency in estimation leads to hesitation

The second vignette illustrates the case of a major tunnel refurbishment project in Montreal, in which only two of the pre-qualified consortia submitted offers. Of these, one withdrew during the evaluation process and the second made an offer that was significantly above the available budget. The first reaction was to postpone the project and organise a second call for bids. However, the Covid context and a report by the Auditor General of Quebec, criticising the persistent inability of the responsible ministry to develop and evaluate projects rapidly led to a reversal of this decision and the award of a contract for a newly negotiated price to the remaining consortium.

The case illustrated in this vignette offers an opposite pattern to the previous vignette: the Ministry of Transport stopped the evaluation process (in the bidding process) based on the fact that there was no competition in the market. The sponsor was ready to pursue the evaluation process in a new bidding cycle.

This project concerned the refurbishment of a tunnel under the St Lawrence River, the Louis-Hippolyte-La Fontaine Tunnel (LHLT). Montreal is an island, with several bridges to link it to the north and south shores, but LHLT is the only tunnel in Montreal, and in Quebec.

Consequently, local expertise in tunnels is rather sparse. The tunnel was built in 1967 for the Montreal Universal Exposition. It is a major road link not only for Montreal but for the whole of Quebec and Canada, for people and goods transiting to the United States. The full infrastructure includes an underwater tunnel, 1.5 kilometres long and a bridge 457 metres long.

Since 2009, normal maintenance works in and around the tunnel, as well as water infrastructure and fire resistance tests signalled the need to undertake serious refurbishment of the infrastructure. The project scope was discussed with a wide variety of stakeholders, producing two main debates: (1) postponing this project for better coordination with other major infrastructure projects going on in Montreal to minimise the consequences in terms of deviations and travel time, and (2) moving away from a narrow view of this project of refurbishment of the same infrastructure towards a long-term perspective on sustainable mobility, including public transportation and active mobility. Finally, the optimal solution, and a design-build-finance execution mode was approved and presented by the ministry in June 2017 (Gouvernement du Québec 2017b). A request for interest was launched in June 2018, from which two qualified consortiums were retained. They both confirmed their participation in the call for proposals. Two technical propositions were received in due time, in February 2020. However, only one consortium submitted a financial proposition by March 2020 (Le Fort 2020), the other having withdrawn from the bidding process.

This was a turning point in the selection process. A single proposition was to be examined, but its price was largely over the planned ministry budget. This situation coincided with the onset of the pandemic, which created fear and uncertainty. The option of delaying the project was now in the air (Bovet 2020). Moreover, the report of the Auditor General came out in June 2020. This report scrutinised the contractual process at the Ministry of Transportation and found a serious lack of expertise in cost estimation (VG 2020). The market context, characterised by recruitment difficulties, amplified the disconnect between the cost estimate that served as a basis for the call for proposals and the reality of the market.

Following this report, the ministry decided to continue with the project of refurbishment. Two additional rounds of negotiations occurred with the sole consortium remaining in the process, before reaching agreement on a cost of 1.1 billion CAD. In June 2020, the consortium was officially selected (MTQ 2020), with virtual meetings organised for the signing of the contract in July 2020 (Le Fort 2020; MTQ 2020).

With regard to the selecting versus shaping trade-off, this case made a point of ending the evaluation by avoiding entering into a second

biding cycle; conversely, negotiations with the consortium leveraged the solution in order to shape the project. The ministry would have easily entered into this new cycle, for reasons of consortium withdrawal, costs in excess of the budget, and uncertainty due to the pandemic. However, the Auditor General report and the precarious condition of the tunnel favoured the signature of the contract.

#### *4.3.4 Allocation versus collaboration trade-off*

This trade-off refers to the compromise between the efforts to develop a representation able to unambiguously allocate responsibilities and risks between participants and the efforts to create conditions for a collaborative elaboration and implementation of the project from its earlier stages. From an allocation perspective, inspired by the prescriptions of agency theory, front-end practices elaborating detailed project representations are seen as the key to an effective transfer of responsibilities from sponsors or clients to contractors. Project representations become boundary objects (Carlile 2002; Chang et al. 2013) which delimit the respective responsibilities and risks of project participants and allow contractors to evaluate whether they should submit a bid and for what price. In the case of design-build and related forms, these representations, somewhat less detailed, become the main interface between owners and execution (and sometimes operation) consortiums, while in traditional design-bid-build mode, they are also a tool for allocating responsibilities and risks between contractors. Prescriptive models suggest that putting more effort into elaborating project representations helps clients, particularly public authorities, to limit their exposure to project cost increases and overruns, and enables selection based on the lowest price and reliance on fixed price contracts.

However, these practices have two shortcomings. The first is that the process of elaborating project representations is cut in two. The client, who brings an owner-operator perspective, aided by engineering experts, develops the representation up to the call for bids, and then contractors, who have manufacturing, construction and assembly competencies, take over from that point, with relatively little change and collaboration possible afterwards. However, a key finding of front-end studies is that, especially for complex systems, projects have higher performance and fewer conflicts during implementation if solutions emerge from the collaboration of participants with different perspectives, such as owners, engineering firms and contractors (Hobbs & Andersen 2001). The second problem with allocation approaches is the fact that reliance on detailed representations and the network of fixed-price contracts based on them creates a rigid structure that favours adversarial relations and precludes adequate responses to unexpected events (Floricel & Miller 2001). The reaction to these problems is the emergence of governance frameworks and contractual forms that favour collaboration and risk sharing

(Mesa et al. 2016). These forms place less emphasis on the early development of detailed representations and their boundary object role, as it is expected that representations will be elaborated collaboratively and that contracting will be essentially incomplete and relational (Davies et al. 2019). But putting together a group of partners with the necessary competencies, and connecting them by a multi-party contract, with joint responsibility for the entire project from beginning to end may require early selection and convergence on a conceptual solution. An early representation of the project solution is also needed in order to provide an epistemic object that will help mutual understanding and the integration of contributions from participants with different perspectives.

This trade-off also provides insights into both paradoxes addressed in this chapter. It may be too early to assume that the relatively low investment in front-end activities is due to the new governance and contractual forms which integrate what were typically seen as separate front-end activities with activities typically depicted as implementation. However, we can assume that such low investment may be due to the fact that project sponsors understand that no representation and contract, however elaborate, will allocate risks perfectly. Instead, additional resources will be needed in order to solve problems as they appear during implementation and react to other unexpected events. Likewise, the limited exploration of opportunities may be caused by the fact that, in the most common approaches, only one perspective – that of the owner-operator – dominates the exploration process. Moreover, in order to avoid excessive delays, the exploration of alternatives has to make way for the elaboration of a unique and rather complete representation that will serve as a basis for the contractual process. This trade-off will be illustrated by two further vignettes.

**Vignette 7: An innovative governance for collaboration**

We continue with the REM case. The REM adopted what CDPQ Infra calls an "innovative governance" which differed from the traditional approach (design-bid-build) or the PPP. In their approach, CDPQ Infra is the owner and the operator of the infrastructure (CDPQ Infra 2021) along with its partners. Partners are essential, as CDPQ Infra does not have the necessary capabilities in the domain of transportation, but a strict allocation of responsibilities might not be feasible. The adoption of a collaborative approach was illustrated in the bidding process.

When proposals were analysed in the case of the first tender for the EPC contract, CDPQ Infra was dissatisfied with the proposals received: costs were significantly higher than expected (Labbé & Robidas 2017). Despite the ensuing delay, CDPQ Infra decided to engage in intensive discussions with the two consortiums to come up with a best

equilibrium of quality/price, and the decision was announced publicly a few weeks later. The project representation evolved with the contribution of one or other consortium. Efforts put into the refinement of the solution with the consortiums could not have happened in an allocation perspective, where each contractual side works with what they think to be an unambiguous solution. Finally, the quality-cost equilibrium is better achieved via collaboration. Regarding Paradox 4 on exploring the opportunity space, this case illustrates how it can also happen in collaboration with partners around a specific solution.

**Vignette 8: The digital technologies associated with a collaborative design approach**

This vignette will discuss the attempt of the Society for Quebec Infrastructure (SQI), a government-owned organisation, to develop a front-end governance framework that would enable the collaborative development of major project solutions.

The SQI is a state-owned organisation which has the mandate to support 120 public organisms in the management of their public infrastructure projects, including planning, realisation and rigorous monitoring (SQI 2017). SQI assumes direct project management for all building infrastructures, but plays a quality assurance role in transportation projects. The SQI reports directly to the Treasury Council.

Over the last few years, the SQI has introduced innovative practices in relation to the digital transformation of the construction industry in Quebec. It is not a simple thing to transform an industry reputed to be a dinosaur in terms of productivity. Not only do digital technologies require specific competencies, but they also call for constant collaboration among stakeholders engaged in project design and construction. Collaboration is the key to success (Brunet & Forgues 2019). SQI has developed a Building Information Modelling (BIM) platform together with an integrated design process, and has engaged in a progressive implementation strategy by working closely with universities and industry (SQI 2021). In 2020 they were awarded the Best in Innovation Award over all categories at the Canada BIM Council (CanBIM 2020).

With digital solutions such as BIM, together with an integrated design process, the same representation of a project can be visualised and shared at the same time by several stakeholders in different spaces, as it evolves over time. This combined approach, along with a progressive implementation strategy, might ease the tensions created by allocation versus collaboration trade-off. Indeed, these practices reinforce investments in the front-end in the form of collective sense-making between owner-operators and contractors.

## 4.4 Some reflections and lessons learned

The trade-offs presented above were illustrated with vignettes describing current project situations. But what about new challenges anticipated in the future? In this section, we develop some reflections inspired from the above trade-offs to face the new (or simply different) paradoxical situations.

### *4.4.1 Thinking the front-end in the context of sustainability*

The quest for a more sustainable environment should reinforce the front-end process. One can observe that many countries do adopt sustainability law for their investments in infrastructure. In developed countries, laws are adopted to compel projects sponsors to follow the United Nations 17 goals to transform the world (United Nations 2021). For developing countries, multilateral development banks require complete documentation to be provided on project sustainability before engaging their funds. Moreover, some scholars have undertaken research to explore how to include sustainability assessment in the overall performance of programmes and projects (Martinsuo & Hoverfält 2018). The interest and will to engage in such a change seem to be there. However, consideration for sustainability calls for efforts and resources at the early stages of projects. Indeed, one of the main roles of the front-end is to make a clear assessment of why major investment is required at the proper strategic level. What is the problem to solve? In a sustainability approach, building no new infrastructure might be the 'best' option. It may involve 'deconstructing' a representation.

Thinking the front-end in the context of sustainability has a tight relationship with trade-off on knowing and exploring. Sustainability offers the opportunity to explore not only more options but *rich* options with the inclusion of social, economic and technology aspects.

### *4.4.2 Front-end governance to prepare for flexibility*

Even carefully worked out solutions encounter major obstacles, which need tactical efforts to deal with them. But obstacles agglomerate towards the end of the execution phase, as the project encounters 'real life'. Rather than endlessly refining the solution choice, which after such unexpected events may not look the best, front-end 'governance' has to put in place the conditions that allow responsive actions, which is rarely done in an explicit manner, and indicates the persistence of uncertainty. This point also includes the relational contractual arrangements.

Front-end governance to prepare for flexibility relates to trade-off on evaluating and shaping, and the trade-off on allocation and collaboration in contractual aspects such as relational contractual arrangements (Davies et al. 2016).

### *4.4.3 Innovative technologies*

The pluralism-support trade-off highlights the difficulty of engaging a variety of users and stakeholders by visualising a conceptual solution. Innovative technologies such as Building Information Modelling (BIM) offer a shared platform among dispersed actors. However, an unexploited advantage of these technologies may be the possibility to enable collaboration with stakeholders at the very early stage of a project (Brunet & Forgues 2019). Interestingly, technologies are not at the core of the innovation in infrastructure projects: collaboration among the plurality of stakeholders remains the major component. A collaborative approach such as the Integrated Project Delivery goes in a similar direction (Walker & Rowlinson 2019).

Yet the inclusion of innovative technologies in the front-end emphasises the relation with trade-off on pluralism and support.

### *4.4.4 Competencies to deal with paradoxical situations*

In pluralist situations, there is rarely a clear path towards the 'best' conceptual solution. In major projects, actors in situations of leadership in the front-end activities constantly play around with ambiguity and uncertainty. This human aspect is rarely addressed in the context of major projects.

This orientation on competencies to deal with paradoxical situations crosses all four mentioned trade-offs, as it refers to a general attitude to accept the two faces of reality and to advance the project in any way possible.

## 4.5 Conclusion

The aim of this chapter was to provide a sense of reality when undertaking the front-end in a major public project. The reality in the context of major public projects is rarely simple, given that these projects last for a long period of time and generally involve a plethora of stakeholders. So, the notion of paradox is excellent when talking about reality in this context: issues, tensions or conflicts are common in the course of front-end activities. This chapter addresses specifically Paradox 2, 'the significance of front-end management', where the critical importance of the front-end is contrasted against its limited resources, and Paradox 4, 'opportunity space', where the selection of conceptual solution is made without exploring the opportunity space (Samset & Volden 2016a). Yet major orientations and sensible decisions are at the core of the front-end activities. We rely on the notion of representation to anchor those paradoxical situations that we identified as trade-off. The structure of the chapter was built around four trade-offs where we followed the development of representations. Each trade-off was explained based on theoretical perspectives. Two vignettes, or short accounts, were provided for each trade-off. The vignettes were chosen for their potential to illustrate real situations occurring in front-end activities. Some reflections were then

offered to explore how those trade-offs might help when undertaking major public projects in the future.

There are some limits in our approach. While it is a good strategy to offer a variety of complex situations, it was not possible to enter into their complexity in depth. We hope that the chapter has covered some caveats identified in a recent review of the literature (Williams et al. 2019). In this period of pandemic, governments are planning to invest massively in major projects as a strategy to restart their economies. This strategy goes hand-in-hand with strategies for the acceleration of project delivery. Care should be taken not to return to the time of *bad* projects (Miller & Lessard 2001; Morris 2013). With the introduction of national governance frameworks in several countries over the last decade or so, we have learned to better manage major public projects (Samset et al. 2016). Other lessons are still to be explored.

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# 5 Estimation

*Richard J. Kirkham*

## 5.1 Introduction

Of the ten 'front-end' paradoxes characterised by Samset and Volden (2016), this chapter is concerned primarily with 'the cost estimation paradox' – that is, the focus on the final cost estimate (the budget), at the expense of early-cost estimates. We consider other paradoxes too, including 'the paradox of disregarded analyses of costs and benefits' and the ubiquitous 'success paradox' primarily through the lens of major public projects. A rich vein of academic scholarship and 'grey-literature' exists and provides a timely opportunity to critique the well-established 'lines of defence' governance and oversight arrangements that surround the delivery of high-risk projects and programmes in the UK (Vo et al. 2021).

The basis for the authorisation of funding public projects and programmes is a business case that demonstrates the benefits and disbenefits of the investment relative to costs, using 'social cost-benefit analysis' (SCBA) techniques – the appraisal of 'public value', as it is also known. SCBA is based on the principles of 'welfare economics' (Hicks 1939) and is concerned with overall social welfare efficiency rather than merely market efficiency (HM Treasury 2020). Public value therefore includes all substantial costs and benefits that affect the welfare of citizens as distinct from simple market consequences. The determination of costs and benefit elements according to the appraisal of social value requires varying degrees of estimation and forecasting which, by implication, introduce uncertainty, risk and complexity. The tendency for public projects to suffer from a predisposition to cost and time overruns has led to a rich vein of academic enquiry into causality, the literature pointing to a set of often deep-rooted and complex issues, including the genesis of the initial estimates of cost and duration against the agreed scope and strategic intent. We know that estimation takes place against a background of cost envelopes, contingencies (risk) and probabilistic methods, and as such, there will always be events which cannot be foreseen but which will nevertheless impact on a project and the long-term outcomes that it intends to deliver. The challenge of reconciling credible estimates with procurement routines which may favour the 'race to the bottom' remains an intractable problem, despite

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academic scholarship and legislative reform (e.g. Social Value Act 2012, Future Generations Act (Wales) 2015) that has attempted to promote a holistic, 'whole life cost' view of investment appraisal in major projects (Boussabaine & Kirkham 2004).

Allied to this, the treatment of risk and uncertainty in the context of estimating is often simplified through largely reductionist thinking and methods. Makridakis et al. (2019a) suggest that the "greatest challenge is to evaluate all risks, which are of very different underlying natures, and determine their overall influence to propose practical actions, both operational and strategic, that can minimise their total negative impact and exploit the available opportunities". However, doing so requires one not only to recognise the limitations of attempting to predict the future but also to be able to determine the uncertainty of such events materialising, assessing their specific impacts and temporal interactions, and ultimately determining how they will interact in the organizational setting. Thus, managing risk is a highly complex and sophisticated endeavour that relies on forecasting accuracy, which, in turn, determines the extent of the future uncertainty, and eventually influences risk. In the context of government projects, we know that political influence and churn are contributory factors to systemic risk and uncertainty (Bloomfield et al. 2019), and that parliamentary cycles will affect policy decisions and fiscal commitments to projects and programmes, and yet our ability to counter their negative effects is usually highly constrained.

We problematise the cost estimation paradox in the context of a well-established conundrum, that is, the naïve desire among some stakeholders for early (often unrealistic) commitments to time, cost and scope on the one hand, and the inevitability of low confidence in the achievement of those same metrics on the other. In this chapter, we explore the paradox through a series of 'interrelated problems', supplemented by six case studies – each intended to illustrate the challenges of cost estimating and forecasting in the context of the work of government across different project contexts and settings in the UK. These interrelated problems bear a similar resemblance to the findings of a 2016 study by Andersen, Samset and Welde – 'Low estimates–high stakes: Underestimation of costs at the front-end of projects', which concludes that "underestimation in the front-end phase was significant … and poses a serious problem in that suboptimal projects are approved". The study identifies underestimating risk, overestimating opportunities, inadequate estimation methods and skills, reliance on weak information, and strategic/deliberate scope creep and division of projects as antecedents to inaccurate cost and time estimates. Intriguingly, the results also evidence the problem of 'pet projects', these being characterised by unrealistic early estimates and 'disputable relevance'.

## 5.2 The search for certainty in an uncertain world

In his 1726 book, *The Political History of the Devil*, Daniel Defoe opined that "things as certain as death and taxes, can be more firmly believed" – a phrase

that is, perhaps, more commonly attributed to US 'founding father' and polymath, Benjamin Franklin, who, in November 1789, wrote to the French scientist Jean-Baptiste Le Roy on the matter of the ratification of the Constitution and the start of a new government:

> Our new Constitution is now established, everything seems to promise it will be durable; but, in this world, nothing is certain except death and taxes.

It is fair to say that human beings naturally find comfort in certainty, and some would argue that we are 'hard-wired' to seek it in an almost intuitive way. Thus, in the context of this book, an appreciation of the rich vein of literature on the psychology of risk is relevant since it may provide insights into why. The Nobel Prize-winning behavioural economist Daniel Kahneman in his influential book *Thinking, Fast and Slow* offers many fascinating insights into decision-making under conditions of risk and uncertainty by focusing on the impact of biases and how these influence and shape human decisions and behaviour.

Kahneman's earlier collaborations with Amos Tversky (see Kahneman & Tyversky 1979) in the field of risk psychology highlight the many important considerations in framing our understanding of how people and organizations make decisions in uncertain conditions. Despite the prevalence of modern advances in computational simulation, forecasting and planning software, it remains the case that humans are ultimately responsible for making decisions on projects and programmes: "the control of risks associated with human factors will affect project and portfolio success" (Merna & Al-Thani, 2005), and therefore we elaborate further the concept of 'risk psychology' in this section.

Risk taking "is any consciously or non-consciously controlled behaviour with a perceived uncertainty about its outcome, and/or about its possible benefits or costs for the physical, economic or psycho-social well-being of oneself or others" (Trimpop 1994). Individuals exhibit unique perceptions of risk, but are generally categorised as being risk averse, risk neutral or risk seeking. Risk management is shaped by the decisions that humans make, and thus our understanding of the way people think is crucial. Numerous theories in psychology and economics have sought to facilitate our understanding of human perceptions towards risk, including the well-known theory of games and prospect theory. The onset of the SARS-CoV2 global pandemic emphasised the importance of risk communication and how individual citizen behaviours are influenced by 'framing', the cognitive processes that establish problem boundaries in a decision-making situation. Tversky and Kahneman (1981) described how decision problems in which individuals systematically violate the requirements of consistency and coherence can be traced to the psychological principles that govern their perception of decision problems. An earlier study involving groups of students who were asked to estimate the speed of a vehicle in collision – but with a stimulus question that involved nuanced statements – revealed that stronger adjectives in the stimulus led to

higher average estimates of speed (Loftus & Palmer 1974). We also know that individuals tend to select inconsistent choices depending upon the framing of a question and in terms of concentration on losses or gains (Plous 1993). Additionally, bounded rationality is also an important concept to understand the complexity and lack of information which exist in the decision-making process. In general, traditional rationality demonstrates the assumption that the decision-maker understands the entire decision problem, including all possible plans of action and their consequences. Moreover, the decision-maker is assumed to possess well defined preferences over final outcomes, and therefore chooses optimally according to those preferences (Diasakos 2007; Gigerenzer & Selten 2002). For all but the simplest problems, making optimal choices arising from rationality requires extraordinary cognitive and computational abilities and resources. However, as problems become simpler, or resources (costs) are used to identify more information about the problems, the decision-making choices are more closely derived from rational decisions. Unfortunately, since the decisions regarding all aspects of problems are made by humans whose rationality is limited by the information they have, it becomes obvious that the decision-making process is likely sub-optimal.

Furthermore, heuristics facilitates the resolution of complex decision problems and is viewed as being close to the optimum. In psychology terms, heuristics enables individuals to make decisions regarding complex problems in situations of incompleteness (Gilovich, Griffin & Kahneman 2002). Kahneman's theory points to fundamental limitations in human mental processes, and thus causes us to employ various simplifying strategies to ease the burden of mentally processing the information required to make judgements and decisions. Thus, decision theory enables us to identify individuals' perceptions towards risk and uncertainty. For decisions under uncertainty, decision theory provides two explanations: an optimistic decision-maker considers the best possible outcome for each course of action and chooses the course of action that corresponds to the best possible outcomes, whereas a pessimistic decision-maker will consider the worst consequence of each possible course of action and select the one that has the least bad consequence.

Moreover, the notion of regret is directly associated with decisions under uncertainty. Most people tend to regret deciding about something after realising the existence of something better. In economics, this is also known as the opportunity cost. Opportunity cost is "the cost of an activity measured in terms of the best alternative forgone" (Sloman 2004). Lastly, when the possible outcomes of a decision are given by probabilities, that decision is one taken under conditions of risk. This process requires calculating "the expected value associated with each possible cost of action" resulting in an action which gives the "highest expected value".

Kahneman's recognition of these conditions and the inherent biases that affect our decision-making are elegantly captured in his concepts of 'System 1' and 'System 2' thinking. This recognises that most humans do not relish the prospect of pondering on complex, often intractable problems that

characterise the delivery of major projects; instead, decision-makers prefer to be 'cognitive misers' (Soll, Milkman & Payne 2015) by circumventing the mental energy required in evaluating uncertainties. The consequence of this is a simple one: decision-makers are constrained by a cognitive error that advocates for one possible future (i.e. the specific project that emerged from a policy announcement), one objective (building the business-case to fit the project), and one option in isolation (the pre-determined project). Decision-makers hence become victims of 'tunnel-vision' – influenced by the dominance of System 1. Intuition overrides any obvious necessity for more reasoned evaluation, and thus the project proceeds with a degree of baseless confidence. Cognitive alertness to bias in our decisions is crucial to expanding our views on all three fronts. Most of us tend to be overconfident in our estimates (optimism bias), and therefore it should not be surprising that over-optimism at the early stages of a project is a recognised antecedent to project 'failure'. Therefore, we must ask ourselves why we observe such a deep-rooted desire to present highly uncertain variables such as cost and time as deterministic values **and** to place such high levels of confidence in their accuracy. It seems perverse to do so, knowing what we do – that the work of government is truly complex and that deterministic forecasts in business cases are generally inflexible to changes in the policy landscape upon which a major project is often predicated.

Here, we suggest that there are two issues at play, cognitive biases and motivational biases coupled with the enduring problematisation of the communication of risk (Makridakis et al. 2019b), arising chiefly from the ambiguities that surround the use of the term 'risk' and its disambiguation from other terms such as *uncertainty, frequency, hazard, survival* and *probability*. When coalescing these problems within a politically influenced landscape where projects are often promoted because of an electoral manifesto pledge or such like, one may appreciate how biases drive the obsession for cost and time certainty at the expense of realism and pragmatism.

### Case study 1: Over-optimism in UK Government projects

In 2013, the NAO published a study into a long-standing problem in government, the initiating of projects based on unrealistic business-case assumptions. Notwithstanding a recognition of the problem and the treatment in the UK Treasury's 'Green Book', the report criticised "frequent over-optimism", which results in the "underestimation of the time, costs and risks to delivery and the overestimation of the benefits". It undermines value for money at best, and in the worst case leads to unviable projects. The recognition of bias and cognitive error (whether unconscious or deliberate) is explicit throughout the report,

which argues that decision-makers should be intolerant of optimism biases in the delivery of projects, but also recognises the influence of "organizational behaviours and incentives and the strength of personal accountability". Prior (to 2013) reports by the NAO illustrate a predisposition of failing to appreciate complexity in the front-end stage of projects, and, as a result, over-estimating delivery capability. Moreover, there is a recognition that government commits to a 'solution' without fully understanding the context and exploring alternative options. Similar observations were recorded in written evidence to the UK Parliament's Public Administration and Constitutional Affairs Committee (PACAC) inquiry into the government's management of its major projects (2020). Academics representing the Economic and Social Research Council (ESRC) funded Project X described a very similar problem:

> The 'front end' of any project is profoundly strategic. It is when we (should) define what is to be achieved, establish its feasibility, vulnerability (Bloomfield et al. 2019) and acceptability, and shape what is meant by 'success' (defined in terms of strategic performance rather than deliverables). Our review of the literature regarding the 'front end' of projects (Williams et al. 2019a) evidences the persistence of predetermined solutions above rigorously evaluated concepts that create public value. We identify a set of often neglected initiation (and completion) 'best practices' that should be in place before any major public project begins.

The 2013 NAO report went further, emphasising that "half of [NAO] reports on major Government projects refer specifically to issues with estimating", including the controversial High Speed 2 project to connect London with Birmingham, Manchester, Leeds and York. The report identifies five factors that contribute to over-optimism: independent challenge and accountability, complexity, stakeholders, evidence base and behaviours and incentives. The report recognises that tension often exists between the responsible use of public funds and the importance of innovation and risk-taking to achieve transformational change. It suggests that decision-makers must demonstrate confidence in the provenance of their decisions using 'realistic' estimates and assumptions. The report concludes with a warning that "optimism bias, and the desire to show success, may lead decision-makers to push on and deliver something even if the outcome is likely to be materially different from, and inferior to, that originally intended", often known as the 'sunk-cost fallacy'.

The issue of realism is captured in the PACAC report, particularly in relation to ministerial decisions around policy and their implications for project delivery, one of the main concerns being the importance of

respecting democracy while practising the highest standards of governance and transparency in public project delivery:

> Projects are hindered by over-optimistic estimates of cost and time schedules, and overstatement of early benefits. Ministers are too keen to commit to specific cost and timescales early in the process, and project managers become tied to these estimates. The early estimates can then shape the rest of the project delivery, sometimes leading to reductions in outputs or benefits as project-managers struggle to keep project timescales and costs in check.

## 5.3 Reconciling the need for, and the paucity of, useful data at the front-end

In the previous section, we argued that clear definition of the 'front-end' project or programme activities is crucial to creating the necessary conditions for a successful project and the delivery of benefits. It is also widely accepted that the opportunity to change the scope of a project (and thus influence cost and schedule) is at its greatest in the early stages of the project lifecycle. In this section, we explore the paradox of reliance on early estimates before much of the initial front-end work is complete.

Assumptions are a necessity in the development of early-stage business cases for projects in government – yet determining final budgets or tendering at an early stage of the process before design, exploration or scoping are complete represents a preoccupation with price-driven metrics and, when it occurs, a fundamental lack of understanding of the nature of major projects and their true cost and value. Using these to inform tendering in the anticipation that these estimates are achievable is in part driven by the enduring inducements to pursue lowest price tendering – or an over-emphasis on capital cost over long-term benefits. In this section we look at the issue of estimating and the implications for project delivery in government.

Cost estimation in this context is one of the main precursors to determining the viability of a project or programme. According to Pinto, cost estimation processes "create a reasonable budget baseline for the project and identify project recourses (human and materials) as well, creating a time-phased budget for their involvement in the project" (Pinto 2007). Therefore, it is obvious that cost estimation and project budgeting are inextricably linked, both aiming to secure the completion of the project on time, on budget and at the appropriate quality. These vital aspects of the project, according to Gray and Larson, "are the lifeline for control since they serve as the standard of comparison of actual and plan throughout the life of the project" (Gray & Larson 2008).

Primarily, cost estimation is taken into consideration before the tendering process for a project begins. During this early stage, organizations tend to

**possess less accurate estimates because of incomplete information and availability of data**. Thus, promoters should be more vigilant to the potential inaccuracy of cost and time estimates. As the project moves forward from the conceptual phase into the execution phase, information flows change, and more data becomes available. As a result, time and cost accuracy of the estimation should improve significantly (Winch 2009). Projects are generally defined as "complex, non-routine, one-time efforts to create a product or service limited by time, budget and specifications" (Gray & Larson 2008), and therefore these characteristics emphasise the importance of considering the implications of unexpected events on initial estimates. Hence, corrections and amendments of the cost estimates should be undertaken based on a continuous process.

During the project appraisal phase, the project organization is concerned with two fundamental decisions. The first decision relates to viability, and whether the project needs additional investment. If the project is viable, then the second decision is concerned with feasibility studies to identify the most successful option of those available. As the project options are established or eliminated, the range of uncertainty should reduce, even though at this stage the process still involves decisions to be made under a level of uncertainty that is often beyond the influence of the decision-maker (Smith 2003).

On the other hand, during the execution stage of a project, the promoter may become more fully aware of the project's expenditure since the infrastructure facility has been designed, constructed, and commissioned. Due to the adequate information about several important aspects of the project, the cost estimation is closely aligned to the true cost of the facility. Nevertheless, the construction phase is perceived as one of the riskiest phases in every project of any nature; therefore, cost estimations can be again slightly out of balance. For example, poor performance of a contractor could lead to knock-on effects such as delays in the project schedule – the estimator should therefore consider how the potential for unforeseen events may be incorporated into the cost estimate.

Finally, the operation phase is seen as the most straightforward stage of the three. The risky construction phase is after all over. Moreover, the project facility has been commissioned and is now operating and generating revenues (tolls paid to use the motorway, charges to use a new power plant, etc.). According to Burke, the accuracy of the estimation improves significantly as the project moves through the different phases discussed earlier. At the end of the project the cost estimation becomes the actual cost, which tends to be higher than the predicted one (Burke 2006) The desiderata for accurate estimation of time and cost (Gray & Larson 2008) include (Figure 5.1):

- Efficient and effective decision support
- The antecedent to a project delivery schedule
- Determination of whether the project is worth doing (strategic alignment)
- Forecasting cash flow requirements


*Figure 5.1* The basis of estimating.

- Understanding how well the project is progressing
- Developing time-phased budgets and project baselines

At this stage, it is important to state some issues that affect the ability to produce reliable and accurate project cost estimates. The nature of the problem often originates from the 'uniqueness' of a project and the consequential implications for innovation. Pinto (2007) suggests that the most common reasons for variations in estimates include:

- Unrealistic early stage estimates: in the previous section we emphasised the problem of optimism bias, but there are other reasons why initial estimates can be lower than the actuality. As a project progresses through the business-case phases, new information can emerge (often related to policy), with implications for time and cost. There may be cognitive issues that come into play, and the way in which estimators interpret data can influence the outcome.
- Unexpected technical difficulties: although an estimate is established in part to identify and mitigate the technical risks of a project we know

that these can often underestimate the true cost. Later in this chapter we explore one example of an IT project that was ultimately flawed by technical errors.

- Clarity of definition: when the project has been created without clear and reasonable scope, objectives and purpose in place, it is the norm that the cost estimation and project budgeting process will be insufficient as well.
- Specification changes: the calculation of the cost estimates according to the specifications received from a client can be highly susceptible to variation – this is particularly problematic in situations where a client or project promoter is 'naïve' and therefore inattentive to the impact that scope and specification changes have on estimates.
- External factors: are mostly concerned with political, economic, social and legislative events that are beyond the control and influence of the project.

The terms of reference of the 2020 UK Parliament Public Administration and Constitutional Affairs Committee enquiry into major project delivery in government focused on the issues of estimating and forecasting in government, and sought answers to two questions, in particular: (1) How well does the government estimate cost, time and benefits at the start of projects? and (2) Are there barriers to doing this well, and what mechanisms could be used to ensure estimates are more accurate?

Written evidence submitted by ESRC-funded Project X academics[1] emphasises a desire for 'single-point estimates' of time, cost and forecasted benefits, despite the material fact that such estimates are likely to be incorrect. The nature of major projects is such that deterministic estimates cannot account for the stochastic behaviour that we have observed in many strategically important projects and programmes – particularly those that that span parliamentary reporting cycles. Anchoring bias can lead to perceptions of success/failure that lie at variance with the actuality of what is achievable, given the capabilities of the project participants and the available resources at the time of approval. In some cases, projects are authorised without adequate consideration of the data requirements.

**Case study 2: National Offender Management Information System project (C-NOMIS)**

In June 2004, a **newly formed** executive agency of the Home Office, the National Offender Management Service (NOMS) initiated an IT programme that was designed to support the implementation of a new method of working, known as 'end-to-end offender management'. Known as C-NOMIS, the system would replace separate legacy database systems in the prison service and probation service with one new, fully integrated system, the principal benefit being to enable

real-time data sharing between the prison service and probation officers and other relevant criminal justice system agencies. However, the programme experienced numerous challenges – leading to a realisation that the system 'go-live' estimated for January 2008 would not be achievable. It transpired that the original programme cost estimate rose by 195% from £234 million in 2005 to £690 million in July 2007. In the subsequent NAO investigation into the C-NOMIS project, the department admitted to a "gross underestimate of costs and that the original cost estimates were badly prepared".

| | *Estimated Cost June 2005 (£ million)* | *Estimated Cost July 2007 (£ million)* | *Estimated Cost Increase (£ million)* | *Cost Increase 2005–2007 (%)* |
|---|---|---|---|---|
| Application development | 51 | 206 | 155 | 304 |
| System maintenance and support | 128 | 243 | 115 | 90 |
| Infrastructure | 14 | 38 | 24 | 171 |
| Implementation | 12 | 22 | 10 | 83 |
| Project management | 13 | 34 | 21 | 162 |
| Value added tax | 0 | 99 | 99 | – |
| Risk (contingency) | 0 | 32 | 32 | – |
| Other costs (sunk costs, management information systems etc.) | 16 | 16 | 0 | 0 |
| Total | 234 | 690 | 456 | 195 |

In the first case study, we highlighted how early estimates shape project delivery, sometimes leading to reductions in outputs or benefits. In this case study, we observe a similar problem in that the NAO 'value for money' assessment of the C-NOMIS project was described as 'poor', suggesting that many of the causes of delays and cost overrun were foreseeable but occurred due to a lack of project delivery expertise within the agency. More specifically, the agency was criticised for a failure to appreciate the nature of the operational context in which the programme was situated, inadequate oversight of the project (at Senior Responsible Owner (SRO) level) and poor supply-chain management, leading to a three-year delay in programme roll-out and reductions in scope and benefits.

## 5.4 Government projects are truly complex yet estimating their cost is deterministically influenced

Earlier in this chapter, we emphasised the propensity for government ministers to commit to deterministic estimates when announcing new projects as a vehicle for the delivery of a policy intent – despite history suggesting that the accuracy of such estimates is often woeful. One of the causes, often quoted by scholars, is that of strategic misrepresentation – this may manifest itself in assumptions best described as 'underdeveloped' and optimistic forecasts of future long-run benefits. While an unrealistically low initial cost estimate may increase the chance of a project being funded, future problems are 'baked in' and are often irreconcilable.

The question of why costs, benefits and time forecasts of complex projects are systematically over-optimistic in the front-end – termed 'normalization of deviation' by Pinto and Slevin (2006) – has pre-occupied much of the project studies literature over the past few decades. This variation during the front-end is important for the concept of 'lock-in'. Costs are considered during the formal decision to execute a project, but often the actual decision to execute precedes this, so decisions are made based on earlier, lower cost estimates. This 'escalating commitment of decision-makers' can occur both at the decision-making level (before the decision) and during project execution. Public projects are particularly prone to wider influences such as political and legislative factors in the project front-end, and this can lead to entrenched problems as the project evolves.

Benchmarking techniques are often utilised by decision-makers in the development of assumptions and early estimates of costs, but historical benchmarking requires careful analysis and clear 'health-warnings' when applied to projects and programmes of high complexity. Government projects usually require the co-ordination of human and physical resources drawn from multiple organizations in both the public and private sectors, the majority of which will not be core to the central project delivery team function in government. This recognition is crucial to recognising that the work of government is inextricably complex, and that the desire for reliable cost and schedule estimates must be tempered with the recognition that complexity, by its very nature, introduces high levels of risk and uncertainty at the 'front-end' of the project or programme. The effective communication of risk and uncertainty is therefore essential, as is the responsible use of probabilistic methods (models) in a format that is understandable to decision-makers.

We can understand complexity, to an extent, through an appreciation of the interdependencies that occur at any given time during the project lifecycle. This is not an easy task however, particularly in very long duration projects and programmes where changes in policy may interact with budget constraints. Complex systems are 'unknowable', and thus we must learn to live with the consequences of complexity in the context of major government programmes.

Defining the scope is crucial to a positive future project trajectory. Strategic intent is clearly important too, revisions to the HM Treasury Green Book in late 2020 seeking to strengthen business cases through improved appraisal of strategic intent. Here, we have problematised the conflicting demands in achieving scope clarity at the very early stages of the project lifecycle, highlighting the importance of unambiguous and clear objective setting and appropriate measurable objectives that are aligned with the policy goals of the government of the day. The effect of parliamentary cycles should be factored into conceptualisations of successful scope development, and an appreciation that the availability of funding from the Treasury will influence the capability of the project delivery team to deliver against the agreed scope. A study led by Cranfield University and funded by the Association for Project Management (APM) on 'the practice of governance' illustrates this problem in the context of 'fixed goal' and 'moving goal' projects and programmes (Bourne & Parr 2020).

Recent reports published by the National Audit Office illustrate some of the points raised heretofore, including the nature of government major projects and how this introduces challenges to accurately estimating the time and resources necessary to achieve delivery. The desire to use 'reference classes' as a means of supporting cost estimating is well versed in the project studies literature, but there are few appropriate comparators to draw upon, particularly in defence capability and government transformation type projects. A further problem related to scope is the influence of other government priorities and how these are often conflated with existing projects and programmes. Where programmes and projects form part of a portfolio, externalities can negatively impact upon the reliability of the initial estimates.

**Case study 3: Prison estate reform**

Her Majesty's Prison and Probation Service (HMPPS) is an executive agency of the Ministry of Justice (MoJ), which embarked on 'The Prison Estate Transformation Programme' (PETP) to improve outcomes for prisoners in key metrics such as decency, safety, education and health care. The programme ran for almost three years before it was superseded in August 2019 by a government announcement committing to build a further 10,000 prison places, in addition to those expected to be built under the PETP. The NAO assessed the programme as ultimately undeliverable. Consequently, the prison estate is not currently meeting the needs of the prison service, and therefore the programme represents poor value for money.

The failure of the PETP was partially attributed to an 'over-ambitious' scope, characterised by a programme timetable that was overly optimistic and susceptible to interdependent projects within the

programme that were operating on a tight timeline. HMPPS planned to build five new prisons by 2020. However, there was little contingency in delivery, and key factors including planning permission for the new sites were not adequately factored in. The House of Commons Justice Committee report 'Improving the Prison Estate', which examined the causes of failure in the PETP, points to fundamental issues of strategy and funding. The report describes the Prison Service as "operating hand to mouth", by reacting to immediate crises rather than developing a long-term strategy for the prison estate. The report recognises that the Ministry of Justice was subject to significant budget cuts in the previous decade, and that most of its spending on the estate was 'reactive' and crisis-driven rather than strategic. The paucity of available funding from the Treasury also led to delays early in the programme.

The Justice Committee report also emphasises the complexity of the programme within a broader landscape of policy reform to reduce re-offending in the UK. It identifies an absence of cross-government strategy, pointing to the importance of a systems thinking approach that recognises that the causes of crime cannot be tackled by imprisonment alone, but by a broader approach to tackling inequality, unemployment, education, mental health care and social services provision. The report describes a ministry that "is still reeling from the long-term consequences of its unrealistic 2015 Spending Review settlement", and "bears the financial and human cost of sustained underinvestment". Interestingly, we see further evidence of optimism bias in that the report suggests that the ministry admitted that its 2015 Spending Review settlement was 'over-optimistic and fundamentally unbalanced'. Having overestimated its expected income and the level of savings it could make in other areas such as the provision of 'Legal Aid', it exposed the PETP to insurmountable problems from the outset.

Others are drawn in through the supply chain because of a specialism, pulling together to build an infrastructure asset which faces unique challenges. Making accurate forecasts around cost and scheduling is therefore difficult in cases where technology readiness levels are low.

Government is over-reliant on cost (and, to some extent, time) in determining project success, and frequently seeks to reduce contingency funds to 'save' money – thus limiting flexibility where new information or data suggests an alternative course of action should be considered, or if economic conditions change.

The quality of an estimate can only be judged during the execution of a project or programme. To expect an initial forecast to stand the test of time, where wide-ranging and uncertain variables come into play, is simply not realistic. However, steps can be taken to better align expected and final outcomes by understanding that the evolution

of project design and re-forecasting improves as the project is better understood.
Promoting better understanding and management of project delivery processes, and adopting more inclusive measurement metrics beyond just cost value will help to reveal the true value of a government project and improve the project delivery team's ability to manage significant change or disruption as it occurs.

**Case study 4: Crossrail**

The Crossrail project is a railway construction scheme which aims to provide reliable, high-frequency suburban passenger train services across London, traversing from Reading in the west to Shenfield in the east, with two spurs to London Heathrow Airport and Abbey Wood, the latter being a new construction. Crossrail connects two major railway termini, London Paddington (for the Great Western Main Line) and London Liverpool Street (for the Great Eastern Main Line). The project was approved in 2007, with construction commencing in 2009 on the central section of the route (mainly underground tunnelling work and the associated infrastructure) and connections to existing lines. In 2016, the Crossrail route was given the operational name the 'Elizabeth Line' at a ceremony attended by HM Queen Elizabeth II at Bond Street Station.

The idea of building a west-east railway line in London is not new; the project's origins can be traced back to the Second World War. Following attempts in the early 1990s to gain legislative approval and access rights, the present scheme was developed by the devolved transport body, Transport for London (TfL) and the UK Government Department for Transport (DfT), commencing in 2001. Crossrail required a 'Hybrid Bill' (a mix of a public bill and private bill), which was submitted to the UK Parliament in 2005 and progressed through the various legislative procedures before receiving Royal Assent in 2008. To deliver the project, a new 'arms-length' delivery organization was created by TfL and DfT as joint sponsors, with the involvement of the wider rail infrastructure asset owner, Network Rail.

The scale and complexity of the scheme presented Crossrail Ltd with a significant challenge in estimating the schedule, and therefore the costs of the scheme. Aside from the civil engineering challenges associated with tunnelling in central London, the nature of the work required Crossrail Ltd to award 36 contracts to private companies to deliver the main infrastructure (permanent way, stations and signalling) and the

electrical power systems required to operate the railway. The contractual arrangements created many interfaces and dependencies between the work-package contractors, the consequence being £2.5 billion in increased costs during the period 2013–2018, as delays and changes to the programme occurred.

Earlier in this chapter, we explored issues of 'over-optimism' and how the actuality can vary significantly from the initial estimates. The Public Accounts Committee (PAC) and National Audit Office (NAO) reports into 'Delivering Crossrail' emphasised this point elegantly:

> In our April 2019 report …, we concluded that the Department, TfL and Crossrail Ltd's fixation on a delivery deadline of December 2018 led to warning signs that the programme was in trouble being missed or ignored. We found that the pressure on, and determination within, those delivering the programme to meet this deadline led to an overriding culture of over-optimism and that when Crossrail Ltd and the programme's project representative identified failings at a much earlier stage, they were not addressed as they should have been.

The propensity to commit to deterministic estimates of time and cost early in a programme's life is, and remains, an enduring problem in public projects. Clearly, competing pressures come into play, and the case of Crossrail is no different. Railway projects are particularly susceptible, due to the complicated nature of the rail industry in the UK and the time-horizon associated with, inter alia, timetabling of rail services. Nevertheless, the literature regularly problematises this in terms of the obvious need for a programme to sufficiently develop to a stage where more accurate information on what is needed to deliver it becomes available. The NAO reports identify the tendency for delivery organizations to seek to incentivise targets that are subsequently recognised as aggressive. The issues identified in Crossrail bear a similar resemblance to the UK's new high-speed rail project (HS2), the first phase of which (London to Birmingham) was originally scheduled to open in 2026, but this was demonstrably too ambitious, given the legislative and planning hurdles that exist. There was also criticism of the 'reference-class' basis that determined the initial estimates. Aside from changes that were required to adjust the programme budget during spending reviews, it was found that "subsequent cost estimates did not account for the level of uncertainty and risk in the programme, resulting in significant cost increases once contractors developed the detailed design of the programme to inform a bottom-up costing". Phase One is now estimated to complete between 2029 and 2033 (note the use of a range of values) on 140 miles of new permanent way.

## 5.5 'The public gets what the public wants'

> You choose your leaders and place your trust
> As their lies wash you down and their promises rust
> You'll see kidney machines replaced by rockets and guns
> And the public wants what the public gets
> But I don't get what this society wants
> I'm going underground, going underground …

The lyrics to the 1979 hit 'Going Underground' by The Jam were borne out of band member, Paul Weller's angst in the face of a British Conservative Government led by the newly elected Margaret Thatcher MP, whom he perceived to prioritise public spending on nuclear proliferation over government programmes that delivered broader public value. The words also betray Weller's contempt for what he perceived to be implicit citizen apathy that manifested itself in a lack of resistance to such policies.

In modern democracies such as the UK, decisions on investment in major projects are often influenced by electoral (rather than economic) cycles. Political parties use their manifesto pledges to entice voters with attractive policies, and if successful, form a government with a mandate to deliver on their promises – usually through projects and programmes. It is right and proper that the government of the day is empowered to determine the projects and programmes it deems necessary to achieve its policy objectives, but the corollary is an obligation on ministers to appreciate the implications of their policy announcements, especially where the required capabilities, competences and capacity of the civil service and its supply-chain may not be fully understood or appreciated. There are many examples in the UK to illustrate that this is an enduring problem – here we hypothesise that 'the public gets what the public wants' in the short term, but that in some cases, the public good may be damaged in the long-run.

The public good, often referred to as 'public value' is explored by Lee, Oakley and Naylor (2011) who reflect on Moore's (1995) critique of 'new public management' (NPM), an ideology that rejected the hereto traditional bureaucratic model of public administration. Their work is important in highlighting the conceptualisation of what may constitute 'public value', or "how the working practices of public servants might contribute to particular sorts of benefits found only in public services". The authors posit that value may be derived by the provision of a new public service (a local bus service partly subsided by the local authority, for example) or increased trust in a public service (or the institution that provides it). We discuss this in the 'Horizon' case study later in this section.

Leadership is crucial to ensuring that scope, time, cost and benefits forecasts are realistic in the context of government transformation. Kortantamer (2019) proposed a framework for responding to project and programme complexity based on surveyed experiences of government transformation and

service delivery. The analysis adopts the theoretical lens of routines as it enables the examination of both formal leadership activities and their improvisations in responding to complexity.

Williams et al. (2019b) presents a cross-national comparison of public sector benefits management (BM) practices in Australia, Canada, the UK and the US, exploring 'benefits management practices in action', and considering to what extent 'espoused' or 'mandated' frameworks are practised and perceived by their users. Employing qualitative analysis, semi-structured interview data were analysed from 46 participants with experience in sponsoring, managing and/or reviewing government projects. The results expose considerable variation in the adoption and standardisation of BM frameworks from inter and intragovernmental perspectives. The research evidence places a strong focus on benefits identification, specifically at the outset (the business case stage, seeking project approval) and a deterioration in focus as the project or programme progresses through the authorisation (or assurance) approval gates towards close-out and operations. A further study of three UK projects illustrates the complexity and fluidity of how benefits are defined, particularly where many are social and non-financial, within a changing political, social and technological landscape, and practical recommendations are made to achieve projects' planned benefits. The results further emphasise the prominence of political interest, leadership buy-in, a benefits-driven culture, a transparent benefit reporting mechanism and an effective 'hand-over' to the business-as-usual operational phase in the implementation of 'effective' BM frameworks.

The public 'at large' tend to focus their attention on the 'costs' rather than 'benefits' of public spending – and thus the pressure to deliver 'on time, on cost' is, ostensibly a pressure that is exerted chiefly by the public (possibly through their elected representatives). Ministers are held to account by elected representatives who, in turn, are empowered to question government on its project delivery performance. This conundrum leads us to seek to problematise the *project performance* versus *project success* tension from a wider socio-economic perspective.

The socio-economic impacts of infrastructure have been extensively researched, both in terms of economic development and social benefits. While the two are closely intertwined, there are also substantial studies exploring the two independently. Thus, we will further divide the literature into the following two subcategories: social impacts and economic impacts.

Although there is no consensus on specific types of impacts, there are several commonalities found in the studies investigating social impacts. Zamojska and Próchniak (2017) describe the social economy as covering employment, social services and social cohesion. This is a sentiment shared by Dobson et al. (2020), who label it as social value with the added aspects of urban environment improvement, and the nurturing of specialist supply chains. The researchers emphasise how the fundamental purpose of infrastructure is to meet societal needs, and as such, the benefits of infrastructure should not

be limited to the provision of its basic functional utilities. Additionally, The Social Value Act (2012) makes it a legal obligation for public sector projects to demonstrate how they add social value.

Bristow and Nellthorp (2000) describe how social impacts also encompass environmental and public welfare and demonstrate how infrastructure directly improves social welfare. They illustrate how, for example, improving the quality of transportation infrastructure is linked to the reduction of road accidents and traffic disruption, which consequently saves travel time and costs. In this case costs are divided into direct costs: damage to vehicles, property, medical expenses, etc., and indirect costs: loss of production through the loss of skilled or unskilled workers – and hence a cost to the economy. The research corresponds to the study by Aschauer (1989), which argues that infrastructure enhances the very quality of life, with direct improvements to public safety, appearance of urban environments, and health and well-being. Agénor and Moreno-Dodson (2006) also demonstrate a clear link between infrastructure and education, as well as accessibility to health care. They describe how efficient infrastructure acts as a direct channel, in which accessibility and quality of health care and education for individuals and society are improved tremendously.

Finally, utilities such as water and energy can be a significant portion of a poor household's income. Foster and Yepes (2006) describe this as another element of social impact, wherein investment into maintaining and improving energy and water supply infrastructure can also alleviate the financial burden faced by poorer households. Straub and Terada-Hagiwara (2010) explain how between one third to a half of infrastructure services are used by households as final consumption, playing an important role in poverty reduction and improving welfare. They demonstrate how infrastructure for utilities provides essential services, the absence of which is a significant dimension of poverty. Additionally, improving existing infrastructure can reduce overall production costs and maintenance costs, resulting in reduced utility prices.

The relationship between infrastructure and economic impacts is usually encapsulated as economic development or growth, and this has been achieved in several ways. The most common method is to directly relate economic development to growth in GDP per capita (Straub & Terada-Hagiwara 2010). Alternatively, Agénor and Moreno-Dodson (2006) explain that infrastructure induces the direct productivity effect wherein the costs for input factors in production processes are lowered. They also argue that this is accompanied by the indirect effect where the overall productivity of the workers is improved. In fact, the idea that infrastructure lowers input costs while generating an overall increase in production is shared across several studies (Aschauer 1989; Calderón et al. 2014; Khanna & Sharma 2021; Lall et al. 2004; Macdonald 2008; Montolio & Solé-Ollé 2009). Muvawala et al. (2020) find that initial high costs lead to a negative impact on economic growth, although this overturns in the long term showing significant economic growth. The authors argue that the negative short-run impact only demonstrates that

public spending needs to be rebalanced in order to better prioritise social sectors. Fan et al. (2002) share similar findings, with overall long-term impacts being an increase in GDP per capita and thus positive economic growth. They also acknowledge that this is largely due to notable regional inequalities and accessibility.

A study by Zolfaghari et al. (2020) evaluated the effects of social and physical infrastructure on income inequality, and found that investment in water, education, health care, energy and digital infrastructure had the largest impact in successfully reducing income inequality. Due to the magnitude of the effects varying across different infrastructure investments, they concluded that an optimal balance must be found in allocating physical and social infrastructures, as an unequal distribution of resources may have an opposing outcome. In relation to this, Leigh and Neill (2011) found that infrastructure investment on a national scale had eventual spill-over effects which contributed to reducing unemployment at a local level. While the results of the study were promising, they were unable to determine the effect on the national economic activity. However, the authors emphasise that there was evidence to suggest that an indirect link between better national infrastructure boosts local economic activity due to lowered transportation costs for independent local business, consequently leading to a substantial increase in job creation.

There is further research examining the relation between unemployment and infrastructure investment, all studies appearing to be of similar disposition – that efficient investment in infrastructure leads to an overall decrease in unemployment and increase in job creations (Edeme et al. 2020; Hernandez et al. 2020; Zhu et al. 2009). Furthermore, Fransen et al. (2019) highlight how transport disadvantage is often accompanied by unaffordable housing, causing long-term unemployment among people from disadvantaged regions to be more likely than among those from more prosperous regions.

Empirical studies on socio-economic impacts in essence do not contradict in their research; however, they are limited in the sense that they often only explore one to three elements. Conversely, the studies that explore a variety of socio-economic impacts do so in the context of a specific type of infrastructure, such as transport, and thus ignore the potential effects of other types of infrastructure. In addition to these limitations, many studies do not differentiate the impacts on a regional scale, but instead provide an overarching understanding, often on a national or global scale. While such methods may work for certain countries where infrastructure investment and economic gains are more equally distributed, this is simply not possible for the UK with its dual economy, where regional inequalities already play a large role in infrastructure investment. Finally, the results from the various studies are produced using a wide range of methodologies, where different social impacts are analysed through differing means, and thus the conclusions drawn – though comprehensive – are not cohesive.

- Government overly relies on cost (and to some extent time) to determine project success and frequently reduces contingency to 'save'

money – limiting room for manoeuvre if new information comes to light, or if economic conditions change.
- Assurance (sometimes referred to as scrutiny) of projects often focuses on the process of completion against arbitrary budgets rather than the wider benefits that major projects can deliver in the long-term.

The implementation of infrastructure investment is just as important as the investment itself. Governmental policies need to be effective in realising and distributing the benefits of infrastructure investment, or else risk adverse effects, such as those of a study in Brazil that demonstrated infrastructure investment having negative impacts on poverty alleviation due to inadequate and deficient public policy (Medeiros et al. 2020). Several studies report similar findings, where infrastructure-driven development in order to stimulate growth at a local level is stunted or not seen to its full potential due to public policies not directing or redirecting consistent resources efficiently (CECA 2018; Edeme et al. 2020; Fransen et al. 2019; Hernandez et al. 2020; Tortajada 2016). The UK in particular is facing several issues in successful policy implementation, due to lack of clarity and consideration for regional differences, consequently receiving public backlash and overall public opposition to infrastructure projects (Coelho, Ratnoo and Dellepiane n.d.).

In some cases, the adverse effects of infrastructure investment are inevitable, and it is up to governmental policies to efficiently mitigate these impacts. An example is soaring house prices creating a housing market bubble – a critical issue that many mega-cities such as London are facing today. Coelho, Ratnoo and Dellepiane (n.d.) demonstrate that, while several infrastructure investments have been made to disperse the population density, for example HS2 and Crossrail, these projects have once again received public opposition due to the perceived policy bias that favours London and the Southeast region. Although there are numerous studies that investigate the impact of governmental policies on benefits realisation from infrastructure investment, many of them focus on developing countries that either do not have the foundation groundwork for infrastructure investment – making any large-scale project a heavy short-term financial burden – or they have a basis but lack development in current infrastructure which inhibits future projects. Finally, most of the empirical literature reviewed was published, or conducted their research prior to the impact of COVID-19, which has exacerbated inequalities between the North and South (Bambra et al. 2020). Thus, governmental policies now need to accommodate for the vulnerabilities that have been exposed due to decades of public spending cuts in the North, in addition to the already lacking infrastructure investments.

The importance of delivering benefits from major project investments is perceived by the PACAC committee to be a "critical success factor". Its recent report states that

> a project's benefits are the very reason it is proposed and delivered, and the Committee does not believe that a project can be deemed successful

> if it does not demonstrate realisation of its stated benefits. The Government has sought to justify spending millions of pounds on infrastructure during economically uncertain times by stating it will boost economic outcomes across the country. The Committee therefore expects the Government to be able to demonstrate growth because of this spend in future years.

The question is, Who is tracking the benefits, and will there be a genuine ex ante evaluation of major investments in the decades to come?

**Case study 5: The Fujitsu Post Office Horizon Project**

In 1999, Fujitsu UK was awarded the contract to design, implement and operate a new information system infrastructure named 'Horizon' for Post Office Ltd – a retail post office company in the UK that provides a range of products including postal services and retail banking to the public through a network of branches. The company is wholly owned by 'UK Government Investments'. 'Horizon' was a five-year project, completed in June 2001 at a total cost of c. £1bn. It was described at the time by Fujitsu UK, as "the largest non-military information technology project of its kind in Europe". The company's own post-project marketing material lauded the "on time, to specification and within budget" achievements of the Horizon project.

In subsequent years, sub-postmasters who used the Horizon system were blamed for unexplained accounting losses (known as balancing errors). Following investigations by Post Office Ltd, many were prosecuted and subsequently tried and convicted of theft or false accounting offences in the criminal courts. In some cases, sub-postmasters were sentenced to prison, despite continued protestations of innocence. During the period 2000–2015, over 900 sub-postmasters were prosecuted.

It subsequently became known to Post Office Ltd that errors in the Horizon system may have been the cause of balancing errors, and that the subsequent prosecution of sub-postmasters on evidence gathered from the Horizon system may have been 'unsound'. This led to a groundswell of public and political opinion that crystallised in a 2016 group litigation in the High Court of Justice (Bates and others v Post Office Ltd). The judge, the Hon. Mr Justice Frazer, who had described the Horizon system as "extraordinarily complicated" found that the system contained "bugs, errors and defects" and that there was a "material risk" that balancing errors in the accounts were caused by the system. After the High Court ruling, the Criminal Cases Review Commission (CCRC) referred the cases of 42 former sub-postmasters to the Court of Appeal, which began taking evidence on 21 March 2021. The Post

Office also settled a separate civil claim brought by over 550 claimants for £57.75 million, without admitting liability, in December 2019.

The UK Government subsequently announced the scope of an Independent Review into the Post Office Horizon IT System and the criminal trials – following prime ministerial approval on the 26 February 2020. Darren Jones MP, the chair of the House of Commons (Business, Energy and Industrial Strategy Committee)'s inquiry into Horizon emphasised the importance of the inquiry in learning lessons from the project:

> It's right that the Post Office has conceded, allowing the wrongful convictions of innocent sub-postmasters to be quashed. This is a landmark decision, but it is important the Independent Review has the powers it needs to play its part in getting to the bottom of this sorry story and help ensure it never happens again. This review is judge-led, which is welcome, but it needs to have the necessary powers to demand evidence and require witnesses to give evidence.

It is quite possible that Horizon is responsible for one of the greatest miscarriages of justice in the history of the UK – only time will tell us this. The ongoing House of Commons (Business, Energy and Industrial Strategy) Select Committee enquiry into the Horizon project is stimulating a wider discourse on the lessons to be learned insofar as governance of IT projects are concerned. The reputational damage to a trusted 'brand' is also being assessed. The Post Office is perceived by many citizens in the UK as a 'trusted' organisation, but the events of the recent past are testing the public's perceptions in a way that could never have been conceived before.

## 5.6 Governments are experienced project promoters, but there is an absence of standardisation in the use estimating practices for major projects

Estimating and forecasting are important underpinning principles in the practices used by government to make informed decisions on major projects and programmes. We have alluded to the impact of complexity in this chapter and elsewhere. The implications for estimating and forecasting in this context require an appreciation of the interrelationships between the technical and non-technical aspects – this is particularly important in the context of government, where departments must seek to co-operate in a holistic way. Sound estimating cannot be practised where disconnections between policy, project delivery and operational delivery plans occur.

This is especially true when comparing major projects which exist in isolation from other projects and a consistent failure to learn lessons. The sector

has responded to the need to improve data capture analysis, retention and sharing; however, these efforts have not always been well-coordinated. There is no single standard for data collection, which makes records difficult to compare. This problem is compounded, to some extent, by a lack of trust and openness between project participants – prevalent among the causes of which are concerns about loss of competitive advantage, which often serves to hinder innovation and co-operation.

There are few consistent approaches to data capture, risk or project management in the work of government project delivery in the UK. Idiosyncratic methods adopted by contractors working on the same project – sometimes adopting different approaches – require that each major project is essentially being established from the 'bottom up' with an immediate need for data and systems integration from the outset. Several recently published standards have attempted to address this problem and their impact will become more apparent over time:

- The 'Functional Standard for Project Delivery' was published by the government in 2019 to harmonise project delivery routines across departments.
- The revised 'Orange Book' was published in 2020 providing guidance on risk and risk management in the context of the Green Book evaluation criteria for investments in projects and programmes.
- 'Cost estimating guidance' was published by the Infrastructure and Projects Authority in 2021 to promote 'best practice cost estimating' by outlining the fundamentals that underpin a good cost estimate, the roles and responsibilities in producing, reviewing and owning the cost estimate to make informed decisions and the assurance process to ensure decision-makers use cost estimates in a responsible way.
- 'Guide for effective benefits management in major projects' was published by the Infrastructure and Projects Authority in 2017 to provide structure and set expectations for major project teams when undertaking benefits management, and aligns with major project assurance processes and the 'Green Book' 5-case process.

Whereas the UK Government has sought to improve standardisation in cost estimating practices to some extent, individual departments with significant project delivery responsibilities continue to maintain specific estimating expertise, the Cost Analysis and Assurance (CAAS) function of the Ministry of Defence being one example. CAAS exists as the MoD's 'centre of excellence' for pricing and costing support to some of the most complex defence engineering challenges, including the astute and successor submarine ('Continuous At Sea Deterrence') programmes and the Queen Elizabeth class aircraft carriers. Conversely, Highways England has instituted significant cost-estimation expertise to support the delivery of two strategic objectives – the Complex Infrastructure Programme (CIP) and the Road Improvement Strategy (RIS).

### Case study 6: Highways England cost estimating for major projects

Highways England Company Ltd is a wholly government-owned company responsible for operating, maintaining and enhancing the motorways and major trunk roads across England. Its predecessor organization, the Highways Agency, was an executive agency of the Department for Transport before it was converted into a government-owned company on 1 April 2015. The Infrastructure Act 2015 requires Highways England to produce a long-term vision for what the strategic road network will require in terms of investment, and how money allocated to it by the Treasury will be invested in operations, maintenance, renewals and enhancements. This document is known as the Road Improvement Strategy (RIS). The current version, RIS2 (for the period 2020–2025) confirms a £27.4 billion budget and was produced following a staged process designed to ensure that investment decisions are based on robust and rigorous analysis. The current RIS2 document identifies six strategic studies and a programme of refreshed route strategies covering the entire network. The strategic studies focus on some of the greatest challenges confronting the road network, including routes into and around major urban conurbations in the North of England such as Manchester. In addition to the RIS, a separate portfolio of 'Nationally Significant Infrastructure' schemes are managed within the Complex Infrastructure Programme (CIP).

The work of Highways England is regulated by the Office of Rail and Road (ORR). The origins of the ORR lie in the Office of Rail Regulation, created on 5 July 2004 by virtue of the Railways and Transport Safety Act 2003. It later became the Office of Rail and Road, responsible for overseeing Highways England under the Infrastructure Act 2015. As part of its regulatory duties, ORR commissioned an independent review into Highways England cost estimating practices in 2019, which included a focus on major projects. The findings from the report describe "consistent, templated cost estimation products with each prepared by its cost estimating team in collaboration with project teams for every major project and at every Project Control Framework (PCF) stage", including:

- Cost estimate summary sheet: containing a detailed breakdown of costs for development, land, preliminaries, construction, tax, utilities and supervision.
- Range estimating template: to determine additional risks estimates and generate a three-point estimate profile for relevant items.
- Estimate release form: essentially an assurance document to confirm the procedural compliance and calculation accuracy.

The report also identifies three main estimating approaches, aligned with the relevant and sequential stages of the Project Control Framework, and described in the *Highways England Cost Estimation Manual*.

1 First-principles, or 'bottom-up' estimating: Using detailed estimates for labour, plant and materials for each item of the works, typically based on a schedule of quantities and rates.
2 Parametric estimating: Generally used to confirm 'bottom-up' estimates, using the relationship between variables to calculate the cost or duration through statistical methods to determine cost estimating relationships. The independent report identifies a number of approaches by Highways England to reflect particular schemes, including 'Smart Motorways', bypass and widening schemes, and a preliminaries cost template.
3 Analogous estimating: Used with historical data for similar projects, and relevant where there is limited information. Analogous estimates are generally considered to be 'top-down' and therefore unlikely to be as accurate as other estimating techniques.

The report concludes that there have been variances in costs across Highways England's portfolio in recent years but does not attribute these to estimating inaccuracy. 'Scope change' and 'external impacts' are specifically identified as the primary cause of cost increases.

## 5.7 Conclusion

This chapter has explored the cost estimating paradox from the perspective of major project delivery in the UK through a series of interrelated problems illustrated by case studies drawn from the UK Government's Major Projects Portfolio (GMPP). Initially, we explored the natural tendencies for humans to seek 'certainty' and the potential for important data to be disregarded in the decision-making process. Second, we problematised the need for, and the paucity of high-quality data at the front-end of a project by considering the tension that exists between the availability of information early in the project lifecycle and the necessity to quantify costs and benefits as part of the business case. Third, we considered the reasons as to why cost estimating is deterministically influenced, and the impact that this may have on the long-run perception of project success. Fourth, we posited that 'the public gets what the public wants' – a provocation that the public 'at large' tend to focus their attention on the 'costs' rather than 'benefits' of public spending – and thus the pressure to deliver 'on time, on cost' is, ostensibly, a pressure that is exerted chiefly by the public. This conundrum led us to seek to problematise the project performance versus project success tension from a wider socio-economic

perspective. Finally, we explored the absence of standardisation in the use of estimating practices for major projects and the implications that this may have for wider improvement to estimating practices across government projects and programmes.

## Note

1 House of Commons Public Administration and Constitutional Affairs Committee, Delivering the Government's infrastructure commitments through major projects, Third Report of Session 2019–2021 Report, together with formal minutes relating to the report, ordered by the House of Commons to be printed 23 July 2020.

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# 6 Incentives and politics

## The perverse incentives paradox: root cause of many other paradoxes; the case of the Dutch Betuweroute

*Bert van Wee*

### 6.1 Introduction

The transport system in general, and, more specifically, transport infrastructure projects as part of that system, has major impacts on society. On the positive side, it allows people to carry out activities in different places, and companies to transport goods. Without an adequate transport system, people could not easily reach jobs several (tens of) kilometres away from their place of residence; they could not easily reach hospitals, recreational facilities and many other destinations. In other words, the transport system provides access to destinations. That access contributes to the economy, and also to the well-being of people. Without an adequate transport system, goods transport costs (in terms of money, time and effort) would be way higher, negatively influencing the economy and strongly affecting the arrangement of production stages and trade patterns.

On the downside, building infrastructure networks or projects, such as motorways or railways, costs a lot of money – in Western countries often in the order of magnitude of £10–30 million per kilometre – with added costs for maintenance and repairs. In addition, line infrastructures are barriers to animals and people, the use of infrastructures causing environmental impacts ranging from climate change due to greenhouse gas emissions to local noise and air pollution. It is also important to note that the pros and cons of transport infrastructure projects are not equally distributed across population groups and other actors. In general terms, the users of projects tend to benefit, while the non-users face disadvantages such as noise, exposure to pollution and barrier effects. Zooming out, the general taxpayer pays for the costs, whereas not all taxpayers benefit equally from transport infrastructure. Not only is the distinction between users and non-users relevant, but there is also a distinction between categories of users, for instance by income group or region. For example, high income segments of the population generally drive more by car, and fly more than low income segments.

Consequently it is understandable that decisions on such projects often induce fierce debates, and it makes a lot of sense that many countries have a

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ministry for transport, responsible not only for preparing decisions on investments and maintenance of transport infrastructures but also for dealing with the downsides.

On the face of it, one would expect decision-making processes in general, and on transport infrastructure in particular to follow a logical line of reasoning, such as (1) assessing what the problem or challenge is, (2) listing candidate solutions, (3) evaluating the pros and cons of candidate solutions and, finally, (4) making decisions. To support such a line of reasoning, several tools are available to assess the pros and cons of policy options (see Mouter 2020, for a recent handbook on the most common evaluation tools). Cost-Benefit Analysis (CBA) and Multi-Criteria Analysis (MCA) are the most commonly applied methods, other methods being Environmental Impact Assessment, Strategic Environmental Assessment and Cost-Effectiveness Analysis. However, decision-making processes often do not follow the line of reasoning as presented above. Literature shows that the outcomes of CBAs on transport projects are poorly correlated with the final political decisions (Annema et al. 2017; Eliasson et al. 2015; Odeck 2010). I do not want to argue that this definition is problematic per se. There could be good reasons for politicians to have preferences other than those implicitly suggested in a CBA. For example, a Green party may value environmental impacts more highly than assumed in a CBA. So the question of when a project is considered to be a success can be answered in multiple ways, depending on a person (politician or other) or organisation's perspective and priorities. (See Chapter 2 of this book and the A303 example for a further discussion on what is 'success' in the case of transport infrastructure projects). As long as the problem of the challenge is clear, the candidate solutions are listed clearly, and the pros and cons are clearly assessed, politicians can choose the solution they prefer, or decide to do nothing at all. This process allows for a mature and reasoned debate.

On the other hand, a less explicit line of reasoning leaves room for perverse incentives. Samset and Volden (2016) refer to the paradox of perverse incentives as follows:

> public investments with no financial obligations for the target group may cause perverse incentives and result in counterproductive projects". They further explain: "The state often appears as a generous donor on behalf of taxpayers when financing projects that benefit specific groups or geographical regions. […] When a project does not entail financial obligations for recipients, there is no incentive to opt for the most socially beneficial or cost-effective alternative. Different actors may have a vested interest in certain projects being chosen. […] The term perverse incentives refers to the situation where one or more actors are motivated to make choices resulting in a project that is a complete failure seen in retrospect.
>
> (p. 308)

This chapter discusses the process leading to a positive decision to construct a controversial rail freight line connecting Rotterdam Harbour to the hinterland, mainly the German Ruhrgebiet: the Betuweroute (also labelled as the Betuweline).

It is not easy to be crystal clear in selecting the proponents of the Betuweroute, but key players are the Port of Rotterdam authorities, the (rail) goods transport division of the former Ministry of Transport, and interested groups of companies active in the transport sector. The Port of Rotterdam would undoubtedly benefit from the Betuweroute, because the connection between the port and the hinterland would improve, as a result of which the Port of Rotterdam would become more competitive relative to other harbours (Antwerp, Le Havre and North German harbours). However, the Port of Rotterdam would not have to pay for the line, so it is understandable that they wanted the Betuweroute to be built. For the same reason, it is understandable that interested groups of transport companies wanted the line: it would reduce their generalised transport costs (if not, they would not use it), whereas they would not have to pay for the line. Note that the tariffs for using rail infrastructure do not cover all costs. EU regulations imply that the variable costs should be paid by the users, but not the fixed costs. The position of the goods transport division of the Ministry of Transport is a bit more difficult to understand. At the time, there were quite close relationships between that division and the goods transport sector. Of course the civil servants would not have to pay for the Betuweroute themselves. In the Netherlands, as in many other countries, there is competition not only between ministries in their claims for state money but also within ministries. My impression is that the goods transport division had an interest in attracting more money for goods transport infrastructure, in this case the Betuweroute, to increase the importance of that division.

The methodology used for this chapter lies mainly in presenting a structured impression based on long-term involvement of the author in debates related to the Betuweroute, research on its environmental impacts, and many contacts with politicians, interested groups, academics and others. Examples of this involvement include: a Dutch language article in a professional journal forecasting that the costs would be about four times higher than announced in the policy documents (Van Wee 1994); a study on the expected environmental impacts of the Betuweroute (Van Wee et al. 1994); supervising a PhD student studying cost overruns of large infrastructure projects in the Netherlands in general, and making detailed analyses of informal and formal decisions and related cost estimates of the Betuweroute (and also the High Speed Rail line from the Netherlands via Belgium to Paris) (Cantarelli et al. 2010a); academic support of a committee advising on the role of parliament in decision-making on large transport infrastructure projects; and numerous contacts with the media.

Section 6.2 describes the Betuweroute. The following section, 6.3, explains what went 'wrong' in the process leading to a positive decision. This

section discusses the key issues in main lines. Section 6.4 elaborates on how this process can be explained, followed by Section 6.5, which zooms out, comparing the results with other projects and the literature. Section 6.6 links the perverse incentives paradox to other paradoxes presented by Samset and Volden (2016), arguing that the perverse incentives paradox helps to explain several other paradoxes. Some of the issues that went wrong, already introduced in Section 6.3, will be discussed in more detail, from the perspective of the additional paradoxes. Section 6.7 suggests what we can learn from the Betuweroute experience. Finally, Section 6.8 summarises the most important conclusions of this chapter.

## 6.2 The case of the Betuweroute

The Betuweroute is a 160 km long, dedicated rail freight line connecting Rotterdam Harbour to the hinterland, mainly the German Ruhrgebiet, and opened in 2007. The discussion on the potential construction of the rail freight line started in the mid-1980s, in a context in which the share of rail in goods transport in the Netherlands was quite small and declining. Between 1970 and the mid-1990s, the share of rail freight had dropped from about 8% to below 5% of all goods transported in Dutch territory (KiM 2016). Rail also played a small role in the transport of goods to and from Rotterdam Harbour. Germany had plans to invest billions of euros (Marken at that time) to improve the rail infrastructure connecting North German harbours to the hinterlands. By then, Rotterdam Harbour was the largest harbour worldwide (expressed in tons of goods transshipped). The fear of Rotterdam Harbour not being as competitive any more relative to the Northern German harbours, and maybe also to those of Northern France (Le Havre) and Belgium (Antwerp), probably played an important role in the debate.

In addition, there were increasing concerns about the environment in general, both worldwide, as expressed by the Brundtland report, 'Our common future' (World Commission on Environment & Development 1987), as well as in the Netherlands. These concerns also applied to the environmental impacts of transport. Depending on the indicator used, the transport sector generally had (and still has) a large share in the emissions of substances such as $NO_x$ and $CO_2$ and was a major source of noise nuisance. Per ton kilometre, road freight emissions were way higher than those of rail (Van Wee et al. 1994), and a shift from road to rail was seen as an option to reduce the environmental pressure of freight transport. However, the rail transport system was generally considered to be not very mature, and on many tracks, rail freight was combined with passenger transport. This also applied to most of the rail to be transported from Rotterdam Harbour to the hinterland. The ambition of a strong increase in the volume of goods to be transported from Rotterdam Harbour to the hinterland raised concerns about the capacity and quality of the rail freight infrastructure.

Concerns about congestion also played a role. In the late 1980s and 1990s, congestion levels in the Netherlands were increasing (as in almost all Western and non-Western countries), and there were particular concerns about congestion levels on the motorways connecting Rotterdam Harbour to Germany. In the Dutch Second Transport Structure Plan (1990) specific corridors considered to be vital for the Dutch economy were prioritised, the connection between Rotterdam Harbour and Germany being one such prioritised corridor.

To summarise, for reasons of the economy (including congestion) and the environment, the quality of rail freight infrastructure connecting Rotterdam Harbour and Germany was considered to be problematic. The debate started with a solution, the Betuweline, without making clear as to what it was a solution for, other than in quite general terms, as explained above. The first argument used by proponents was an economic argument: the Dutch economy would benefit from building the Betuweroute. When the CPB, the Netherlands Bureau for Economic Policy Analysis, wrote a report that the Betuweroute would probably not be economically viable (CPB 1993), the argument that the environment would benefit became more important in the debates. However, a study on the environmental impacts of the Betuweroute (Van Wee et al. 1994) revealed that the impact of building the Betuweroute on Dutch freight emissions would be very low (1%–2.5%) or could even be absent if there was no high level connection to the German rail freight system (the decision of Germany to build their part of the line was not yet made). Emission reductions could only be realised when additional rail freight was mainly the result of a shift from road to rail. But in the economic underpinnings of the Betuweroute, proponents argued that the rail line would attract additional freight via the Netherlands, at the cost of Belgium and German harbours. It was argued that of the additional goods transported via the Netherlands (due to the Betuweroute), 50% would not be transported via the Netherlands (but via neighbouring countries), 40% would be transported via barge, and only 10% would be transported via road (Van Wee et al. 1994). This explains why the report on the environmental impacts of the Betuweroute argued that, in this case, the environmental benefits would be negligible: the substitution from road to rail would be very limited. So, either the Betuweroute was to some extent beneficial for the economy (mainly because more goods would be transported via the Netherlands), but then there were no environmental benefits, or vice versa. In addition, if there were environmental benefits, the cost-effectiveness of the Betuweroute would be extremely low (Van Wee 1994). Later it was argued that the Betuweroute would reduce congestion on the competing motorway (from Rotterdam to Germany), but traffic experts expected this reduction to be marginal. Note that the demarcation for all calculations was the Netherlands, both in the case of the economy and the environment. It could be that increased emissions on Dutch territory, because additional freight would be attracted, would lead to a reduction in emissions on German or Belgian

territory. Of course, comparable distribution effects apply to economic impacts, so the demarcation to focus on Dutch territory for both the environmental and economic effects was at least consistent.

## 6.3 What went 'wrong'?

From the perspective of 'rational decision-making', several things went 'wrong', leading to a positive decision to build the Betuweroute. As argued above, I assume 'rational decision-making' to at least include the following steps (see also Chapter 3):

- a clear description of the problem or challenges
- a selection of candidate options
- an ex ante evaluation of the pros and cons of candidate options
- a decision including the rationale relative to the three previous points.

I realise there are many other, often more complicated, process models, but these four steps are, in my opinion, the minimum requirements.

Below I briefly list several violations of these four steps, returning to several of the points made in more depth in Section 6.6, where I compare the process leading to a positive decision to build the Betuweroute to several of the other paradoxes presented in Samset and Volden (2016).

1 There was no clear debate on the problems/challenges/aims.

In informal debates, proponents argued that the capacity of the hinterland rail connection was simply too low to accommodate the forecasted demand, so more capacity was needed. The debate started with a solution, the Betuweroute, without a clear analysis of the challenges, problems or aims. As explained above, there were some notions with respect to the economy, the environment and congestion, but these were formulated in quite general terms. Moreover, the topics were considered specifically as far as they were relevant to the transport of goods from Rotterdam Harbour, but not in general terms. For example, there were no debates on the general performance of the Dutch economy, and its strengths and weaknesses, leading to the conclusion that lack of capacity in the rail infrastructure for the transport of goods from Rotterdam Harbour to the hinterland would play a significant role in the economic performance of the Netherlands, and that improving the rail freight system was to be prioritised over any other 'solutions'.

Obviously key actors wanted the Betuweroute for whatever reason(s), and were not interested in the rationale of the aims, problems or challenges underpinning the project. From their perspective, this makes sense: if one wants something, a debate that could challenge that desire is not attractive because it could lead to other solutions, or even to not taking any action at all, because no solution could be a 'good' solution for

the problem or challenge. For a wider discussion on the front-end stage of projects: see Chapters 3 and 4 of this book.

2 No alternative solutions were considered.

Also as explained above, no alternative solutions were considered, such as inland shipping or road related solutions. This despite several claims in the debates that there was much surplus capacity in the barge system, and high quality waterway connections of Rotterdam Harbour to the hinterland. The Netherlands is located on the sea side of several large rivers, providing very good access by barge to many destinations in Northwestern Europe, especially in the Netherlands and Germany. Also the road network, particularly the motorway network, is very dense in the Netherlands, so several alternatives to rail transport already existed, and new infrastructure or the reduction of bottlenecks in existing infrastructure would increase access via roads or waterways considerably because of the availability of already existing high level networks.

In addition, for the dedicated rail freight line, only one alternative was proposed: the line as it was built. There was only one additional option: a split of the line on Dutch territory, including a rail freight line to the north of Germany. However, that option was considered to be not realistic, and was soon abandoned.

Again, as for topic 1, this made sense from the perspective of those interested in the Betuweroute, because a debate on alternative solutions to the aims, problems or challenges could lead to alternatives such as measures in the area of inland shipping, which were considered to be not attractive by the proponents of the Betuweroute.

3 The cost estimates were unrealistically and deliberately low, and the demand forecasts were flawed.

In the Second Transport Structure Plan (STSP), published in 1990, the Betuweroute was announced at a cost of £1.1 billion (2.3 billion guilders at the time, the conversion rate being 2.2 guilders per euro). For a 160 km rail line, with many barriers such as a channel, in a densely populated country, this was a ridiculously low estimate, not only from hindsight but back in 1990. I made a back-of-the-envelope calculation based on the costs of a few other large transport infrastructure projects, and estimated the costs to be about £4.5 billion (10 billion guilders) (later published in Van Wee 1994). In 1990/1991, I needed a more adequate estimate for the development of long-term scenarios for Dutch society, published in 1992 by the CPB. On 'phoning a contact for the Betuweroute at the Ministry of Transport, asking for a realistic cost estimate, I was shocked to receive the reaction: the line could definitely be built for £1.1 billion, and it was absurd that I had some doubts. My objection that the estimated costs per kilometre would be way lower than the costs of other recently built transport infrastructure projects was waived away: the ministry was sure that the line could be built for £1.1 billion. I then realised that something was wrong, and this was politically very sensitive. I checked

my calculations, asking a few other researchers for feedback, and they confirmed my estimates. I published my concerns in 1994 in an article in a professional journal (Van Wee 1994). By then I was working for a governmental institute closely related to policy making, the National Institute of Public Health and the Environment (Dutch abbreviation: RIVM), which later became the Netherlands Environmental Assessment Agency (Dutch abbreviation: PBL). All the research we did was as input for policy making, but was not allowed to draw conclusions on what policy makers should or should not do. Because my role was that of an independent researcher, not an activist trying to influence decisions, and not that of a researcher working for a university (and thus at a greater distance from policy making), I took no further action.

Later an official of the ministry who was heavily involved in policy making for the Betuweroute told me she did not sleep at all for two nights after I published the article, because she was afraid politicians would read it, and the positive decision to build would be endangered (which did not happen). The final costs of the Betuweroute were £4.7 billion (Cantarelli et al. 2010a). It seems that my estimate had been very accurate, but note that due to inflation between 1994 and 2007, £4.7 billion at 2007 prices represents a lower value than at 1994 prices.

Also the demand forecasts were not at all realistic (Meijdam 1993), but more wishful thinking. In the community of transport economists, the demand forecasts made on behalf of the ministry were considered to be ridiculously high, while those in the scenario without the Betuweroute were considered to be ridiculously low. Consequently the impact of the Betuweroute on rail freight demand, and the likely economic benefits of the line were heavily overestimated.

4 Several political parties supported the line at a very early stage, without any information on the problems/challenges, alternatives and effects.

Before the formal decision to build, several political parties committed to the Betuweroute, without having a clear picture of the problems/challenges and alternatives, or their pros and cons. In the Dutch context (and in many other democracies), it is difficult to change a political position after early commitment: politicians who do this get the reputation of being unreliable. This early commitment led to the installation of a committee to advise on the role of parliament with respect to large infrastructure projects (TCI, Temporary Committee Infrastructure projects) – see below. One of its recommendations was to not support or reject projects or proposals before key process steps (as presented above) have been made.

5 Two metres of reports were published preceding the decision-making, but many of those were manipulated or biased. The reports also made different assumptions with respect to the macro-economic scenarios when estimating the impacts of the line. No clear report summarising the main pros and cons was published.

The previous topic does not suggest there was no research on the impacts of the Betuweroute. The formal decision to build up all the reports together resulted in a pile 2 metres high. One of the problems was that this was way too much for politicians to read/check, even though the reports were published over several years. Another problem was that the assumptions behind the estimates were different, inconsistency between the claimed economic benefits (as a result of attracting more goods transport via the Netherlands) and the claimed environmental benefits (due to a shift from road to rail) being an example. A third problem was that several studies were not conducted according to academic standards, and were far from neutral. Several reports were written with the a priori idea that these should support a positive decision to build the Betuweroute. Academics criticised some of those reports heavily, but their criticisms generally did not reach politicians. A final problem was that there was no document giving a systematic and clear overview of all the relevant pros and cons of the Betuweroute, let alone possible alternatives. Several former members of parliament told me later that they missed a clear and neutral document of only a limited number of pages that summarised the rationale for the Betuweroute as well as providing an overview of the pros and cons.

6 There was no systematic evaluation of all the pros and cons (CBA or MCA).

Consequently any systematic comparison of the pros and cons of building the Betuweroute, such as a cost-benefit analysis or multi-criteria analysis, was lacking. The reports written only provided pieces of the jigsaw puzzle, explaining the effects, but the pieces did not fit, nor did they give the complete picture. An ex ante evaluation of the pros and cons of the alternatives (in this case, at least, to build or not to build the Betuweroute, preferably also of alternatives) would lend discipline to the debate. First of all it would lead to the development or application of future scenarios that are internally consistent. In case of the Betuweroute, as explained above, the assumptions behind the economic argumentation were inconsistent with the implicit assumptions underpinning the environmental argumentation. Second, at least for CBAs, there is quite a mature debate on how CBAs should be carried out, and to some extent this also applies to the state of knowledge in the 1990s. It should hence have been easier to trace manipulation. Third, such an ex ante evaluation would probably have received a lot of attention from the media, interested groups (for and against the Betuweline) and academics, and thus it would have fuelled the debates.

7 There was no idea about opportunity costs.

In most countries, the budgets of ministries are relatively stable. This implies that the yearly budgets for new transport infrastructure projects do not vary much between years. This means that projects that are financed come at the cost of other projects that could have been built. In

economic terms, building a project implies opportunity costs: an opportunity to build one or more other projects is missed, and so are the related benefits of those projects. It was not clear at the costs of which projects building the Betuweroute did come. It might have been at the cost of other projects that were never realised, or were postponed.

This problem was not limited to the Betuweroute only, because in the years when it was constructed, other large-scale transport infrastructure projects were built, such as the high speed rail line connecting Amsterdam and Rotterdam to Antwerp, Brussels and Paris, and extensions of the port of Rotterdam. Those actors with an interest in smaller transport infrastructure projects often complained that these large projects took too large a share in the overall budget of the Ministry of Transport for transport infrastructure projects. It is important to realise that in the Netherlands, local municipalities and provinces have limited self-generated financial resources. Consequently they rely on financial resources provided by the Ministry of Transport (at national level).

8 To increase support, many additional measures to reduce local environmental impacts were taken.

The original plans for the Betuweroute included hardly any measures to reduce the local impact, such as noise walls or barriers. I cannot prove it, but I always had the impression that this was done deliberately to achieve as low as possible cost estimates. But that was not at all realistic. For example, in 1978 a law had already been implemented to reduce exposure to high noise levels of road and rail projects. The early designs of the Betuweroute did not fulfil the related legal requirements for noise.

Local resistance against the Betuweroute was fierce: many local municipalities protested because they did not benefit from the line, but did face negative local impacts such as noise, barrier effects and visual impacts. To reduce local resistance, many local measures were added to the original plan. These measures were partly needed for legal reasons (noise) but more measures were added. No analysis of the additional costs and benefits of those added measures was made.

## 6.4 How can this be explained?

An important question is: how can what went 'wrong' be explained? Samset and Volden explain this, emphasising the differences between aligning the recipients' objectives and national objectives, and information asymmetry. Both explanations definitely apply to the Betuweroute. As explained above, the proponents had specific objectives based on self-interest, rather than national objectives. They also had way better insights than parliament on the pros and cons, based on an overload of reports, that were largely not neutral.

But there is more to add to the explanation of what went wrong. The area of political economics is very useful in helping to understand what went wrong. I depart from the political economics framework for the implementation (or

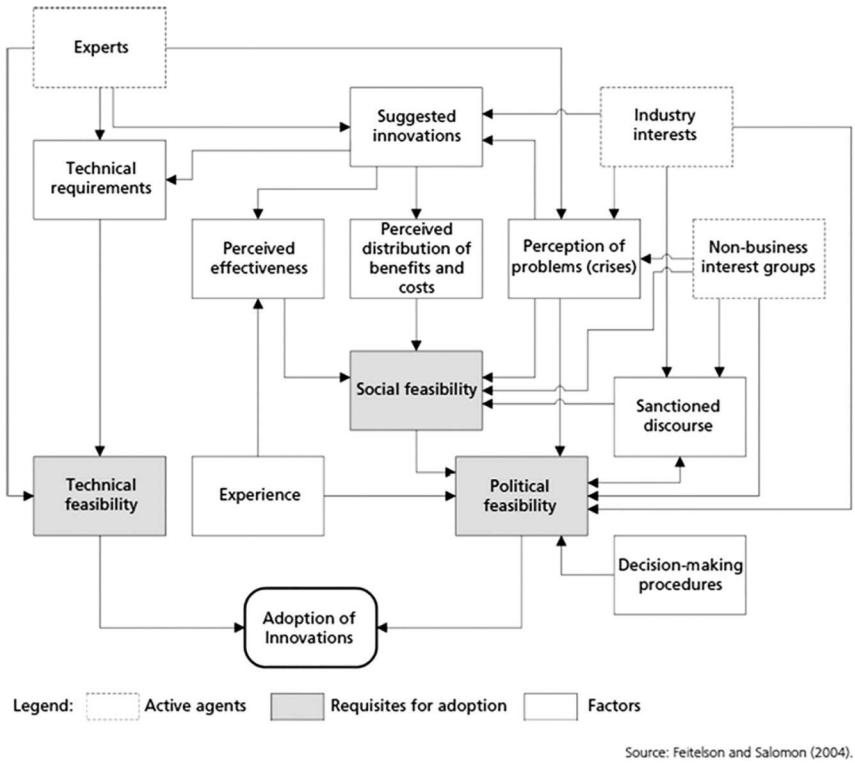


*Figure 6.1* A political economy model of transport innovations.

not) of candidate innovations, as proposed by Feitelson and Salomon (2004) and visualised in Figure 6.1.

The framework is very useful to understand the success or failure of complex candidate innovations that need the support of both public and private actors, such as large-scale transport infrastructure projects. In most countries such projects are publicly financed. Even in countries like France, where parts of the transport infrastructure are privately financed (toll roads), support of the public sector is needed.

I use this framework to help understand what went wrong in the main. Figure 6.1 shows that candidate innovations need to be technically and politically feasible. The Betuweroute is a conventional rail line, so technical feasibility was not at all a point of discussion. Figure 6.1, in addition, shows that for political feasibility, social feasibility is also important. Although there was substantial resistance from local municipalities and other interest groups along the proposed route, overall, the social support was quite strong. Awareness of the increasing congestion on motorways and the environmental pressure of road transport fuelled this support, and was dominant in the sanctioned

discourse (see Figure 6.1). The perception was that a dedicated rail line from Rotterdam Harbour to the German Ruhrgebiet would be an effective solution to these problems. In addition, several actors, especially organisations such as Rotterdam Harbour, and transport interest groups, supported the rail line. A factor less visible in the framework is that in the preceding decades, rail investments had focussed on passenger transport, not freight transport. This, combined with the low share of rail in freight transport on Dutch territory resulted in a positive attitude of many actors towards investing in a rail freight line, that is, the Betuweroute.

Looking to what went wrong, I will next discuss some possible explanations.

1 There was no clear debate on the problems/challenges/aims.
2 No alternative solutions were considered.

   Those actors with an interest in the rail line, such as Rotterdam Harbour, and highly placed people working for the former Ministry of Transport on rail freight had no interest in first discussing the precise problems and alternative solutions. They wanted the Betuweroute, and were able to put it on the political agenda at an early stage of the discussions. The decision-making procedures (see Figure 6.1) did not ask for a clear assessment of the problems/challenges, nor for alternative solutions. In other words, the perverse incentives paradox very well describes what went wrong in these respects.
3 The cost estimates were unrealistically and deliberately low. The demand forecasts were flawed.

   Comparing the final costs with those on the decision to build, cost overrun appeared very limited, but as explained above, comparing the final costs with the original cost estimates published in 1990, the cost overrun was very large (Cantarelli et al. 2010a). This is not uncommon: the vast majority of large transport infrastructure projects worldwide face cost overruns (Flyvbjerg et al. 2014), the strategic behaviour of those having an interest in a positive decision to build being a likely explanatory factor (Cantarelli et al. 2010b).

   The problem with strategic behaviour and cost overruns is that those who benefit from a positive decision to build are not those who need to pay. It is the tax payer who pays, or – if one assumes the total public budget for transport infrastructure to be constant – those who would have received the benefits from projects that could not be built. Because it is seldom made explicit which those projects are, those who lose out are set to remain anonymous.

   Comparable problems exist with respect to demand forecasts.

   Figure 6.1 explains that perceived problems and the distribution of cost and benefits influence social feasibility. The congestion and environmental problems were widely shared, but due to the notion that the costs would be quite low, the distribution of costs and benefits hardly played any role in the early stages of the debate.

4 Several political parties supported the line at the very early stages, without any information on the problems/challenges, alternatives and effects.

In line with the previous point, several political parties committed at an early stage, probably because they thought the Betuweroute would be an interesting option to reduce congestion and the environmental problems of road freight, and would consequently be socially feasible. Probably they did not worry too much about the distribution of costs and benefits because of the low cost estimate overall. Next they thought it would be a nice strategic decision to improve the competitiveness of Rotterdam Harbour, and this position was probably fuelled by input from industry (companies in the area of goods transport and Rotterdam Harbour) who suggested there would be a problem with the competitiveness of Rotterdam Harbour if the Betuweroute were not to be built ('perception of problems', in Figure 6.1). They were probably influenced by actors having an interest in the early commitment of politicians.

5 Two metres of reports were published preceding the decision-making, but many of those were manipulated or were at least biased. Moreover, the reports made different assumptions with respect to the impacts of the line.

6 There was no systematic evaluation of all the pros and cons (CBA or MCA).

At the time, there was no tradition of systematic evaluations on the pros and cons of candidate large transport infrastructure projects. Hence it was relatively easy to order studies and reports that considered only a part of the questions to be answered. It was also relatively easy to select non-neutral research institutes which wrote reports that the ministry wanted to be written. The early commitment of several political parties (see above) resulted in support for the positive attitude of successive Ministers of Transport, and because of that early positive commitment, the manipulated reports did not receive much attention from politicians. The decision-making procedures (see Figure 6.1) did not prescribe how research needed to be done, or how assessments of the pros and cons needed to be made.

7 There was no idea about opportunity costs.

By then (and still) the concept of opportunity costs hardly received any attention in debates on large infrastructure projects – debates were mainly on projects in isolation – in terms of the decision-making procedures. The Betuweroute debate was no exception. Discussions on opportunity costs would have extended the debate relative to considering alternatives to the Betuweroute, and the main actors did not have an interest in such wider talk. The decision-making procedures (see Figure 6.1) did not ask for opportunity costs to be made explicit.

8 To increase support, many additional measures to reduce local environmental impacts were taken.

Because of the early commitment of several political parties and the positive attitude of successive Ministers of Transport, opposition needed to be avoided as much as possible, or, formulated in terms of Figure 6.1, social feasibility was 'bought'. Therefore, if local municipalities protested against the Betuweline because of local impacts, the reaction was often to reduce such impacts by adding hardware to the rail line.

To summarise, those with an interest in a positive decision to build the Betuweroute did not have to pay its costs, and had no interest in a more mature procedure as suggested above (the problems/challenges, options, evaluation). In addition to this discussion based on the framework of Feitelson and Salomon, public choice theory (Buchanan 1986) is helpful in understanding the positive decision to build the Betuweroute. Public choice theory explains political behaviour from an economic perspective, assuming the self-interested behaviour of people. Politicians want to be (re)elected. They receive more attention by playing a role in clearly visible large-scale projects than, for example, in reducing the maintenance problems of infrastructure, or from supporting smaller, less visible projects, even if these have better benefit to cost ratios. Flyvbjerg et al. (2014) argued that politicians have more to gain from a positive decision to build large-scale infrastructure projects, than to lose from the cost overruns of such projects.

Specifically for the perverse incentives paradox introduced above, explanations are first that the Port of Rotterdam supported the project but did not have to pay, so it was easy for them to ask for the line. Second, the ministry probably had as a perspective: the budget for transport infrastructure is constant. Which project to choose? Because passenger transport then dominated expenditure, those who were involved with goods transport also wanted some money to be spent on goods transport infrastructure.

## 6.5 The broader context: other projects and literature

This section elaborates on the question as to what extent the results can be transferred to other contexts. The overall picture is that the Betuweroute is in some respects a 'worst in class' example, but it is not unique.

As explained above, the Betuweroute faced a strong cost overrun if we compare the final costs with those in the Second Transport Structure Plan. Cost overruns are by no means an exception to the rule, the strategic behaviour of those with an interest in a positive decision being one frequently suggested explanation (Cantarelli et al. 2010b; Flyvbjerg et al. 2014); (see also Chapter 5 of this book). Perverse incentives apply in the sense that those responsible for unrealistically low cost estimates do not pay the bill, literally and figuratively. Note that cost overruns also have other explanations (Cantarelli et al. 2010b), optimism bias being an important one. Optimism bias implies

that those estimating costs did not intend to underestimate them, but were too optimistic. If optimism applies, one could argue that there is still a problem with 'wrong incentives' because there is a lack of incentive to do 'better'. Those estimating costs could be provided with guidance on how to estimate costs via institutional rules. A specific method to arrive at cost estimates is Reference Class Forecasting (Flyvbjerg and COWI 2004). This method implies that cost estimates of comparable projects realised in the past are used to estimate the costs of new projects. In addition, it is an option to allocate some of the risks of 'wrong' cost estimates to private parties.

Next, overly optimistic estimations on the use of transport infrastructure projects are also not an exception: many ex ante evaluations overestimate demand (Van Wee 2007). Institutional rules could provide incentives to do 'better'.

Looking at other projects, the most comparable project was the already introduced high speed rail line from the Netherlands to Belgium and Paris, completed in 2009. Comparable problems existed with respect to cost overruns, demand shortfall and decision-making. In addition, after the opening of the line, there were problems later on with the poor quality of the trains, and currently (2021) the line has only limited use, way less than forecasted / assumed in the decision-making processes.

Another example is a not (yet) built fast rail line (conventional rail, HSL or Maglev) connecting the North of the Netherlands to the Randstad area (Amsterdam and Schiphol Airport). The North of the country is doing economically less well, at least in terms of unemployment rates, average incomes and diversity of the economy. About two decades ago, discussions started on building a fast rail line to reduce these problems. At an early stage, some kind of commitment was given to the Northern provinces to build the line. Two CBAs were carried out, both showing that the costs would be much higher than the benefits. Related travel demand modelling studies showed that trains would have increasingly lower occupancy rates on the more northerly sections of the line. Economic impacts would be limited, and the increased number of jobs in the North would not come at the cost of the prosperous West, but at the cost of the Eastern part of the country, also a region that is not doing well economically. Partly based on the CBA results, a negative decision was made, and the North received other forms of financial compensation. Nevertheless the debate was re-opened, and a recent study was carried out, a CBA being part of that study. Again the conclusion was that costs would be way higher than benefits (about 2.5 times higher, at least). So, again, this is an example of a discussion in which only one type of solution was proposed – a fast rail line connecting the North of the Netherlands to the Randstad area. In this case, multiple alternatives to that rail line were considered, such as fast conventional rail versus high speed rail. Again, the proponents of the line did not have to pay for it, and the perverse incentives paradox describes what happened.

Zooming out to the much wider category of Dutch transport infrastructure projects, the way these are financed is of interest. As already explained

above, local and provincial authorities have relatively low 'own income' to spend on transport infrastructure projects compared to other countries. They largely rely on money from the national Government. This has important advantages, because the national Government evaluates candidate policies from a national perspective, not only a local or regional perspective. The risk of departing from the local perspective is that a project could make sense from a local perspective, but not from a national perspective, because the gains for a local municipality come at the cost of losses to other municipalities. For example, improving the canal connecting Amsterdam harbour to the North Sea could be beneficial from the Amsterdam perspective, but not from the national perspective, because Amsterdam and Rotterdam Harbour compete. A disadvantage of the reliance on national funding is that local governments could ask for projects they would not build, and would not have to pay for fully, even if they had the money. After all, they receive most – if not all – of the benefits, but pay only a small part of the costs. On the other hand the national perspective is an example of a 'good incentive', at least from the perspective of the Dutch tax payer.

## 6.6 Relationships with other paradoxes

As explained above, this paper departs from 'the perverse incentives' paradox. The paper of Samset and Volden (2016, p. 299) presents ten paradoxes. The 'perverse incentives paradox' (Paradox 9) influences several of the other paradoxes, at least Paradoxes 1, 2, 3, 4, 6, 7 and 10. In this section, I will argue how. The definitions of all paradoxes below are literally taken from the original paper of Samset and Volden (2016).

1 The success paradox: success is measured in terms of tactical performance rather than strategic performance.

Samset and Volden make clear that success is a difficult term, and can be defined and operationalised in many different ways. They further explain:

> …is necessary to distinguish between the projects' tactical and strategic performance. Success in tactical terms typically means meeting short-term performance targets, such as producing agreed outputs within budget and on time. These are essentially project management issues. Strategic performance, however, includes the broader and longer-term considerations of whether the project would have a sustainable impact and remain relevant and effective in its operational phase, throughout its lifespan. This is essentially a question of getting the business case right, or, in short, of choosing the most viable project concept. […] Strategic performance … includes the broader and longer-term considerations of whether the project would have a sustainable impact and remain relevant and effective in its operational phase, throughout its lifespan. […] Strategic performance is

> a question of how the project performs after the outputs have been delivered.
>
> (p. 300)

Distinguishing tactical versus strategic performance makes sense, and the paradox suggests the focus is often on tactical, not strategic performance. In case of the Betuweroute first of all, to the best of my knowledge, it was not made explicit what 'success' would mean, not even in tactical terms. There were notions of a shortage of capacity on the existing rail tracks for goods to be transported from Rotterdam Harbour to Germany. In addition there were abstract notions that the Betuweroute would be a 'strategic decision', and good for the Dutch economy, but it was less clearly explained what strategic *performance* was to be obtained. This can be understood from the perspective of the paradox of perverse incentives: if strategic performance was specified, if would be relatively easy to show that it was doubtful that the Betuweroute would be a success. If success was defined in quantitative economic terms, the report of CPB (1993) referred to above would undermine the claim that the Betuweroute would be a success.

As Samset and Volden make clear, sustainability should be a component of strategic performance. In the case of the Betuweroute, environmental impact was the most likely sustainability dimension, in addition to economic performance. Indeed, as explained in Section 6.3, environmental impacts were mentioned in the Betuweroute debates. However, it is striking to see the line of reasoning in the arguments. In 1994, I was asked by the Dutch Ministry of Housing, Spatial Planning and the Environment (a ministry that does not exist anymore in its current form) to write a report, together with others, on the average freight emission factors for rail, road and barge. My contact at the ministry told me that the results would be used to quantitatively underpin the plea for building the Betuweroute, from an environmental perspective. Seemingly there was an interest in measuring strategic performance. But the problem was, as explained above, that only providing emission factors would be misleading, because the Betuweroute was, for economic reasons, argued to attract more freight to be transported via the Netherlands and to compete with barge transport. So suggesting that the Betuweroute would be good for the environment because emissions per ton kilometre of rail transport were lower than those of road transport, without including the impact of the economic scenarios (transport volumes by mode with and without the Betuweroute) on emissions would be incomplete, or even misleading. Therefore, we, as researchers, decided to multiply the emission factors by transport volumes for the scenario with and without the Betuweroute, showing that the impact of the Betuweroute on freight emissions would be very low. This was despite the request, and even order, to leave out these calculations. The report hardly gained attention in

the debate, but later on several politicians told me they felt manipulated because as far as they could remember, they had never explicitly received information other than the emission factors. Moreover, as one politician told me, maybe our report had been provided on a Friday afternoon, together with many other documents, to be read over the weekend, when family members expected him to spend time with them, so he could have easily overlooked the report.

As a side note: the calculations we made by multiplying average emission factors for road, rail and barge and transport volumes was a very rough method. As Van Wee et al. (2005) argue, average emission factors do not necessarily apply to specific cases, for several reasons. For example, the characteristics of goods vary by mode, so for the transport of a given type of goods, other factors could apply. In addition, detour factors differ between modes because of different networks, and long distance road transport has lower emission factors than average road transport.

All in all, the perverse incentives paradox explains the occurrence of the success paradox in the case of the Betuweroute: those with an interest in a positive decision to build the Betuweroute had no interest in discussing the strategic performance of the rail line.

2 The paradox of the significance of front-end management: less resources are used up front to identify the best conceptual solution (project governance), than to improve tactical performance during implementation (project management).

Samset and Volden put this paradox in the context of uncertainty and information to reduce uncertainty, and argue,

> It is widely believed that uncertainty is highest at the initial stage, when the project concept is conceived, and that it tends to reduce rapidly as information accumulates over time. […] Major issues such as agreeing on the most effective solution to a problem and the choice of concept need to be dealt with as early as possible – later on is too late. […] Where projects fail strategically, it is likely that the problem can be traced back to decisions in the earliest phases, when the initial idea was conceived and developed. What happens during the front-end phase is therefore essential for a project's success. […] In most cases the key issue at the earliest stage is to shed sufficient light on the underlying problem that provides the justification for the project, and the needs that the project is meant to satisfy. […] It is a paradox therefore that most of a project's planning resources may be spent on detailed planning and engineering, while too little is usually spent on getting the idea right from the start where the potential to reduce uncertainty by means of adding information is the largest. The paradox is that most resources are used to reduce uncertainty during the implementation phase, where the potential is much less.
>
> (p. 301)

In case of the Betuweroute, a lot of documents had already been produced years before the decision to build, but as explained above, there was no information on what the problems or challenges were, and which alternative solutions would be available. The information aimed to underpin the need for the Betuweroute and to increase the likelihood of a positive decision to build. So again those having an interest in a positive decision to build, including the Ministry of Transport and Public Works, did not have an interest in a strategic discussion to identify the problems, challenges and alternative solutions. In other words, the perverse incentives paradox helps to explain what happened in the case of the Betuweroute with respect to the paradox of the significance of front-end management.

3 The paradox of early information overflow: decisions are based on masses of detailed information up front rather than carefully selected facts and judgemental information relevant to highlight the essential issues.

Samset and Volden write about this paradox,

> the front end phase is when fundamental choices are made, uncertainty is at its highest freedom to choose is at its optimum, and available information is most restricted. Adding information, therefore, makes sense – but only to a certain degree. The crucial issue is not the volume but what type of information is needed. […] In the initial phase of a project the priority is to establish an overall perspective, and to analyse the problem in its context, considering the needs and priorities of stakeholders, users and affected parties, in order to come up with a sensible strategy. Opportunities and risks should be considered. Experience suggests that creativity, imagination and intuition can be more valuable at this stage than large amounts of data.

They also emphasise

> the need to invest in relevant information at the earliest stage of a project, while at the same time limiting the search to what is useful for decision-making at this stage. A targeted search for information regarding the main uncertainties likely to affect the project is more cost-effective than an unguided search, since it makes it possible to increase the share of relevant information and reduce the total amount.
>
> (p. 302)

This paradox definitely also applies to the Betuweroute. As explained above, 2 metres of reports were produced, but not the type of reports needed in line with the argumentation of Samset and Volden. The reports aimed to convince decision-makers and others of the need for a positive decision to build the Betuweroute. Again the perverse incentives

paradox helps to explain what happened in case of the Betuweroute with respect to the paradox of early information overflow.

4 The paradox of the opportunity space: the choice of conceptual solution is made without systematically scrutinising the opportunity space up front.

Samset and Volden write about this paradox,

> Every project is initiated to solve some problem or meet some needs. And every project faces a choice of concept in terms of how to solve this problem. Consequently, a key task in the early phase of a project is to identify possible ways to solve the problem it has been mandated to solve (setting up the opportunity space), furthermore to evaluate alternative concepts (limiting the opportunity space), and decide on the one best suited. There is much evidence to suggest that this is not always how things are done. (…). A (…) case study of 23 major public investment projects (Whist and Christensen, 2011) went deeply into how the analytical and political processes interacted during the front-end phase, in order to understand how this affected the outcome of the projects. It was found that the majority of projects started out with a predetermined solution.
>
> (pp. 302–303)

The Betuweroute perfectly matches the pattern found by Whist and Christensen (2011): as explained above, the project started with a predetermined solution. No alternatives were considered. A difference between the Betuweroute and the first part of the description of Samset and Volden is that there was not a clear description of the problem. Moreover, the need was formulated in a narrow-minded way: there was a need for a better rail connection between Rotterdam Harbour and the hinterland. But the need behind that better connection was not made explicit. Again the perverse incentive paradox helps to explain what happened: if those with an interest only want a predetermined solution, then it is better to avoid any discussion on the problems it should solve or the needs it should satisfy.

5 The cost estimation paradox: the focus is on the final cost estimate (the budget), while early cost estimates are overlooked.

Samset and Volden write, referring to a report written by Welde et al. (2014),

> The report discusses possible reasons for the substantial underestimation in early phases. An often used distinction is made between political, technical, and cognitive reasons (e.g. Flyvbjerg, 2005). It may be very difficult to prove that the cause is political, but in several of the projects there were clear indications that the first estimate was deliberately low in order to increase the chance of the project idea being considered. This corresponds well with other studies that

> have attempted to prove that costs are underestimated deliberately to make the projects appear more attractive. (…) Hence, it is clearly a paradox that so little attention is devoted to the initial estimate.
>
> (p. 306)

As explained above, the early costs estimates of the Betuweroute were ridiculously low, and discussing the estimates was a very sensitive matter. I will now elaborate a bit more on the dynamics of the cost estimates. Cantarelli et al. (2010a) introduce the concept of lock-in to explain what happened. Following Woerdman (2004), they explain (p. 793), "Lock-in is created when suboptimal policies are used as a consequence of path dependency, even though a better alternative is present". They explain how low cost estimates might lead to a situation of lock-in, and how politicians and other actors might decide to support a project long before the formal decision to build. They propose a theoretical framework to help understand which factors ('input variables') lead to lock-in (Figure 6.2). It is beyond the aim of this chapter to fully discuss the framework, but it shows that lock-in occurs due a complex interplay of factors leading to escalating commitment, the need for justification, inflexibility and the closure of alternatives. The framework helps in understanding the importance of the cost estimation paradox: cost estimates that are too low might lead to early commitment, long before the formal decision to build. Actors with an interest in a specific project might benefit from the communication of low cost estimates at an early stage, in the hope of early commitment.

Cantarelli et al. show the timeline of cost estimates in the years preceding the formal decision to build (Figure 6.2).

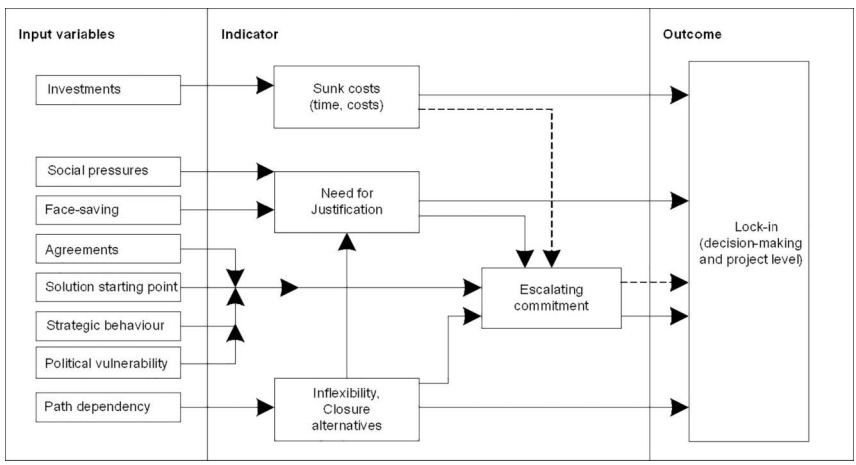


*Figure 6.2* Theoretical framework for lock-in. Solid lines represent the influence of conscious lock-in, dotted lines the influence of unconscious lock-in.

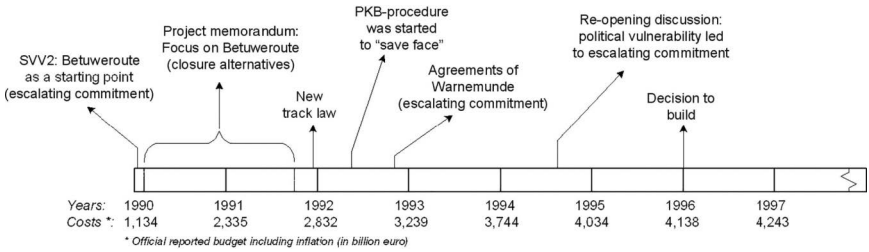


*Figure 6.3* Timeline for the Betuweroute project (decision-making level).

Figure 6.3 shows that the initial cost estimate was as low as £1.1 billion, whereas the cost estimate at the decision to build was £4.1 billion. It is difficult to say at what point of time politicians and other actors had the idea that there was no longer any way back, for reasons of early commitment. The research team (Cantarelli and colleagues) tried to empirically assess these actor specific points in time by contacting the politicians involved in the decision-making process. The responses they received were so low that they had to abandon the study.

Again the pattern is in line with the paradoxes discussed above: the paradox of perverse incentives explains that it made sense for proponents of the Betuweline to come with excessively low cost estimates. Next a process of lock-in occurred, as a result of which there was no way back, long before the decision to build. The theoretical framework presented by Cantarelli et al. (2010a) might be helpful to understand the process of lock in.

Not only is the discussion on lock-in and early commitment relevant to help understand the importance of the perverse incentives paradox and the impact it has on the cost estimation paradox, but it also makes clear that the literature on cost overruns comparing final costs with costs at the decision to build shows only part of the real problem. Because early cost estimates tend to be lower than those at the decision to build, and because of early commitment (as a component of lock-in), it is very possible that cost overruns based on a comparison of final costs and costs at the 'point of no return' are way larger than those that follow from comparing the final costs with those communicated at the decision to build.

6 The paradox of disregarded analyses of costs and benefits: detailed estimation of cost and benefits is commonly done up front, but disregarded by decision-makers, who tend to emphasise other aspects.

Samset and Volden write about this paradox,

> A substantial amount of resources is devoted in major investment projects to establish a decision basis. Detailed Cost–Benefit Analyses are often performed, and complex models are developed to simulate

> traffic volumes and other inputs to these analyses. However, there are indications that decision-makers have little confidence in Cost Benefit Analysis in Norway. […] The paradox in this case is that so much effort is devoted to the calculation of a net present value that decision-makers may not find useful or credible.
>
> (pp. 306–307)

As explained above, no CBA preceded the decision-making process in the case of the Betuweroute. The perverse incentives paradox probably explains why: a CBA would show that the costs would be way higher than the benefits. So the proponents had no interest in a comprehensive, clear and neutral CBA. It is important to realise that at the time of the Betuweroute debate, it was not common to carry out a CBA. But, as will be explained in the next section, the discomfort that many had with respect to the whole Betuweroute procedure and debate led to the obligation to conduct a CBA for large transport infrastructure projects in the Netherlands.

On a side note: about a decade or so ago, I was contacted by an organisation that wanted to organise a conference on the positive decision to build the Betuweroute. This was after the opening of the line in 2007. They suggested the core should be a debate between a proponent of the Betuweroute and someone who was 'against' building it. They contacted me to fulfil the role of the latter. I first explained that I was not 'against' building the Betuweroute, but supported the idea that parliament should be well, clearly, impartially and timely informed. This did not apply to the Betuweroute. Second, I explained that it was very unlikely that the benefits could ever be high enough to compensate the high costs, and that we did know this at an early stage. So, I was willing to make these points, and debate with a proponent. I even made a 'quick and dirty' CBA underpinning my second point. The organisation was pleased with my willingness to contribute. Several weeks later they contacted me again: the conference had been cancelled because none of the proponents was willing to debate with me on this topic at a conference. This gave me the impression that they had already known that the costs would be larger than the benefits, and that parliament had not been informed adequately.

7 The paradox of 'predict and provide': the tendency is to choose a 'predict-and-provide' strategy rather than to explore alternative solutions.

Samset and Volden write about this paradox:

> When confronted with capacity problems, the planners, who are often engineers, almost always recommend increased capacity based on estimates of future demand. However, unsurprisingly, there is often excess demand for public services and infrastructure offered free-of-charge to citizens. The need should not be defined narrowly

> as a need to increase capacity but rather as a need to solve the congestion problem. The latter allows for a variety of measures, including demand regulation, congestion pricing, and legal and informative measures, most of which are far cheaper than a construction project to expand capacity. […] The paradox in this case occurs when needs and benefits assessments in public infrastructure projects are decoupled from overriding political priorities and goals, possibly because such overriding societal goals are conflicting and multidimensional. (p. 308)

This definitely applied to the Betuweroute debate. A manipulated forecast was made showing a very strong increase in rail freight demand, and that there was definitely not enough capacity on the existing rail infrastructure. Proponents hence argued that the line needed to be built. The variety of other measures as addressed by Samset and Volden was ignored. The perverse incentives paradox clearly explains that this makes sense from the perspective of the proponents of the line: if you want a line, you do not want a debate on alternative solutions for rail freight transport capacity; neither do you want a debate on the overriding political priorities and goals, in this case relating to the economy, environmental impacts of freight transport, or congestion on the road connection from Rotterdam Harbour to the hinterland.

## 6.7 What did we learn?

Because of the positive decision to build, combined with a lack of understanding of the rationale and no clear and neutral assessment of the pros and cons of the line, many people (politicians, interested groups, citizens, etc.) felt manipulated, although on the positive side, the process also contributed to important improvements in decision-making procedures.

First of all, together with the process leading to the construction of the High Speed Rail line from the Netherlands via Belgium to Paris, which faced comparable criticism, it led to the development of a manual to ex ante evaluate large transport infrastructure projects, the core being the obligation to carry out CBAs for such projects according to the manual (Eijgenraam et al. 2000) published by the Netherlands Bureau for Economic Policy Analysis (CPB). The report was the result of many debates and contributions from leading researchers and institutes. The manual not only prescribed a CBA for large national transport infrastructure projects; it also explained how to carry out CBAs. In addition, after three years of applying the manual, a thorough evaluation of experiences was made, leading to several additions to the manual. Up to 2017, over 100 CBAs had been carried out using the manual (Annema et al. 2017).

Second, in 2013 a more generic manual was written, to be applied to all kinds of projects, and not only transport projects (Romijn & Renes 2013), published by CPB and PBL (Netherlands Environmental Assessment Agency). Again, a CBA is the default, and instructions were given on how to ex ante evaluate projects.

Third, largely because of the experiences with the role of parliament in the decision-making process of the Betuweroute and the High Speed Rail line from the Netherlands via Belgium to Paris, as explained above, a committee (temporary committee infrastructure projects – Dutch abbreviation TCI) was founded to study and advise on the role of parliament in the decision-making processes of large infrastructure operations. The cost overruns of both projects played an especially important role in the establishment of the committee. The committee report (Tweede Kamer 2004) advised, among other things, on research support for parliament, removing the ban on contacts between members of parliament and civil servants, and making sure that members of parliament are not overloaded with less relevant information, while important information should be sent to parliament.

## 6.8 Conclusions

This chapter departs from what Samset and Volden (2016, p. 308) refer to as 'the paradox of perverse incentives':

> public investments with no financial obligations for the target group may cause perverse incentives and result in counterproductive projects. [...] The term perverse incentives refers to the situation where one or more actors are motivated to make choices resulting in a project that is a complete failure seen in retrospect.

The chapter has explained that the positive decision to build the Dutch Betuweroute, connecting Rotterdam Harbour to the German Ruhrgebiet can be understood by this paradox. Although a cost-benefit analysis was not carried out, it is extremely likely that the benefits will never be high enough to compensate for the construction costs of almost £5 billion (even ignoring other costs, such as maintenance costs). No private party had an interest in participating in the building of the rail line. Yet a positive decision to build was made. Those actors supporting the construction of the line did not have to pay for it – the Dutch tax payer had to pay. However, the social benefits in terms of the environment and congestion reduction are very small. As economists have argued: the main beneficiaries are German companies who have an additional transport option to receive and ship goods way below the real transport costs. What is more, these German companies did not pay anything for the construction of the line, as they do not pay taxes in the Netherlands.

The chapter also makes clear that many things went wrong, such as having no clear explanation of the problems the line was supposed to solve, or the

related challenges. No alternatives were considered, and the cost estimates were seriously flawed.

I argue that the perverse incentives paradox helps to explain several of the other paradoxes discussed in the paper of Samset and Volden: those having an interest in a positive decision to build the Betuweroute did not have to pay for it, and this resulted in several perverse incentives that are further detailed and discussed by other paradoxes.

Although the Betuweroute is a 'worst in class' example, it is no exception. Cost overruns and demand shortfalls are a worldwide problem. The problem that those who benefit from a positive decision to build do not pay for the costs, providing a wrong incentive, is also common.

On the positive side, the Netherlands learned a lot from the Betuweroute (and the HSL South). Since 2000, it has been obligatory to assess candidate national large transport infrastructure projects via a social cost-benefit analysis, making use of a dedicated manual. Based on the advice of a special temporary committee report published in 2004, the role of parliament in the decision-making process was strengthened. Later (2013) a manual for the ex ante assessment of all kinds of projects was introduced. Several experts think that the decision not to build a fast rail line connecting the north of the Netherlands and the west was largely due to the CBA showing that the costs would be way higher than the benefits. Koopmans (2010) estimated the CBA related costs of CPB, and assumed that a negative decision to build candidate projects evaluated according to the CBA manual for which costs exceeded benefits could be attributed to 10% of the CPB and CBAs. The welfare losses (calculated from the difference between estimated costs and benefits) were about £20 billion. Hence, the positive value of the CPB and CBAs is estimated to be £2 billion (10% of £20 billion), implying a benefit-cost ratio of the related work of 17. In other words, the obligation to carry out a CBA according to the CBA manual was a decision which significantly increased welfare in the Netherlands. The negative experiences with respect to the Betuweroute, the lessons learned and the actions taken made positive contributions to Dutch society.

A final remark on the paradox, as formulated by Samset and Volden (2016, p. 308), in particular the sentence, "The term perverse incentives refers to the situation where one or more actors are motivated to make choices resulting in a project that is a complete failure seen in retrospect": I argue that this applies to the Betuweroute, but not only in retrospect; long before the formal decision to build, several researchers had already warned that a positive decision would result in welfare losses.

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# 7 Closing the loop

## Ex ante and ex post evaluation in order to learn from mistakes and successes

*Knut Samset and Gro Holst Volden*

Paradoxical dilemmas such as those discussed in this book could have been avoided in many cases, if planners and managers were better at learning from experience. There are valuable lessons to be learnt from success as well as failure – in many cases, lessons that are quite obvious and relevant. However, ex post evaluation for designated learning purposes is not commonly performed. The tendency is not to look in the mirror to learn from similar undertakings, but only straight ahead on how to plan the next big project. This predicament was discussed in our initial paper on the ten paradoxes – in fact, we considered presenting it as Paradox 11.

### 7.1 On evaluation in general

Generally speaking, the purpose of evaluation is threefold, that is, it contributes to efficient control, management and learning. In some cases the focus is on all aspects simultaneously; in other cases it is restricted to one, for instance the control aspect, in which case the exercise comes close to what is normally termed an audit. The control aspect is the most restricted, focusing on expenditure in relation to budget, progress in relation to plans, outputs in relation to standards, etc. The management aspect is broader, looking at performance, organisational issues, processes, etc. The learning aspect of evaluation is even broader and requires a more open-ended mandate in order to focus on and get a deeper understanding of causes and effects, achievements seen in relation to experience with similar projects, etc. It is often necessary to study groups of several projects simultaneously in order to draw lessons for the future (Samset 2003).

An investment case, process or project is typically divided into three distinct phases. At the beginning, the idea and decision phase lasts until the final decision to implement is made. The implementation phase follows, until the project's outputs are realised. Finally, there is an operational phase, in which the benefits of the project are realised or revenue comes in. This process is illustrated in Figure 7.1.

Experience indicates that today, most evaluation activities occur during the implementation phase or just after its conclusion, with options designated

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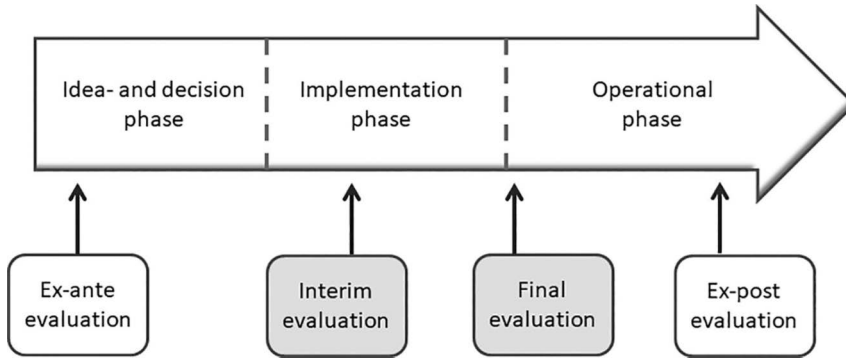


*Figure 7.1* Evaluation of an undertaking at different points in time.

interim evaluation and final evaluation, respectively. This is puzzling, because the implementation phase is the period in which the project is least likely to benefit from an evaluation (Samset 2003). An interim evaluation can help to avoid or correct mistakes during the implementation phase, that is, it provides *management* information. A final evaluation assesses the results at the conclusion of the implementation phase, that is, it provides *control* information.

It is a paradox that systematic ex ante and ex post evaluations are rarely used. Ex ante evaluation provides *strategic* information about the main choices at an early stage, when the possibility to influence the course of an undertaking is greatest. It aims to find the best approach or conceptual solution of possible alternatives, and to clarify the major questions that will determine the terms of planning, which are essential. Ex post evaluation undertaken well into the operational phase will provide *learning* information to improve design and decisions for similar projects in the future, which is also valuable (Andersen et al. 2008).

Ex ante evaluation consists of a broad initial assessment aimed to identify which alternative will yield the greatest benefit from an intended investment. More commonly, considerable resources are used on detailed planning of one specific solution, whereas alternatives are not considered, or are inadequately assessed early on. Consequently, there is no adequate basis for concluding that the preferred alternative is the best choice.

The benefits to be accrued from comprehensive appraisals upfront were demonstrated by a World Bank evaluation of more than 1,000 investment cases. It concluded that as many as 80% of the cases that conducted a thorough feasibility study and secured the 'Quality at Entry' were successful, whereas only 35% of those with poor preparation upfront were successful (World Bank 1997).

The benefit of ex ante evaluation is principally related to whether one can identify the best solution to the problem at hand and avoid expensive and ineffective solutions. This will be based on estimates of the project's effects. Such estimates are useful for management decisions during implementation, and provide benchmark information for interim and ex post evaluations. Ex ante evaluation may also be useful for studying different scenarios and the effects of changes in certain parameters during implementation. Systematic sensitivity analysis is all too little used, even in major, extensive projects (Jovanovic 1999).

The purpose of ex post evaluation is to draw lessons of experience from relevant cases. The motivation is principally that it may contribute to double-loop learning. Consequently, to evaluate a single project is seldom sufficient; it is necessary to evaluate several similar projects. However, this is not commonly done; therefore, the use of evaluation for learning purposes is not encouraging (Schindler & Eppler 2003).

Businesses, particularly industries, are better than the government at both ex ante and ex post evaluation, with their ex ante market forecasts and ex post user surveys. However, these are relatively limited assessments in which return on investment (ROI) is the paramount objective, and market demand and user satisfaction are key evaluation criteria. In such cases, a narrow economic incentive clearly motivates the studies.

Each investment case or project represents only one of several possible concepts that may be realised. In advance, other concepts may have been assessed but rejected in favour of the one preferred. After the project is completed, it is evaluated in relation to planned and projected goals and effects, and to the ex ante situation – but rarely in relation to the counterfactual, that is, what the situation would have been had the project not been realised (Harberger 1997). The reason for this is first and foremost that people's preference is commonly to invest in something new. However, experience shows that, in retrospect, the zero option might have been the most beneficial choice. Therefore, an ex ante evaluation should also review the zero option because it affords a basis of comparison for assessing future benefit.

Incentives in public investment projects are not as clear. The goal is often more compound and complex. Attention is focused on effects for users and society, and on benefit-cost efficiency, but individuals are not made accountable to the same extent in relation to the achievement of objectives, as is the case in business. Consequently, there is no clear tradition for such evaluations. One notable exception is the Norwegian Ministry of Finance, which introduced a scheme in 2000 for ex ante evaluation of the country's largest public investment projects, the so-called quality assurance (QA) scheme (Volden and Samset 2017). Twenty years later, more than 300 projects have been exposed to this QA scheme. In the coming years, several ex post evaluations will be made of these projects, under the auspices of the Concept Research Programme at the Norwegian University of Science and Technology (NTNU).

The study presented in this chapter is based around the first 29 such evaluations undertaken to date (2021).

## 7.2 Evaluation based on insufficient information

In an ex ante evaluation, much must be based on assumptions, because fewer facts are available. It is more bounded by history, facts and interpretations, leading to a selection of decision premises influenced by organisational structures and actors' roles, as noted by Simon (1957). Lack of information leads to greater reliance on experience, on opinion, or, at worst, on guesswork. This is a disadvantage but not a hindrance. A combination of facts and well-founded assumptions are the best you can provide in the early phase. However, an ex ante evaluation can contribute systematic generation and analysis of such information. The assumption is that this process will provide better results than no systematic analysis, although the information base is weak. There is a large amount of literature in this area, for example, Goodwin and Wright (1991), Bazerman (1994) and Williams et al. (2009).

As already mentioned, ex ante evaluation occurs when principal decisions are made and the possibility of making changes is greatest – but also when uncertainty is highest and the information basis is most limited. What matters then is which *type* of information is needed. Since the main focus is on the problem to be solved and corresponding needs to be met, there is less need for *detailed* scrutiny of the alternative solutions to the problem.

This illustrates a dilemma, because most projects start out with only one specific conceptual solution to a problem. Much of the information generated is associated with that particular solution. Indeed, in many cases, the amount of specific, detailed information contributes to restricting the original choice of concept to the extent that it will eventually be the realised option. This is referred to as Paradox 3 in the 'Paradoxes' paper. In too few cases are other possible concepts identified and analysed sufficiently.

Concerning the information needs in ex ante evaluation, the amount of information generated often outstrips the needs – one asks for more, although the needed information is already there (Feldman & March 1981). Experience suggests that in the earliest parts of the process, our concern should be to understand the problem in its context, together with the needs and interests of affected parties, in order to design a sound solution in strategic terms and to assess possibilities and risks. Therefore, at the outset, the need is first and most importantly to establish perspective. Intuition, creativity and imagination can, then, be more valuable than exact, quantitative information. One could, in many cases, turn the problem around and argue that rather than being a hindrance, lack of detailed information early on can actually be a benefit, providing focus and flexibility to the analysis.

Moreover, the validity of information may be a problem. It is obvious, as experience confirms, that the more precise the information is, the more

rapidly it becomes obsolete. It is tempting to speak of information half-life. For example, in a rapidly expanding market, the value of information on demand as a basis for planning may depreciate within a few days. At the same time, the validity of qualitative measures is often more durable than precise quantitative information. Consider, for example, the basic perceptions of the needs of user groups. We may know little about the urgency of the need, but can be certain that it will persist for a long time. Therefore, it may be included in initial assessments.

Omitting details and less relevant information helps to avoid *analysis paralysis*. This is yet another argument for not swamping the initial process with detailed quantitative information. The need for precise and detailed information increases with the advance of the process. Later, such information will be more readily available (Williams et al. 2009).

Commonplace opinion holds that the quality of a decision base is crucial for decisions. However, opinion varies on the meaning of 'the quality of a decision base'. Experience suggests that decision-makers are often less affected by decision bases than one would think is desirable. Studies have shown that even when good decision bases are available, decisions are more influenced by the decision-maker's intuition and personal or political preferences than by facts and analyses (Feldman & March 1981; Henden 2004; Mintzberg 2000). The practical implications of this are not necessarily disastrous. Several studies have shown that in many situations, intuition is preferable to rational analysis, particularly when the decision situation is complex, as is often the case in large investment projects. The assumption, then, is that intuition is based on experience and training. If the decision-maker has the necessary relevant professional experience in the sectors involved, intuition can help make sound decisions more rapidly. However, we cannot expect effective intuition without thorough knowledge of the theme at hand. In turn, that characteristic involves many years of experience, combined with workable analyses.

Early on, it is essential to establish the best possible understanding of reality as a basis for identifying a suitable strategy. Subsequent critical steps include identifying the overall framework conditions that should guide subsequent decisions on the choice of concept, and then the necessary framework conditions that should guide the planning and shaping of the project. The framework and conditions form the specific solution to the problem in hand – in other words, what the project is to deliver. In such a stepwise process, it is advantageous to choose an approach with corresponding increases in degree of detail and the level of precision of information. The challenge is to acquire the essentials and limit the magnitude of what is communicated. This improves communication and increases the likelihood of the evaluation results being used. The Pareto Principle, also known as the 80-20 rule, may be used to illustrate information needs. The notion is that in a cause-effect relationship, a few vital causes lead to the greater part of the consequences. To clarify these causes is the central challenge.

## 7.3 Some evaluation criteria

An evaluation involves an assessment employing specific evaluation criteria and measures against standards or expected values, such as knowledge and proficiency relative to learning goals or effects relative to strategic plans. A key question in an evaluation of a public investment project is whether the project was successful. Evaluation is thus a matter of determining the degree of success.

Samset (2003) argues that in order to be truly successful, public projects must not only perform well operationally but also tactically and strategically. However, whereas operational project success is highlighted by practitioners as well as academics, tactical and strategic success is often ignored, possibly because it challenges the way analysts think and has political aspects to it (Samset & Christensen 2017).

All projects are explicitly or implicitly based on an assumed set of causal relationships between inputs, project activities, outputs, outcome, and ultimately, broad societal outcome, as illustrated in Figure 7.2. Several authors argue the merits of using this so-called logic model (McLaughlin & Jordan 1999; Samset 2003), also referred to as the programme theory (Chen 1990; Rogers et al. 2000; Weiss 1997) as representation of the project to help visualise important aspects, and especially when preparing for an evaluation. The logic model helps to clarify for all stakeholders: the definition of the problem, the overarching goals, and the relationship between project success on an operational level (output), tactical level (outcome) and strategic level (achievement of the societal objective).

There are many ways to evaluate, depending on the type of project, purpose, tradition, etc. A much-used evaluation model is based on five evaluation criteria that together express the degree of success on all three levels. This standardised set of five evaluation criteria is used by the UN and other institutions and development aid organisations, and has been endorsed by the OECD-DAC (OECD 1991, 2002).

Evaluation according to this model highlights (1) the need for the project (relevance), (2) whether the uses of resources and time are reasonable (efficiency), (3) whether expectations are fulfilled (effectiveness), (4) what other positive or negative effects may occur as a result of the project (impact) and (5) whether the positive effects persist after its conclusion (sustainability).

As noted by Picciotto (2013), development projects are not so different from projects in developed countries. The five criteria reflect hard-won lessons of


*Figure 7.2* The project's logic model.

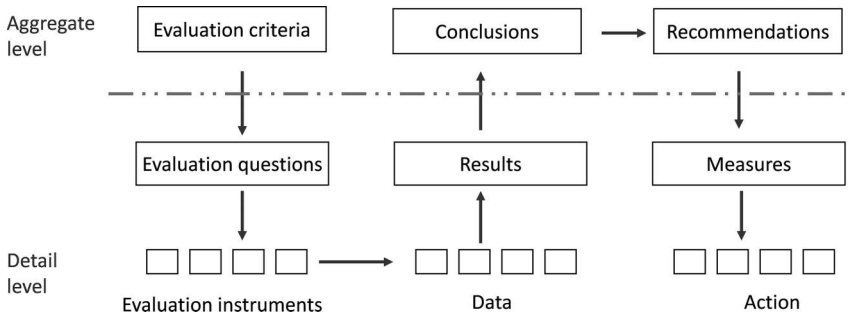


*Figure 7.3* Evaluation is part of an information process based on overriding questions and, through analyses and decision-making, results in actions at the detail level.

experience and have, by and large, replaced prior approaches that focused only on inputs and outputs. They can be used equally at project, programme and policy level, and are aligned with the results-oriented stance favoured by most countries. Other sectors have introduced variants of the criteria (see, for example, the European Commission (2013) concerning socio-economic development in Europe; ALNAP (2006) concerning humanitarian projects; and the European Commission (2015) concerning regulations). The framework has hardly changed over time and thus shows an impressive stability.

Evaluation typically involves a process in which overriding evaluation criteria are disaggregated into more detailed evaluation questions relevant to the conditions to be evaluated. Then, information is acquired and aggregated to support conclusions relative to the overriding evaluation criteria.

The OECD-DAC model is an example of a goal-oriented evaluation, which is one of many possible approaches. The model is principally intended for application in the ex post situation, but could conceivably be even more beneficial in the front-end phase. The question is to what extent sufficient information exists at an early stage.

- Regarding the issue of *efficiency*, doubtless the costs of a project and the nature of its delivery are reasonably well understood at an early stage. However, there may be doubt as to whether the cost estimates are realistic and the conditions of implementation will allow that outputs are produced as anticipated. Consequently, gauging efficiency is hardly worthwhile in the earliest phase, while the complications facing planners and decision-makers in estimating realistic costs clearly indicate that the basis for evaluating efficiency is usually poor.
- The same could be true of *effectiveness*. Undoubtedly, the first-order effects sought are usually clearly known, but realistic forecasting can be notoriously flawed.

- Early estimates of *impact* are even more difficult. Undoubtedly, experimental knowledge may be acquired by studying similar projects, but we face conditions that are difficult to forecast and arguably require imagination and guesswork beyond our capabilities.
- However, the situation for *relevance* differs. Common sense and user surveys, as well as knowledge of markets, laws and regulations permit us to form an early, accurate picture of whether an initiative is relevant. That we may be notoriously poor at this sort of early evaluation is not due to it being impossible, but rather to it not being done to a sufficient extent.
- Initially, forecasting future *sustainability* is also difficult. However, the question is closely related to whether an initiative is relevant. Moreover, we can usually realistically analyse cashflow early on.

The conclusion, then, is that with reasonable effort, we can obtain a good picture at an early stage of whether a proposed project is relevant and sustainable, whereas the other three criteria must be assessed at a later stage in the planning process. The good news is that relevance and sustainability are precisely the two aspects that are most crucial to whether a project will succeed strategically. Consequently, such a delimitation of a very first ex ante evaluation will, therefore, be the minimalist answer to what might be an appropriate approach, not least because the benefit relative to resource allocation will be quite high. Results from ex post evaluations carried out according to the same criteria will thus come into use at different stages in the planning of new projects.

## 7.4 Ex post evaluation of large public projects. The case of Norway

In Norway, as mentioned above, ex ante evaluation is compulsory in a scheme requiring external quality assurance of the decision basis for projects with an estimated investment cost exceeding 100 million euros. The scheme includes: (1) appraisal and external quality assurance of the choice of conceptual solution before the Cabinet's decision on whether to start a pre-project, and (2) subsequent quality assurance of the project management basis and cost estimate before the project is submitted to Parliament for approval and funding. Quality assurance is performed by external experts who are pre-qualified by the Ministry of Finance (Volden & Samset 2017).

As of today, (2021) about 300 projects have been subject to this scheme, of which some 120 have so far been completed. There is strong evidence that early evaluation and quality assurance has improved the Norwegian government's basis for decisions regarding major public investments (Kvalheim et al. 2015) and that most of the projects keep within their budgets (Welde 2017). Nevertheless, projects also need to be evaluated ex post, to verify how they perform strategically. To that effect, we applied a broad, goal-oriented evaluation framework based on the one presented above on 29 Norwegian

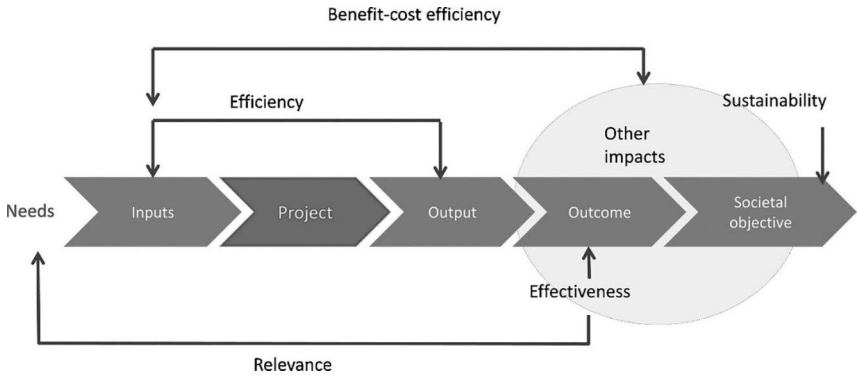


*Figure 7.4* The Norwegian evaluation format.

projects that had been quality-assured in their front-end phase. The presentation below is an update of the findings in Volden (2018a) based on the first 20 of these projects.

## 7.5 A format of six evaluation criteria

The chosen evaluation format is depicted in Figure 7.4, and is based on the five OECD-DAC evaluation criteria, plus benefit-cost efficiency as a sixth criterion (this is similar to the structure from a similar origin in Chapter 2, Table 2.1). Obviously, since society's resources are limited, it is crucial that they are spent on projects that yield the highest value for money. Benefit-cost efficiency in a narrower sense is covered by the 'efficiency' criterion of the OECD-DAC model, as the relationship between inputs and outputs. We found it useful to distinguish between the two levels of efficiency by treating them as separate criteria. For benefit-cost analyses, we followed the standard method, as presented by, for example, Boardman et al. (2011). The six criteria's relation to the logic model is illustrated below in Figure 7.4.

Our definitions of the six criteria, and the level of success which they represent are presented in Table 7.1.

The purpose of evaluations is to provide an *overall* picture of the degree of public project success. The format is comprehensive enough for this purpose, yet minimalistic. With budget limitations, we cannot be too ambitious regarding the methodological rigour when responding to each criterion. Experimental designs are rarely realistic for any of the evaluation criteria, and certainly not for the strategic ones. Rather, the choice is on simplified evaluation designs, economic data collection methods, and triangulation between various data sources and methods of analysis, quantitative as well as qualitative, to ensure validity and reliability.

*Table 7.1* Definitions of the six evaluation criteria

| *Level of Success* | *Evaluation Criterion* | *Definition* |
|---|---|---|
| Operational | Efficiency | This concerns project implementation and outputs in terms of cost, time and quality, and how economically the project organisation has converted inputs into outputs |
| Tactical | Effectiveness | This concerns whether the agreed outcome has been obtained and to what extent the project has contributed to this outcome |
| Strategic | Other impacts | This includes all consequences *beyond* the agreed outcome (i.e. side-effects) that can be attributed as the result of the project, positive and negative, short-term and long-term, for different stakeholders |
| | Relevance | A project is relevant if there is a *need* for what the project delivers. Project relevance is measured in relation to national political priorities, but also stakeholders' preferences. It is essential to bring conflicts of interest to light as part of the evaluation |
| | Sustainability | A project is sustainable if its benefits are likely to persist throughout its lifetime. This usually requires that the total impacts (financial, environmental and social) are acceptable in the long run |
| | Benefit-cost efficiency | This should be measured in terms of total willingness to pay in relation to cost, or secondarily in terms of outcome in relation to cost (i.e. cost-effectiveness) |

A main feature is that all evaluations should apply the same format. This is to facilitate learning, since it allows us to draw lessons from aggregates of evaluations. Not only did we apply the same six criteria in all project evaluations, but we also aggregated the results by setting a score between 1 and 6 for each criterion in all projects. This was to facilitate a comparison of achieved success across projects.

## 7.6 The evaluated projects

As mentioned, about 300 major projects had been through the government's quality-at-entry scheme since the year 2000, being primarily roads (56%), buildings (12%), railway (8%), ICT (7%) and defence (16%). Since the subsequent detailed planning and implementation period of such large projects is extensive, only 120 projects have been completed so far. Of these, about half (60) have been in operation for at least five years, and are thus considered

*Table 7.2* Key information relating to the sample projects. Sorted according to the year of evaluation

| *No.* | *Project Name* | *Sector* | *Start (yr.)* | *End (yr.)* | *Eval. (yr.)* | *Evaluator* |
|---|---|---|---|---|---|---|
| 1 | E18 Momarken–Sekkelsten | Road | 2005 | 2007 | 2012 | Concept |
| 2 | Double track Asker–Sandvika | Rail | 2001 | 2005 | 2012 | VTI |
| 3 | Skjold class MTB | Defence | 2003 | 2013 | 2012 | Scanteam, Concept |
| 4 | Customs control area, Svinesund | Building | 2004 | 2005 | 2012 | SINTEF, Concept |
| 5 | Lofoten fixed link | Road | 2003 | 2007 | 2014 | UiN, Nordlandsforskning |
| 6 | E6 Riksgrensen–Svingenskogen | Road | 2002 | 2004 | 2014 | COWI |
| 7 | Eiksund fixed link | Road | 2003 | 2008 | 2014 | Menon |
| 8 | NAV ICT Basis | ICT | 2006 | 2010 | 2014 | NIBR |
| 9 | Svalbard Research Park | Building | 2003 | 2005 | 2014 | Concept |
| 10 | Double track Sandnes–Stavanger | Rail | 2005 | 2009 | 2015 | Oslo Economics, Atkins |
| 11 | Perform | ICT | 2008 | 2012 | 2015 | Menon, Vivento |
| 12 | E16 Kløfta–Nybakk | Road | 2005 | 2007 | 2015 | Urbanet |
| 13 | Military area. Østlandet | Defence | 2002 | 2012 | 2015 | Prokonsult |
| 14 | University College campus Halden | Building | 2003 | 2006 | 2015 | SINTEF, Concept |
| 15 | Rv 519 Finnfast fixed link | Road | 2005 | 2007 | 2015 | Menon |
| 16 | New Opera House. Oslo | Building | 2005 | 2008 | 2016 | HR Prosjekt |
| 17 | Halden Prison | Building | 2006 | 2010 | 2016 | Oslo Economics, Tyrilistiftelsen, Sweco |
| 18 | E6 Svingenskogen–Åsgård | Road | 2005 | 2008 | 2016 | Menon, Concept |
| 19 | E6 Åsgard–Halmstad | Road | 2004 | 2005 | 2016 | Menon, Concept |
| 20 | Gevingåsen railway tunnel | Rail | 2009 | 2011 | 2017 | Concept. SINTEF |
| 21 | Double track Barkåker-Tønsberg | Rail | 2009 | 2011 | 2017 | Concept, SINTEF |
| 22 | IFI2 building at University of Oslo | Building | 2006 | 2010 | 2018 | Concept, Multikonsult |
| 23 | Hardanger bridge | Road | 2009 | 2013 | 2018 | Menon |
| 24 | Atlanterhav tunnel | Road | 2005 | 2009 | 2019 | TØI, Dovre Group |
| 25 | EFFEKT | ICT | 2005 | 2013 | 2019 | Menon |
| 26 | GSM-R | ICT | 2003 | 2008 | 2019 | SINTEF, Concept |
| 27 | LOS Logistics project | ICT | 2008 | 2017 | 2019 | Oslo Economics |
| 28 | TETRA Emergency network | ICT | 2010 | 2015 | 2020 | Agenda Kaupang |
| 29 | College campus Bergen | Building | 2010 | 2014 | 2020 | Concept |

ready for evaluation. So far, therefore, we have evaluated half of all evaluable projects.

These are included in this meta-evaluation: ten road projects, seven buildings, four railway projects, six ICT projects and two defence projects. The projects were chosen in chronological order and constitute a relatively representative picture of quality-assured projects in their operational phase (50%). Table 7.2 provides an overview, including which evaluators were involved. They represent consultancies in Norway and Sweden, and researchers from the Concept Research Programme, all of whom were considered independent of the projects and the implementing agencies.

## 7.7 The evaluation process

The six criteria framework is not a guarantee of high-quality evaluations in itself. Obviously, evaluation skills, impartiality, appropriate data collection and analysis methods, etc. are required.

Each evaluation followed a defined process, which consisted of six steps, based on Samset's (2003) project evaluation textbook and aligned with Michael Scriven's Key Evaluation Checklist (2015).

1 The Concept Research Programme selected the project to be evaluated, and sought acceptance from the responsible ministry (e.g. the Ministry of Transportation in the case of road projects). The ministries could, in principle, decline, but none of them did. A contact person in the ministry (and its subordinate agency when relevant) was identified.
2 The evaluation team was established, usually following a public call. Concept researchers participated in some evaluation teams, in order to gather experience in the use of the model. The team consisted of three or four people, all with the necessary evaluation skills and knowledge of the sector. The scope was set to approximately three people-months of work per evaluation, depending on the project's complexity and availability of data.
3 The evaluation team reviewed and, if necessary, adjusted the project's internal logic. It then operationalised each of the six criteria by selecting more specific indicators or evaluation questions to be answered.
4 The evaluation was carried out by collecting and analysing data, and answering the evaluation questions by combining different data sources and methods. We leaned on a number of authors who have suggested the mixing of methods to improve rigour in the evaluations of complex interventions (see for example Green et al. 2015; Ton 2012; and Yin 2013), and the use of so-called rapid evaluation methods when faced with restricted budgets and timelines (Bamberger et al. 2004; Samset 2003; World Bank 2004). The use of existing literature and expert statements to assess the integrity of the programme theory was used as a supplementary approach to strengthen the validity of findings. Detecting

impacts beyond the intended effects normally requires a wide, inductive and multidisciplinary approach.

5 In Step 5, the evaluation team summarised its assessment for each criterion by setting a score between 1 and 6, where 1 was failure and 6 was highly successful. A score of 4 was awarded when the result for the relevant criterion was acceptable, but not an over-achievement. An overall guideline for score-setting was prepared in advance to assist the evaluation teams.

6 The final report was made public and distributed. The report and key results were stored in a database that is openly available to the public (www.ntnu.edu/concept/evaluation-reports). The ministry and responsible agency were encouraged to follow up the results internally.

## 7.8 A meta-evaluation

In the remainder of this chapter we present some findings and recommendations based on experiences from the 29 evaluations conducted so far. We refer to this as a meta-evaluation. It is based on an update and extension of the findings presented in Volden (2018a) based on 20 evaluations. In addition, we briefly present findings from a recent survey of the use and benefits of the evaluations (Bukkestein et al. 2020).

The term 'meta-evaluation' is ambiguous. Generally, it implies that the original analyses of data become objects of a new analysis on a higher level (Glass 1976). The much-used UK Magenta Book (HM Treasury 2011) primarily refers to meta-evaluation as a synthesis of several related evaluations, with the purpose of providing some estimate of the average or combined effect. This interpretation is close to what Yin (2013) defines as cross-case synthesis. On the other hand, Scriven (2015) refers to meta-evaluation as an evaluation of one or more evaluations in order to identify their strengths, limitations and other uses, against a set of quality standards. A similar interpretation is suggested by Stufflebeam (2010) who distinguishes between three groups of standards: technical adequacy, utility and cost-effectiveness.

In line with the OECD (2002), we chose to include both the above-mentioned interpretations: meta-evaluations are here defined as "evaluations designed to aggregate findings from a series of evaluations. It can also be used to denote the evaluation of an evaluation to judge its quality and/or assess the performance of the evaluators" (OECD 2002, p. 26, our underlining).

First, in Sections 7.9-7.13, we present an aggregation and synthesis of the findings from the 29 separate evaluations, to establish the success of Norwegian investment projects. The main data source for this part was the 29 evaluation reports. We coded and summarised the assessments done by the evaluation teams, based on a set of questions prepared for the study. This included, for each evaluation criterion, the overall score as well as a range of more detailed indicators (e.g. efficiency, time, cost and quality, respectively). Different measurement scales were used for different aspects, including inter

alia the number scale used for score-setting, binary variables (achieved/not achieved, etc.) and qualitative descriptions. Accordingly, the aggregation of findings across projects was partly quantitative and partly qualitative. The scores awarded on each criterion were particularly useful, since they allowed us to compute averages and see how they differed across sectors (although the number of projects was too small for statistical testing).

Thereafter, in Section 7.14, we summarise key challenges and weaknesses related to the evaluations themselves. This is based on a thorough registration and assessment of various quality aspects in the first 20 evaluations, as presented and discussed in Volden (2018a). We looked at, inter alia, the interpretation and application of the six criteria, rigour in design, quality of data, triangulation, the use of score-setting, and characteristics of the evaluation teams (competence, multi-disciplinarity, impartiality, etc.). Our assessments were unavoidably subjective, but meticulously explained and documented. We also held a focus group meeting with experienced evaluators who represented half of the firms or research institutes that had participated in the Concept evaluations (cf. Table 7.2). The participants were given the opportunity to comment on and share their experiences and assessments of the evaluation model, the process, and the need for guidance. The review based on the first 20 evaluations resulted in an update and extension of the guidelines for evaluators. This led to some improvements in the last nine evaluations, but our general impression is that the identified challenges and weaknesses are still present to a greater or lesser extent.

As noted by Scriven (2015), the use or non-use of an evaluation's results cannot be regarded as a quality criterion of the evaluation itself. Admittedly, many aspects of an evaluation will affect the probability that the results will be used, such as quality and credibility, clear communication, right timing and user involvement. But just as often, the failure to use the results and recommendations is due to bad management (Scriven 2015). A separate survey on the use of evaluations was conducted recently and presented in a Norwegian report (Bukkestein et al. 2020). In Section 7.15 we briefly present some of those findings and discuss what can be done to increase ministries' and agencies' actual use of evaluation results in the planning of new projects.

## 7.9 Findings

### *7.9.1 Project success*

Table 7.3 presents the scoring results from all 29 evaluations. Scores 1-2 are shown as white, scores 3-4 as light grey and 5-6 as dark grey.

The overall picture of performance and achievements is quite positive, with average and median scores between 4 and 5 for all criteria. The weakest result concerns benefit-cost efficiency. Evaluators noted that this was the most challenging criterion to assess. Generally, there were few really poor scores except for one project, that is, the development of an ICT system in the defence

*Table 7.3* Evaluation results, N = 29

| *Project* | *Sector* | *Efficiency* | *Effectiveness* | *Other Impacts* | *Relevance* | *Sustainability* | *Benefit-Cost Efficiency* |
|---|---|---|---|---|---|---|---|
| 1 | Road | 3 | 5 | 4 | 5 | 5 | 6 |
| 2 | Railway | 5 | 3 | 4 | 5 | 5 | 3 |
| 3 | Defence | 4 | 4 | 4 | 3 | 2 | 2 |
| 4 | Building | 6 | 4 | 4 | 5 | 5 | 4 |
| 5 | Road | 4 | 5 | 4 | 3 | 4 | 3 |
| 6 | Road | 5 | 6 | 5 | 5 | 5 | 6 |
| 7 | Road | 5 | 6 | 5 | 4 | 5 | 5 |
| 8 | ICT | 5 | 6 | 4 | 3 | 5 | 3 |
| 9 | Building | 6 | 4 | 5 | 5 | 5 | 3 |
| 10 | Railway | 4 | 4 | 4 | 5 | 5 | 3 |
| 11 | ICT | 5 | 5 | 5 | 5 | 6 | 5 |
| 12 | Road | 4 | 5 | 3 | 5 | 4 | 4 |
| 13 | Defence | 5 | 5 | 5 | 6 | 5 | 5 |
| 14 | Building | 5 | 4 | 3 | 4 | 5 | 4 |
| 15 | Road | 5 | 5 | 5 | 5 | 5 | 6 |
| 16 | Building | 5 | 5 | 6 | 5 | 4 | 4 |
| 17 | Building | 5 | 4 | 5 | 4 | 5 | 4 |
| 18 | Road | 4 | 5 | 4 | 5 | 4 | 6 |
| 19 | Road | 5 | 5 | 4 | 5 | 4 | 6 |
| 20 | Railway | 4 | 3 | 4 | 4 | 4 | 2 |
| 21 | Railway | 4 | 3 | 3 | 3 | 4 | 2 |
| 22 | Building | 2 | 5 | 5 | 5 | 3 | 4 |
| 23 | Road | 4 | 4 | 3 | 3 | 3 | 3 |
| 24 | Road | 3 | 5 | 5 | 5 | 5 | 6 |
| 25 | ICT | 4 | 4 | 4 | 5 | 5 | 6 |
| 26 | ICT | 5 | 4 | 3 | 5 | 4 | 4 |
| 27 | ICT | 1 | 2 | 2 | 3 | 2 | 1 |
| 28 | ICT | 4 | 4 | 5 | 5 | 5 | 3 |
| 29 | Building | 5 | 4 | 5 | 4 | 6 | 5 |
| Average | Score | 4.3 | 4.4 | 4.3 | 4.5 | 4.5 | 4.1 |
| Median | Score | 5 | 4 | 4 | 5 | 4 | 4 |
| No of projects that scored 4 or better | | 25 | 25 | 23 | 23 | 25 | 18 |
| No of projects that scored 5 or better | | 15 | 14 | 12 | 18 | 17 | 11 |

sector (no. 27), which can be considered a failure. Four projects received high scores across the board. However, the majority showed more ambiguous results, being successful according to some perspectives and less successful in others.

Table 7.4 shows correlations between scores obtained on different criteria. It is not surprising that the four strategic criteria are correlated, since they concern the same level of success. But we also found correlation across analytic levels, indicating that a project that is well planned for success in one perspective has a greater chance to succeed in other perspectives as well. However, score setting is partly subjective, and there is a risk that evaluators make

*Table 7.4* Correlation matrix (N = 29)

| *Correlations* | *Efficiency* | *Effectiveness* | *Other Impacts* | *Relevance* | *Sustainability* | *Benefit-Cost Efficiency* |
|---|---|---|---|---|---|---|
| Efficiency | 1.00 | 0.28 | 0.36 | 0.25 | 0.59 | 0.25 |
| Effectiveness | | 1.00 | 0.52 | 0.29 | 0.33 | 0.65 |
| Other impacts | | | 1.00 | 0.47 | 0.50 | 0.45 |
| Relevance | | | | 1.00 | 0.47 | 0.63 |
| Sustainability | | | | | 1.00 | 0.53 |
| Benefit/cost eff. | | | | | | 1.00 |

*Table 7.5* Evaluation results: median per sector (N = 29)

| *Sector* | *Efficiency* | *Effectiveness* | *Other Impacts* | *Relevance* | *Sustainability* | *Benefit-Cost Efficiency* |
|---|---|---|---|---|---|---|
| All | 5 | 4 | 4 | 5 | 4 | 4 |
| Building | 5 | 4 | 5 | 5 | 5 | 4 |
| Defence | 4.5 | 4.5 | 4.5 | 4.5 | 3.5 | 3.5 |
| ICT | 4.5 | 4 | 4 | 5 | 5 | 3.5 |
| Railway | 4 | 3 | 4 | 4 | 4,5 | 2.5 |
| Road | 4 | 5 | 4 | 5 | 4,5 | 6 |

different assessments, in the same way that some professors are 'strict graders', while others give out A's all the time (see further discussion in Section 7.14)

Although the number of evaluated projects was low, the results indicate some interesting sectoral differences, as shown in Table 7.5. *Building projects* scored very well on operational success, but slightly lower tactically and strategically. Some of them had ambitious goals that would require more than physical facilities to achieve. *Railway projects* were closely aligned with government strategies for a 'green shift' in transport, and thus were considered relevant and sustainable. However, they scored very low on benefit-cost efficiency and on effectiveness. The *road projects* scored high on most criteria, but somewhat lower on efficiency, and also on other impacts due to negative (environmental) side-effects that had not been properly dealt with.

## 7.10 Operational project success

*Efficiency* concerns a project's operational success. The evaluations show that 25 out of 29 projects scored 4 or better, and 15 scored 5 or better according to this criterion. One project stands out with a score of 1. It had an 80% cost overrun and considerable delays.

As shown in Figure 7.5, 21 projects (72%) were completed with a final cost below the approved cost-frame. Ideally 85% of projects should keep within

the cost-frame, which is normally set at probability level P85. The projects also have a target cost which is normally set at probability level P50. The evaluations show that 15 out of 29 projects (52%) kept within the target cost, which is about as expected. All 29 projects underwent external quality assurance of cost-frames and steering documents, which certainly seems to have been helpful in ensuring realistic budgets. The promising results relating to cost control are confirmed in a study including 78 completed projects that had been through external quality assurance (Welde 2017).

No single cause can explain the observed cost overrun in some projects in our sample. Explanations are rather project-specific, the three most frequently mentioned being:

- Geology/ground conditions (ground investigations not carried out in advance)
- Market situation (tight market resulting in highly priced bids)
- Additional work not specified in the contract. Unit-price contracts are normally used in Norwegian public projects, where the project owner carries all the risk.

There are indications that projects with a shorter implementation period have somewhat better cost control than long-lasting projects. Similarly, it seems that earlier projects (i.e. those completed in the early 2000s) performed better than more recent projects, which is possibly related to economic cycles, or perhaps because the best projects were completed first. Project size did not seem to affect cost control.

It should be noted that some of the deviations were considerable, in both positive and negative directions. Some evaluators indicated that overruns

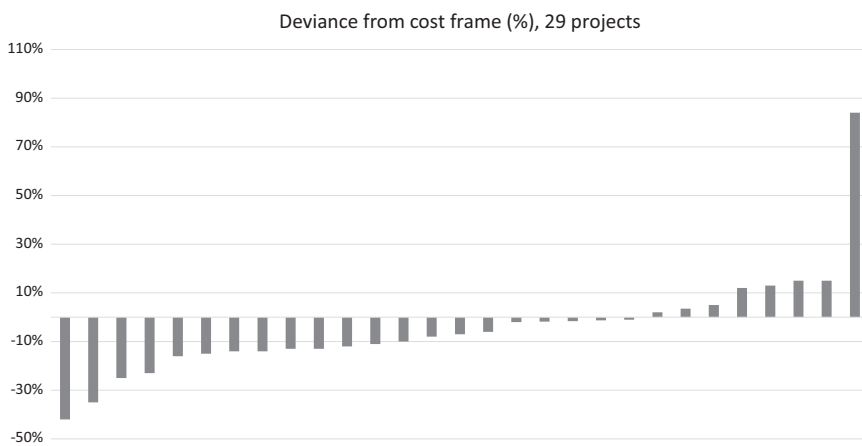


*Figure 7.5* Deviance between final cost and cost frame, sorted by size of deviance, N = 29.

may be explained by the cost-frame being too tight, or conversely that the cost-frame might have been too generous in the case of some underruns. This suggests that the quality-at-entry scheme may not serve as a guarantee for realistic budgets.

The evaluations found that most of the projects performed well not only in terms of cost but also (even more so) in terms of time and quality. 26 out of 29 projects (90%) were completed within their time-frame, and 28 (97%) were considered acceptable in terms of quality standards. Most projects were also considered well organised and managed. Performance in the three parts of this so-called 'iron triangle' was clearly correlated, in the sense that projects with a high score on cost control also had high performance in terms of time and quality, compared with projects with a low or medium score on cost control.

Overall, the building construction sector stands out positively in terms of operational success. Six out of seven building projects performed excellently in terms of cost, time and quality. The evaluations mentioned that several of these buildings had been awarded architectural prizes. Road projects experienced the largest cost overruns as well as cost underruns, implying that the National Public Roads Administration should make efforts to produce more accurate estimates.

## 7.11 Tactical project success

With regard to tactical project success, as measured by *effectiveness*, 25 projects scored 4 or better and 14 scored 5 or better, which means that most of the projects' outcomes were acceptable. Three projects received top scores, that is, two road projects that realised considerable time-saving and reductions in accident levels, and one ICT project that generated improved quality of services for users. That said, most of the projects had some room for improvement in terms of goal achievement.

Table 7.6 gives an overview of 'typical goals' and their achievement in each sector. Some of the projects had very ambitious goals, which may partly explain their limited achievements. This includes the building projects, some ICT projects and the railway projects. Obviously, when a new prison building aims to improve the quality of imprisonment in such a way that the likelihood of new crime is reduced, this requires more than the physical infrastructure. Ambitious goals should have been given more attention than was paid in the sampled projects. In recent years, benefits management (BM) activities have been implemented in major ICT projects, and are also becoming a key topic in the railway sector. We believe there is much to learn across sectors about how to succeed with benefits management.

On the other hand, most of the road projects had less ambitious goals related to time-saving and traffic safety, their achievement depending more directly on the quality of the road itself and requiring no additional measures.

*Table 7.6* Typical goals and their achievement, per sector, N = 29

| *Type of Project* | *Typical Project Goals* | *Tactical Success – Median Score* | *Tactical Success – Comment* |
|---|---|---|---|
| Building (7 projects) | • Co-locate departments A and B and realise professional synergies<br>• Effective rehabilitation of prisoners – through improved facilities<br>• Effective research and education – through improved facilities | 4 | Goals only partly achieved. Direct effects are observed (e.g. user satisfaction with the building), but effects on business achievement is more uncertain and often limited. No (or very little) active benefits management is carried out |
| Defence (2 projects) | • Defence of coastal areas (new vessels)<br>• Increased defence capability (training fields) | 4,5 | Only two projects, both with acceptable goal achievement, but also difficult to measure |
| ICT (6 projects) | • More efficient administration of welfare services<br>• Efficiency and management within defence<br>• More efficient emergency services | 4 | Goal achievement varies considerably between the six projects, and is difficult to assess. Not all projects have being carrying out benefits management activities |
| Railway (4 projects) | • Travel time-saving<br>• Sustainable transport through modal shift (improved rail competitiveness) | 3 | Limited effects so far, but may potentially increase if/when other measures are implemented (co-ordination of timetables, restrictions of car use, etc.). Benefits management activities only introduced recently |
| Road (10 projects) | • Travel time-saving through shortening of a road or increased capacity<br>• Traffic safety<br>• More efficient transport between island and mainland (bridge/sub-sea tunnel) | 5 | Travel time-saving and safety goals are largely achieved. In some projects wider benefits for the economy were also mentioned as goals, but such effects could not be seen |

## 7.12 Strategic project success

The other four evaluation criteria express strategic project success. The evaluators concluded that the projects performed acceptably in these dimensions too. All projects but two scored 4 or better on at least one strategic criterion.

### *7.12.1 Other impacts*

As many as 23 projects scored 4 or better on other impacts, and 12 scored 5 or better. Several projects generated positive side-effects, such as city development, learning effects (the project being a pilot for new working methods, etc.) and additional user groups. One project, the New Opera House in Oslo, received top score for its positive effect on subsequent urban development. Generally, the building projects did best in terms of maximising positive side-effects, typically depending on the location of the building. Some projects could have done more to avoid negative side-effects, in particular some road and railway projects with negative effects on nature and the local environment. The majority of projects, however, had no extensive positive or negative side-effects.

### *7.12.2 Relevance*

Twenty three projects scored 4 or better on *relevance,* 18 scored 5 or better, and none scored below 3. This implies that all were considered solutions to real problems. Some ICT projects were 'must-haves' to facilitate a reform, etc.

However, the relevance criterion is in itself often multidimensional, and some projects involved conflicts of interest (i.e. they were not equally relevant in all perspectives). This was the case with regard to the Lofoten fixed link, a road project that connected a remote region to more urban areas, but left the neighbouring remote region even more isolated.

In some cases, evaluators suspected that other, more relevant solutions to the problem existed (at least more cost-efficient ones). For example, some of the studied ICT projects involved the development of new, complex solutions, although simpler, off-the-shelf systems already existed. Similarly, better route choices existed for some of the railway projects.

### *7.12.3 Sustainability*

Twenty five out of 29 projects scored 4 or better on *sustainability*, and 17 scored 5 or better. This implies that project benefits were largely expected to continue over a sustained number of years. For example, transport facilities were considered to have sufficient capacity within their planned lifespan (40–75 years), and most new buildings had expansion possibilities on site.

However, projects had to be sustainable in *all* aspects (i.e. financial, environmental and social) to be assigned a top score. For example, the Opera House project was considered to have long-lasting effects on cultural policy goals, but was not given a top score because growing operational and maintenance costs made it financially unsustainable. In this case (and others), the project's sustainability depended on increasing public subsidies over time.

### *7.12.4 Benefit-cost efficiency*

Overall, the projects scored slightly lower on *benefit-cost efficiency*. In total, 18 out of 29 projects scored 4 or better, and 11 scored 5 or better.

We found some clear sectoral differences. The five most benefit-cost efficient projects were all road projects in urban areas. On the other hand, all the railway projects scored relatively low. It should be noted that evaluators found this criterion difficult to assess. Often, benefits could not be monetised and had to be assessed qualitatively (for example in defence and building projects), resulting in high uncertainty and low comparability across projects.

Interestingly, the low benefit-cost efficiency for some projects was known by decision-makers ex ante. This indicates that the CBA had not been crucial to project selection. In fact, some of the road projects that proved to have a positive net present value ex post were estimated to be negative ex ante.

## 7.13 Discussion

In most of the cases, the evaluators concluded that the projects were successful in more than one aspect, especially in operational terms. There appears to be some correlation between the scores for the various criteria. This is not surprising, since a well-thought-out and carefully planned project will normally be successful in several respects. However, there may also be conflicts, for example when some of the projects scored high on relevance and sustainability, and lower on benefit-cost efficiency.

All four railway projects were well aligned with the government's strategy for sustainable transport (although one scored low on relevance due to the unsuitable location of a station). However, with passenger numbers less than estimated by the planners, and a relatively high capital cost, the value for money was considered low. We agree that not all projects can or should be 'profitable', but one should at least consider whether a simpler solution, still with acceptable goal achievement, would substantially improve value for money. Similarly, a project with high effectiveness but negative side-effects should perhaps be redesigned to achieve a better overall score.

One noteworthy observation is that many of the projects that scored high in tactical and strategic terms were not aimed at specific stakeholder groups or regions, but rather followed from national political objectives. This supports earlier findings that when specific stakeholder groups manage to mobilise government funding for 'their' project, the project may turn out to be less

relevant from the perspective of the wider society – a phenomenon known as perverse incentives in project selection (Volden 2018b).

The positive results found in the sampled projects seem to conflict with the public discourse and studies that demonstrate a low level of success in public projects. For instance, Flyvbjerg et al. (2009) use the expression "over budget, over time, over and over again" and explain the widespread problem of cost overruns by delusion and deception. We think that caution should be used when referring to public projects as generally unsuccessful. First, the media as well as academic literature are largely concerned with cost control, which is only one aspect of project success. Second, as noted by Love et al. (2015), different empirical studies on cost control come to quite different conclusions, depending, inter alia, on the point of reference from which a cost overrun is measured (those that find the largest overruns typically compare with early and uncertain estimates). The 29 Norwegian projects stand out as relatively successful, which can be explained, at least to some extent, by the quality-at-entry requirements which ensure that they were thoroughly planned and reviewed before being submitted to Parliament for approval and funding. It should be noted that the remedy suggested by Flyvbjerg et al. (2009) to avoid delusion and deception was to take an *outside view* on project planning and estimation, which is exactly what the quality-at-entry scheme does.

On the other hand, we cannot eliminate the risk that some scores were positively biased. A study by Wiig and Holm-Hansen (2014) found that in evaluations of development assistance projects, *positive* side-effects were mentioned more often than negative ones. They suggest that evaluators may be reluctant to criticise without hard evidence on which to base their criticisms, but willing to mention a positive issue that has the same level of uncertainty. While acknowledging the general risk of positive bias, we believe it was moderate to low in the 29 evaluations. The main reason is that the evaluations were organised by a third party, and all the teams were entirely independent of the projects.

However, another and more pertinent matter is how to ensure that the scores were well-calibrated across projects. The scores were set by a different evaluation team in each case, based on the team's subjective assessments of findings. As will be discussed in the next section, it is crucial to have clear guidelines for score-setting. In particular, the level of ambition inherent in the goal hierarchy must be considered when deciding on the score for effectiveness. We suspect that different levels of ambition relating to project goals may explain some of the sectoral differences when it comes to effectiveness.

## 7.14 Lessons learned about the evaluation framework and procedure

The evaluations provided useful experience on the evaluation model and our own practice. A thorough review of various quality aspects of the first 20 evaluations led to an update of the guidelines for evaluators, which, in turn,

led to some improvements in the last nine evaluations. However, our general impression is that the identified challenges and weaknesses were still relevant, and ought to be taken into account when conducting evaluations.

### *7.14.1 General experiences of the model*

It seems clear that the chosen framework worked well, and that the six criteria covered the main aspects of public project success. Some experienced evaluators noted that the strategic criteria were 'eye-openers'. Knowing that pure economic evaluations are often considered by decision-makers to be too narrow (Nyborg 1998), our evaluators agreed that the six-criteria framework was more relevant.

The process of disaggregating the criteria into specific indicators and then aggregating the findings to provide answers to each criterion provides a good balance between the need for standardisation and flexibility. The evaluations converged more and more into a common form, and their quality improved over time.

However, we also see some challenges related to how 'other impacts', 'relevance' and 'sustainability' were interpreted. Some evaluators treated these strategic aspects superficially, realising that they cannot be measured in quantitative terms. Others interpreted them too narrowly, as found by Chianza (2008). Others still confused them with benefit-cost efficiency, downplaying, for example, the environmental, social and ethical concerns. The evaluators confirmed that they were sometimes uncertain about the interpretation of these criteria.

### *7.14.2 Methodological rigour to be balanced against available resources*

The evaluations comprised six criteria, each of which required proper treatment. At the same time, the budget and time available implied clear limitations regarding scope and methodological rigour. Our evaluations were undoubtedly 'rapid', and the scores sometimes uncertain. This is not uncommon in evaluations, and must be accepted. However, it is crucial that the choice of methods and limitations are communicated. These findings support those of Samset (2003), Bamberger et al. (2004) and others who have argued that it is possible to conduct evaluations of acceptable quality under budget, time and data constraints.

### *7.14.3 The need for a broad approach to data collection and analysis*

Different methods of data collection and analysis are needed for different evaluation criteria. For efficiency, data from project reports were used, as well as interviews and benchmarking of cost data with similar projects. For effectiveness, time-series data for outcome indicators were used (often

including comparison groups, such as similar geographic regions without the new infrastructure) and interviews with a wide range of stakeholders. For the strategic criteria, the evaluators normally used a combination of different sources, predominantly qualitative ones. For benefit-cost efficiency, they used all existing data and a set of assumptions and price tags. All evaluations included site visits.

It is costly to collect primary data, and evaluators must therefore prioritise carefully. Generally, the evaluators for the 29 projects studied chose simple and informal methods.

Most evaluators used triangulation to an acceptable extent, but some focused too much on quantitative data and experiment as the gold standard. For example, one evaluation report devoted more space to discussing the difficulties of quantifying benefit-cost efficiency than to describing it with alternative data. The quality of an evaluation with limited time and budget rests strongly on the ability to use a broad approach with a wide range of sources and methods.

### *7.14.4 The project logic ought to be reviewed*

Reference data, in terms of descriptions of the goal hierarchy or logic model, often has weaknesses in project evaluations (Samset et al. 2014). The quality-at-entry scheme required each project to have a defined goal hierarchy. Despite this, more often than not, there were problems, such as a missing causal logic or the wrong level of ambition (too high or too low). Evaluators ought to take such weaknesses into account, but unfortunately some were not critical enough. Ideally, they should re-establish the logic model *as it should be*, as a basis for their evaluation, in accordance with the project owner. At least they should adjust for the level of ambition when setting scores. A project should not be awarded a score of 6 if its goal was trivial, and likewise, it should not be awarded a score of 1 if the goal was unattainable.

A theory-based approach to evaluation might also be helpful. Scholarly literature can be used to assess whether certain changes are likely to be an effect of the project (i.e. the attribution problem). Kaplan and Garrett (2005) mention that a common example of theory failure is to assume that a new technology or infrastructure will make people change their habits without additional measures, such as training and financial incentives. A review of the programme theory could have revealed such a failure, and may similarly reveal redundant project components.

### *7.14.5 Broad and impartial evaluation teams*

It is required that evaluation teams have no relation to the projects they evaluate. Furthermore, that they have expertise within evaluation, economics and project management, and some knowledge of the sector and type of project. As noted by Scriven (2015), an evaluation team must be broad and

represent different perspectives and disciplines, as this is essential for comprehensive and balanced assessments.

In our evaluations, impartiality was well assured, and we have not yet experienced lack of confidence in the evaluations from stakeholders or the wider public. On the other hand, some of the teams consisted primarily of economists and were thus considered insufficiently broad and multi-disciplinary. This may explain why some evaluators interpreted 'other impacts' from a narrow, economic perspective.

#### *7.14.6 Score-setting needs to be better calibrated*

Score-setting was an essential part of these evaluations. Experience indicates that the use of scores is valuable for drawing lessons across projects and sectors. However, it is essential that results are well-calibrated. Scores were set by different teams who may interpret and use the scale differently. Subjective judgements regarding the choice of indicators as well as score-setting cannot be avoided, but can be minimised using clear guidelines for evaluators. A common problem in the first 20 evaluations was subjective score-setting. Later, the guidelines were updated, leaving somewhat less room for discretion.

## 7.15 How to ensure that ex post evaluations contribute to learning

The purpose of doing ex post evaluations is, ultimately, to improve the success of future projects. For this to happen, it is not enough that evaluations are of good quality. The results and recommendations must also be perceived, understood, and used.

It is well known that evaluations are not always used as intended (Dahler-Larsen 2012; Samset 2015). Eliasson et al. (2015) showed that cost-benefit analyses of Norwegian road projects that were performed ex ante did not have any effect on which projects were selected for implementation. In a review of state enterprises' use of evaluation, one of the main findings was the lack of follow-up of evaluation results (Agenda Kaupang & Rambøll 2016). At worst, evaluation becomes symbolic rather than truth-seeking. Samset (2015) illustrates this aptly by describing the results from a study on the use of evaluation in the development aid sector. Officials and decision-makers were asked to identify which information sources they considered most important for learning. Of 19 different sources, evaluation reports were in 15th place, and were thus considered among the least important sources of learning, despite the extensive scope of evaluations in the field of development aid.

Our evaluations were performed ex post, when it was too late to make changes in the project as such. However, the findings should be useful to improve appraisal tools and models, to reduce inaccuracies in estimations of costs and benefits, and to improve project management tools and procedures

to be used in future projects. Thus, what we are discussing is *indirect use* of evaluation results.

A survey on the use of Concept evaluations by the target group (i.e. ministries and government agencies) was performed recently (Bukkestein et al. 2020). Interviews were conducted with senior project owners and employees involved in project planning and appraisal in affected ministries and agencies.

A key finding was that the target group had varying knowledge of the evaluations concerning their own sector. Those who had been involved and were aware of the evaluations often showed considerable interest in them. But generally, the evaluations were not sufficiently anchored in responsible ministries/agencies and the results were not disseminated sufficiently widely after the evaluations were completed.

Furthermore, very few (hardly any) evaluations were initiated by the ministries and agencies themselves. Project appraisal and planning was thorough and systematic, and for the largest public projects, external quality assurance was conducted according to the Ministry of Finance's scheme, but ex post, only a few evaluations had been carried out. These evaluations focused on operational success and had essentially a control function, rather than learning as their main focus.

Bukkestein et al. (2020) provide a set of recommendations on how to improve the use and benefits of evaluations, the most important being:

- The ministry/agency should be involved in the evaluation process, earlier and more systematically than they are today. They should also be involved in discussing the results and their implications.
- Evaluators should distinguish more clearly between informants/data suppliers on the one hand, and the target group of the evaluations on the other, although the same people often hold both roles. The latter role is easily forgotten. This is particularly a problem when evaluations are outsourced to external evaluators, as practised by the Concept programme.
- When conducting a broad six-criteria evaluation, we need to acknowledge that different parts of the evaluation may have different target groups. Normally, operational project success concerns the agency most, tactical success concerns both agency and ministry, and strategic success concerns the ministry most.
- One may consider separating the three levels of success into three separate evaluation parts, and even carrying them out at different times. Instead of waiting five years until the project can be evaluated in all three perspectives, its 'efficiency' can be evaluated much earlier, when the results will be more relevant for the executing agency.
- The target group is less interested in the score they obtained on a certain project from the past, and more on how to improve their next project. Some of the earliest evaluations were only concerned with finding the right level of project success, and had less focus on the explanations

behind good or bad results. More recently, therefore, a separate chapter of 'learning points' is included in the evaluation reports.

- Evaluation results must be easily available and communicated. Much is done already to disseminate the results. Short and informative summaries are presented on the Concept website, and oral presentations are offered to the ministry and agency as the report is launched. This dissemination work must be continued and strengthened with help from the organisations themselves.

## 7.16 Conclusions

Ex ante evaluation is needed to link the decision processes to the results of overriding reasoning based on facts and systematic analysis. The result of a decision-making process is not necessarily in accordance with this requirement. The final choice can be better or worse than that recommended at the outset. However, in any case, the best-case result comes from democratic processes that legitimise the outcome. The criteria for ex ante evaluation are often associated with a rational ideal of strong management and clear thinking.

Ex ante evaluations should also build on experience from ex post evaluations, preferably in sufficient numbers to provide a greater scope of experience, and should at the very least include several alternative courses of action. Moreover, the evaluation criteria in ex ante evaluation ought to correspond to a degree with those of ex post evaluation. This is particularly important when constructing learning loops that function over time. Not least, it is important that ex ante evaluation is made to a central reference in the subsequent decision-making process against which the various alternative courses of action are evaluated.

What can be learned from such an analysis? First, the decision-making process associated with major public investment projects is complex, which implies that learning should be complex and versatile. It is important to be aware of various considerations and difficult trade-offs. Hence, our analysis functions as an ex post evaluation. At the same time, the absence of clear organisational thought and rational calculation, as a reflection upon the central aspects in the early phase of a project's life, affords considerable potential for ex ante evaluation. Second, ex ante evaluation and its utilisation is not an objective or unambiguous process, but rather a political and administrative process. Various actors, such as political and administrative leaders, may use these evaluations in differing ways. Some may interpret them in their own interests and accordingly slant undertakings and learning, whereas others may adhere more closely to conclusions and recommendations suggested by the evaluators. In today's societies, it is relatively common that either evaluations are clearly managed, or that results are interpreted, slanted, politicised and oversold. This analysis may contribute to more control and greater breakthrough, but may also undermine the credibility and support of projects.

In Norway, ministries and agencies with large investment projects have become quite good at ex ante evaluation (appraisal) and planning. Since the year 2000, project decision documents have gone through external quality assurance. As discussed in Volden and Samset (2017), this has provided decision-makers with a better basis for selecting which projects to implement. The scheme provides a more systematic approach to the early identification of project ideas than the prior system. Rather than going straight to selecting road sections and determining a technical solution, planners are forced to take a broader perspective and to discuss societal aspects, which allows ideas to mature and stimulates creativity in the agencies. Thus, the scheme has done much to remove or curb several of the paradoxes described in the 'Paradoxes' paper.

The assumption is that this will also contribute to improved project performance. However, ex post evaluation is not part of the scheme, which is a paradox in itself. In general, ex post evaluations of government investment projects are still rare. Worsley (2014) referred to ex post evaluations as "the weak link" in the assessment process for transport projects in OECD countries. This is perhaps not surprising. In contrast to, for example, health or educational programmes, an infrastructure project cannot be implemented stepwise. Therefore, it could be argued that whereas good planning is crucial, ex post evaluation is a waste of time and resources. However, that would be an erroneous conclusion because there is much to learn from one project to another, both within and between sectors. Given the poor reputation of public projects in high-income countries in general (Flyvbjerg et al. 2003), the potential to improve project practices is considerable; so is the potential to improve project planning, governance and the quality at-entry scheme itself.

Evaluation should be based on the project's logic model, as discussed above. It should ask not only about economic aspects but take a broad and multifaceted view on project success. In their most recent economic survey of Norway, the OECD (2017), focusing primarily on transport projects, suggested that ex post evaluation of projects should be conducted more systematically, and that a broad framework should be applied, to strengthen scope, accuracy and credibility.

Systematic ex post evaluation of the largest public projects is now being implemented by a research programme, with funding from the Ministry of Finance, as illustrated above. We applied a generic evaluation framework inspired by the one recommended by the OECD-DAC for the evaluation of development assistance projects and programmes. We described the development of an evaluation practice that started in 2012 by testing the six-criteria framework on four different projects. The experiences with the model were good, so evaluations continued, and over time we developed better guidelines for score-setting and other issues. After 29 evaluations, we can begin to draw conclusions about the success of the projects. Recently, we have also begun to discuss what more can be done to ensure that the evaluation results are used and contribute to learning. Over time, we will build a large and

hopefully useful database with results from completed projects, all evaluated according to the same framework.

A key finding so far is that most of the projects were successful in one or more perspectives, as considered by the evaluators. This contrasts with the public discourse and studies by Flyvbjerg and others which conclude that public projects are unsuccessful. Some projects scored high on relevance and sustainability, but low on benefit-cost efficiency, and vice versa. This type of deviance needs to be communicated to project owners and various stakeholders, who might have conflicting views on the weighting of the criteria. The evaluations thus provide a basis for discussing whether a better balance between different concerns could have been possible. The possibility to compare and learn across different sectors is also considered useful. Some sectors are better at cost control, others at benefits realisation, still others at sustainability, etc.

The findings of the evaluations should be useful for the purpose of accountability, as well as for learning and improvement. Although each evaluation was limited in time and resources, it may identify major risks and problems that should be examined in more detail by the responsible ministry. Furthermore, the findings should provide input to the appraisal and planning processes of future investment projects funded by national government. It should be noted again that the sample of projects was not statistically significant; thus, any attempts to generalise findings should be regarded as preliminary and tentative. Over time, when the database of evaluated projects is larger, it should be examined as to whether the patterns described above still hold.

- We argue that ex post evaluation according to our suggested model will be helpful in overcoming all ten paradoxes from the 'Paradoxes' paper to a greater or lesser extent:
- The six-criteria framework implies a broader perspective on project success than is normally taken. Hopefully this will inspire planners to focus more on strategic issues as a basis for project selection (cf. Paradox 1, 'the success paradox' and 2, 'the significance of front-end management').
- The simple framework, if used ex ante, with a special focus on 'relevance' and 'sustainability' early on, should also help planners single out important information and avoid information overflow (ref. Paradox 3, 'the paradox of early information overflow').
- This, together with the building of a database that includes a wide range of solutions to various problems may also open planners' eyes to the opportunity space that exists on when to solve their next problem (cf. Paradox 4 'the paradox of the opportunity space').
- It is essential that a project's goal hierarchy constitutes a logic model with goals at different levels being connected. Ex post evaluation may demonstrate common weaknesses in goal structures, which may, in turn, be used to improve strategic alignment in future projects (cf. Paradox 5, 'the paradox of strategic alignment').

- The building of a database with actual results from completed projects may also curb the problem of early cost estimates being unrealistic (cf. Paradox 6, 'the cost estimation paradox'). The database may thus facilitate a system often referred to as Reference Class Forecasting, that is, a way of predicting the future by looking at similar past situations and their outcomes.
- A paradox that should definitely be affected by ex post evaluation is Paradox 7, on disregarded analyses of costs and benefits. When estimates are well-documented and based on results from past projects rather than pure guesswork (as is often the case today), it will be more difficult for decision-makers to ignore them.
- Evaluation may also curb the 'predict & provide' paradox (Paradox 8), especially if it makes planners focus more on the 'relevance' criterion. Assessing a project's relevance implies taking a step back and asking what the problem is, not simply assuming that a constant expansion of the infrastructure in line with some trend is the best solution.
- The use of actual results from completed projects may also prevent perverse incentives from materialising, at least in the form of systematically skewed benefits and cost estimates (cf. Paradox 9, 'the paradox of perverse incentives').
- Finally, by including the 'sustainability' criterion as part of the evaluation, planners will widen their horizons and assess long-term benefits and costs, also ex ante (cf. Paradox 10, 'the paradox of myopic decisions').

The evaluators' experiences of the evaluation framework were largely positive. They found it relevant and meaningful that evaluation was not limited to aspects of project management success, which has traditionally been the focus in the project management community. Neither was the framework limited to benefit-cost efficiency, which is normally the focus in the transport sector. (Other sectors rarely conduct evaluations at all). Instead, the six criteria covered intended and unintended effects alike, together with goal-oriented and efficiency perspectives, and explicitly raised questions about long-term sustainability. Also, this meta-evaluation revealed some improvement points, from which the lessons learned are continuously used to improve the framework, processes and guidelines for future evaluations, how the evaluation teams should be put together, how the criteria should be understood, and clear, common principles for score-setting.

Ministries and government agencies need to see the benefits of the evaluations and their learning potential. It is still too early to determine whether these 29 evaluations will lead to improved practices, but so far it seems that they have not been used to the extent that we had hoped for. This is hardly surprising, as the non-use of evaluations has been a topic within the evaluation literature since the 1970s, and it is well-documented that many evaluations are more ritual than reality. We believe there should be a system where planners are obliged to request, and use ex post results from previous projects

when planning a new project. That is, the use of evaluations should be systematically integrated in organisations' project governance frameworks.

Over time, hopefully, many project evaluations will be produced corresponding to this framework. One ambition is to further improve their quality and ensure that scoring becomes better calibrated over time. Since the projects in each sector have similar outcomes, allowing for standardised measures, the resulting evaluation database would then provide a valuable basis for robust practices and better determinants of government investment projects' success.

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# 8 Conclusions

*Terry M. Williams*

## 8.1 The setting of major public projects

This book has been discussing the genesis, planning and delivery of major public projects. Projects are the key organisational form used to deliver transformational policy change and build new systems in the public sector. This includes not just obvious physical systems, such as military systems and infrastructure construction, but also public change and transformation programmes, major IT systems, and programmes aimed to achieve major policy aims, such as decarbonising transport and energy. As a leading official in delivering such programmes in the UK stated, "The vast majority of government policies are delivered through projects of various forms" (Meggs 2017, p. 3).

> Currently, more than 20% of global economic activity takes place as projects, and in some emerging economies it exceeds 30%. World Bank (2009) data indicate that 22% of the world's $48 trillion gross domestic product (GDP) is gross capital formation, which is almost entirely project-based. In India it is 34%, and in China it is 45% [of GDP].
>
> (Scranton 2014, p. 1)

We therefore have considerable experience of undertaking such projects. However, it is well-known that these efforts have not always been viewed as successful, either by the public or by governments. Samset and Volden (2016) looked at data in Norway on how such projects were set up, and found a number of 'paradoxes' or dissonances which need explaining so that we can understand how to avoid or overcome them. This book has been considering those paradoxes.

So what are the 'paradoxes' that are the subject of Samset and Volden's paper? Are they true paradoxes in that two contradictory positions appear to be true (such as the exploration/exploitation contrast in organisational ambidexterity)? Or are they simply examples of the phenomenon frequently seen in organisations of the 'Knowing-Doing gap' (Pfeffer & Sutton 1999)? Do we really know how to make our projects deliver, and if we utilised the lessons

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of Pfeffer and Sutton, could we develop our organisations so that they more often deliver projects in what we know to be the better way?

It appears from the last six chapters that the aforementioned paradoxes are more subtle than either of these, and are inherent to some extent in the front-end of any project, the evolutionary process of which is embedded within its environment. Such paradoxes are exacerbated by the nature of major projects in the public and political domain. They naturally occur in actual practice, and we can recognise them, the suggestion being that these paradoxes give rise to behaviours that lead to inadequate analysis and decision-making, and disbenefits to the final outcome. The object of this book has been to explore such paradoxes, to explain *why* they arise, consider how to manage them, and where possible, to suggest what behaviours we should be encouraging to try to avoid their negative effects.

How have we approached these questions? Our approach has been to look at projects as they are embedded in actual public practice. There has been a lot of research in the area of projects and project management in the public domain, mainly falling into one of two types, and leaving a gap in what we know:

i There is considerable research on what organisations need to do and why, which regards projects as individual 'black box' entities: strategy, societal transformation, economic geography, etc. – well-grounded but treating projects as entities that realise strategy. There is also a stream of research looking into what projects are set up to achieve and whether or not they achieve this: key here is a stream of research by Flyvbjerg and colleagues – most famously in Flyvbjerg (2003), but with considerable later research (although there is also a stream of research arguing against some of their findings and pointing in particular to Hirschman's 'Hiding Hand' idea, e.g. Ika et al. 2021).

ii There is also considerable research on 'project management', looking within a project, assuming a specific task has been well-defined and presented for a project team to achieve, and ignoring the environment around the project. These were traditionally rather theory-light, normative studies, but recent years have enlarged the scope of such work.

- Neither looking solely at the environment or solely at the project is sufficient. The move recently into 'Project Studies' (e.g. Geraldi & Soderlund 2016) recognises the need to study both the project itself and its environment – and the complex interfaces between them (some of the research by Ika has also started to look 'under the bonnet' of projects). A 'project' is not a separate entity from its environment, but we must understand how both work together, particularly as the project is formulated and planned. Hence we have taken such a holistic approach in this book.

- The book has tried to explain behaviour in the setting-up of projects within their real environments. Each chapter has taken a different aspect of the front-end of the project, offering a depth of material that warrants careful study and provides lessons for the practising manager. This chapter takes a cross-chapter view, and brings together some thoughts on seven ideas that crop up in most, if not all of the chapters: the problem or need that triggered the problem; the jump to an early project solution; stakeholders and consultation; information generation and flow in the project; accountability for the results of the project; and reflecting back on a project.

## 8.2 The front-end as a process

Traditional thinking, as described above, has looked at the project as an exercise to carry out a defined task in a specific time, at a specific cost. As we have looked at the paradoxes, we have seen that these arise because the decision to carry out a project, and the definition of what that project is, is not a specific point in time, but a process that can take considerable time. The generally accepted discussions and analyses of such activities often see front-end processes as being outside of time, based on the implicit assumption that their own dynamics should not impact the results of the project, but this is clearly not correct. We have been exploring this process that derives from the initial idea or recognition that 'something must be done', to the point where a project is agreed, 'signed off' and made to start – what is generally known as the 'front-end' (Williams et al. 2019).

This process might not be straightforward, even in simple projects within a private company. Within the public sector, the project has to emerge from a mass of stakeholder interests and political influences. There is a need to communicate between all the different factions, and Chapter 4 takes the idea of representation construction to conceptualise the project front-end – not only internal representations but also external representations, which are key for communicating about the project and eliciting assessments from decision-makers and stakeholders. This takes place over time, with changes and revelations in the process, as discussed below. Even then, the various stakeholders and decision-makers do not share common goals, and, indeed, might be driven by a variety of cognitive, emotional and social reactions, so that decision-makers will also need to be in a process of filtering and balancing those views.

This process cannot be seen as a sequence of rational, logical decisions, but must take into account the above influences. We have been looking at how it explains the paradoxes, and how we can use this knowledge to design better front-ends. This has been the driver for the chapters. Chapter 2 considered how project aims are defined; Chapter 3 looked at the logic behind the process, and in greater depth at how one major public body's front-end process

aimed to tackle these issues; Chapter 4 used the processual nature of the front-end to explain the trade-offs that must necessarily be made.

Perhaps the clearest illustration of the temporal effect of the front-end is the activity of project estimation. While well-researched as a 'one-off' activity, this book has been exploring the effects of the processual nature of the front-end. Chapter 5 traced the changes to estimates as information became available in the front-end, quoting a parliamentary committee report stating that ministers were too keen to commit to cost and timescale estimates (which are usually stated deterministically, i.e. with no uncertainty bounds, despite the early stage of development) early in the process. They go on to say that "project managers become tied to these estimates. The early estimates can shape the rest of the project delivery …". The earliness of these estimates can be forgotten later, as only the final, approved estimate is remembered (the 'cost estimation paradox'), but early estimates can shape a project if they are wrongly relied upon. The extensive case study presented in Chapter 6, exploring many of the paradoxes illustrates this.

These chapters, of course, overlap, and we have tried to include cross-references between them. The 'paradoxes' themselves are not ten independent paradoxes, but are related causally. This is a simplification, many of the paradoxes being mentioned in the various chapters, but Figure 8.1 shows where the interests of the chapters are most focused, and how the sequence of chapters to some extent follows the causal effects of the paradoxes.

## 8.3 The project trigger

As can be seen, we should first consider what has prompted the project (Chapter 3 uses the term 'project trigger'). What are we actually trying to achieve in our project? Success is multifaceted, but primacy should be given to the objective for embarking on a project. If we concentrate purely on the tactical objectives of the project (time/cost/scope), we are missing the point. The part of government which wants (or needs) to achieve something ought to consider first what it is trying to achieve and why, in the short and long term – including the long-term effects on sustainability (as discussed in Chapter 4). It is only then that we can logically move on to the 'front-end' of the project.

These are easy statements to make, and Chapter 2 explored the difficulty and complexity of establishing a strategic project aim in the public sector. Such complexity includes the wide range of heterogenous stakeholders with different aims, the frequent difficulty of specifying, let alone quantifying targets for the 'public good', the added difficulty of comparing these disparate benefits with a single cost, a wide range of political factors, including the mismatch between project lifecycles and budgetary or political cycles, the turbulent socio-economic environment around a project that might change perceptions of its target and its success, the question of whether it is the project or other parties that are responsible for reaping the benefits, the position of the project goals in relation to other related projects, and so on. Often it is

not feasible simply to specify a set of well-defined project goals which remain constant throughout the project.

It is in the nature of public projects that there is a wide range of heterogonous stakeholders, usually with a wide range of heterogonous aims and objectives. Stakeholder engagement, establishing success criteria and balancing these, for example, is difficult and time-consuming. It can give results that the commissioning department might not like, or, indeed, the requirements might be mutually conflicting, as in Chapter 4's fourth vignette concerning the freedom of individual cars. Sometimes public debate on the perceived need is lacking altogether. In Chapter 6's Betuweroute case study, "it was not made explicit what 'success' would mean, not even in tactical terms". There were simply notions of the benefits of extra capacity and strategic advantages; indeed, if "success was defined in quantitative economic terms [a specific report] would undermine the claim that [the project] would be a success". We will discuss this further below.

For projects in the public view, the immediate is often more pressing than the longer term. It is perhaps because of all these difficulties that it so easy to concentrate on the well-defined and more easily defensible 'tactical' success criteria. Estimating and setting tactical targets is known and comfortable, and avoids the fundamental question of what we are trying to achieve. Defining a project with tactical success measures also gives stability in a world where the perceptions and meanings of the objectives might be disputed and changing. Moreover, public perception often focuses on the tactical on-time/on-cost criteria rather than the strategic project objectives. Certainly it appears to be a general phenomenon that, rather than logically concentrating on achieving the end result, the public sector often measures success in terms of tactical performance – the 'success paradox'.

These pressures and issues clearly feed through into the project front-end, and muddy the waters even before the start.

## 8.4 The early solution

The 'paradox of the significance of front-end management' describes how less effort is spent identifying the best conceptual solution than on estimating and improving performance against tactical success factors. Public views and perceptions are current and pressing now – so it is not surprising that the planning horizon is too short, and that short-sighted decisions are made (the 'paradox of myopic decisions'). Indeed, often, and perhaps due to political influences (such as a minister's 'pet project'), we decide on the solution or project upfront, without the logical sequence of identifying the problem that is to be resolved, or the needs that are to be satisfied, before exploring solutions.

Chapter 4 introduces the 'knowing vs exploring' trade-off: we need to explore the solution space, but how can we explore it unless we understand the solution that we are exploring? On the other hand, if we study individual solutions too much then we may neglect the exploration. In practice, if

we consider a solution, we need a representation that reveals the unknowns and complexities, and guides specific knowledge production. The more we consider this solution, the more we need to know about it, and so the more we focus on it rather than exploring other possibilities. Moreover, this or that knowledge will only be applicable to this specific solution and cannot be redeployed for evaluating alternative solutions. This implies elaborating particular solutions without sufficiently exploring other, different solutions (the 'paradox of the opportunity space'), as well as being swamped by too much unnecessarily detailed data (the 'paradox of early information overflow'). This trade-off may also provide an indirect explanation for the 'paradox of the significance of front-end management', since the focus is on developing the one solution in the best possible way rather than selecting amongst solutions about which little is known.

The discipline of a structured process ought to help ensure that our front-end follows a logical process such as that shown in Figure 3.1. As Chapter 3 discussed, this ought to help lessen the 'paradox of the opportunity space', since multiple solutions or concepts should be generated by the initial process. It ought also to help lessen the 'paradox of strategic alignment', as the objectives and benefits of a project have to be clearly articulated upfront. Indeed, there might be a lessening of the 'predict and provide' paradox. One important recommendation in Chapter 4 was to ensure that the governance of the front-end provides conditions that allow responsive actions and changes. However, the fundamental trade-off remains, and the experience is clearly often that of jumping into a solution too early.

Sometimes, of course – maybe often – the extreme position is taken of adopting one solution at the start without considering any other solutions at all. Based on the Norwegian data, Chapter 7 claimed that "most projects start out with only one specific conceptual solution to a problem". This can be driven by political considerations. In the C-NOMIS case discussed in Chapters 2 and 5, the political agenda was considered. In the Betuweroute case study in Chapter 6, key actors "had no interest in first discussing the precise problems and alternative solutions …. The decision-making procedures did not ask for a clear assessment of the problems/challenges, nor for alternative solutions".

Public projects are clearly highly complex in terms of the meaning of success, the complexity of stakeholders, the definition of the project activities, and so on. But public and political decision-making demands simplicity, and 'deterministic estimates' (Chapter 5) as soon as possible. Chapter 5.3 discussed two case studies illustrating this dissonance – perhaps going some way to explain why early, sometimes very expensive attempts to estimate costs and benefits were disregarded (the 'paradox of disregarded analyses of costs and benefits'), and anyway defining individual solutions too early, before the solution space was properly explored.

All of the above points to an early commitment to deciding on a specific solution upfront, the results of which have been explored throughout

this book. It affects estimation, since costs are considered at an early stage based on earlier, lower cost estimates before fully knowing about the solution (Chapter 5 talked about the 'escalating commitment of decision-makers'). Chapter 6 described this 'lock-in' effect, which might be caused by political decisions, or reliance on early (too-low) cost estimates, followed by escalating commitment, the need for justification, inflexibility and the closure of alternatives.

Even here, though, the solution is not simply to avoid early solution choice in all circumstances, because the project owner is not a passive figure seeking a solution, but rather an active participant. Chapter 4's 'evaluation vs shaping' trade-off discussed the compromise between evaluation and leveraging a solution to shape the future. Major projects are always subject to significant uncertainty and lack of knowledge, so evaluation of options can only go so far. Project sponsors often therefore focus on shaping the world around the project, and project representations become a future-making tool. This perhaps explains, and to some extent justifies 'the paradox of the opportunity space' and also the 'paradox of the significance of front-end management': endless evaluation does not always promote a better project, but sometimes the rapid selection of a solution – if not the best solution – may, in fact, be desirable because it facilitates the structuring effect on the environment.

Chapter 7 recommended an ex ante review at the end of the front-end before a project actually goes ahead, and offered some guidance. After these chapters were written, the UK National Audit Office (2021) published a synthesis of how they review major projects, which could provide useful guidance, particularly for ex ante reviews. A strong governance process should create a 'stop-go' hurdle before the project proceeds, such as the government decision in Chapter 3, particularly if it includes the requirement for such an ex ante evaluation, as in the Norwegian system described in Chapter 7.4.

## 8.5 Stakeholders and consultation

Chapter 2 described the wide range of stakeholders that may be involved in a project. Some will be powerful elements within government; some will be disinterested regulators or permission granters; there may be some who feel powerless, but have important views to express in what is ultimately a public project; pressure groups might consider themselves to be involved; hence there is likely to be a hierarchical range of analysts and decision-makers. Unlike much of private industry, the process is (or at least should be) carried out in the public view – and with the knowledge that there could be public and parliamentary scrutiny after the event. The public, particularly, can be very vociferous in expressing their views about such projects; the use of the word 'uproar' in Chapter 4's third vignette, when a particular element was left out of a public presentation is not uncommon.

The discussion above and in Chapter 2 showed multiple issues in gaining input from a range of heterogenous stakeholders with possibly conflicting

views. This need to consult stakeholders is discussed in Chapter 4's 'pluralism vs support' trade-off. There are clear problems in trying to gain a complete pluralistic scrutiny of the front-end from all stakeholders – this muddies the water to such an extent that a solution may not be found, or may prevent supporters from rallying around the successful option, and offer arguments for opponents. Again, this is a difficult balance in a public-facing project: the need to consult fully against 'paralysis by consultation'. One suggestion in Chapter 4 followed the observation that innovative technologies, including systems such as Building Information Modelling (BIM) are already used to develop product designs, and "an unexploited advantage of these technologies may be the possibility to enable collaboration with stakeholders at the very early stage of a project".

Rarely will any of these conflicting views be from disinterested viewpoints, as stakeholders want specific benefits, but few will be paying for these, or paying for over-spends, which can lead to the 'paradox of perverse incentives'. This is where projects which lay no financial obligations on the target group may cause perverse incentives – we will revisit this below.

## 8.6 Information

A key aspect of the front-end being a process rather than a point in time – a very long process in some cases, such as many military projects – is that we have to consider the temporal flows of information.

Running through all the chapters (see Figure 8.1) is the 'paradox of early information overflow'. Rather than carefully assessing, and making judgements on selected key information, there is a deluge of information upfront, all being very early indications, and decisions are based on these. This leads to early solutions, as highlighted above. As stated in Chapter 7, "in many cases, the amount of specific, detailed information contributes to restricting the original choice of concept to the extent that it will eventually be the realised option". This illustrates what happens in practice with Chapter 4's 'knowing vs exploring' trade-off – it is not just that by exploring individual solutions too much, we *may* neglect the exploration – in fact, this is what happens in practice. There is merit in making strategic decisions on 'scant information' (see Williams et al. 2009). Chapter 7 discussed how early decision-making should consider the problem in its context of stakeholder interests – "rather than being a hindrance, lack of detailed information early on can actually be a benefit, providing focus and flexibility to the analysis".

As the front-end proceeds, Chapter 5 described how new and better information becomes available. In addition, Chapter 7, in particular, considered the validity of information over time. While some data might remain robust over the period of the front-end, demand data, for example, might change over a short period. This is particularly true of projects with a longer front-end, such as military projects. In the well-known torpedo battery example,

which was "officially opened as planned and without cost overrun, it was closed down one week later by Parliamentary decision" (Williams & Samset 2010, p. 40). An ex ante review before the project was executed might surely have understood the out-of-date premise for the project.

Indeed, the public conception of rational decisions made at a single point of time in the front-end is clearly at odds with the actuality of humans' sense-making, both as they explore options, but particularly as they seek to know more about particular options. Chapter 4 talked about the "improvisational, bricolage-like nature of representation construction", discussing not only how the information comes to hand, but also how the mechanisms by which it is represented can have considerable impacts upon the process of understanding.

This dispassionate discussion of information presumes that the main characters are disinterested and unswayed by external motivations. Chapter 4 already noted the need to – and benefit of – "consider[ing] a broader range of cognitive, emotional and social reactions". However, the work of Flyvbjerg (2003 and following) would point to 'strategic mispresentation', as political or other motivations seek to influence the information and particularly the estimates put forward. Chapter 5 discussed how,

> this may manifest itself in assumptions that may be best described as 'underdeveloped' and optimistic forecasts of future long-run benefits. Whilst an unrealistically low initial cost estimate may increase the chance of the project being funded – future problems are 'baked in' and are often irreconcilable.

Examples of this in the public sector are legion. Within this book, the extended Betuweroute case study in Chapter 6 described some of the political estimation of cost, with one official not sleeping for fear that politicians would read some specific, disinterested, better – and much higher – cost estimates and "a positive decision to build would be endangered". The final cost was, indeed, close to those disinterested estimates. One issue, as Chapter 6 pointed out, is that "those who benefit from a positive decision to build are not those who need to pay", which leads to the question of accountability.

## 8.7 Accountability

Chapter 2 discussed the multitude of stakeholders and their differing needs and desires. However, this only considered what they wanted out of a project, rather than their input, Chapter 6 bringing to the fore the 'paradox of perverse incentives' for those actors who do not have to contribute.

In a public project, there are many actors with many motivations, who mostly do not have to pay if the project goes wrong. For example, "the Port of Rotterdam supported the project but did not have to pay, so it was easy for

them to ask for the line" (Chapter 6). Furthermore, those responsible for providing estimates can make these unrealistically low (or benefits predictions unreasonably high) since they do not pay for the results:

> the paradox of perverse incentives explains that it made sense for proponents of the Betuweline to come with excessively low cost estimates. Next a process of lock-in occurred, as a result of which there was no way back, long before the decision to build.

Indeed, Chapter 6 showed how this underlying paradox can loop back, helping to explain several of the other paradoxes (which would start to make Figure 8.1 more realistic but somewhat difficult to read). Perverse incentives can be so strong that an actor can be "motivated to make choices resulting in a project that is a complete failure seen in retrospect" (Samset & Volden 2016, p. 308).

Therefore, a key governance question in such projects is: who is accountable for the outcome of the project? In the language of Chapter 2, responsibility for delivery of the as-defined project output (i.e. the 'tactical success') is in the hands of a project manager, and often there is a contract with a private sector partner. However, as Chapter 2 explained, the public is interested in the overall strategic success, in other words, delivery of some useful contribution to the life of the country, at a reasonable price. There is therefore an increasing realisation that there has to be accountability within the system for the project outcome – the benefit that the project brings to the country.

In the UK system there is a position known as the 'Senior Responsible Owner' (SRO) who is responsible to the government and to parliament for delivery of both the project and the benefits, and who has to sign a letter agreeing to this (see UK Government 2019 for an example). These responsibilities are set out in a UK Government handbook (Infrastructure and Projects Authority 2019), which clearly states, "The senior responsible owner is accountable for a programme or project meeting its objectives, delivering the required outcomes and realising the required benefits. The senior responsible owner of a government major project is accountable to parliament".

This is easy to state, but there are clear difficulties which we have already established.

As pointed out in Williams et al. 2020, the evaluation of benefits can be difficult to disentangle from the general movements of the economic environment; there is often a move away from the original pre-defined project (launched under a previous national budget and maybe even a different national government) and "the emergent and sometimes fluid nature of benefits". Furthermore, some projects only facilitate the gaining of benefits, while other bodies are required to 'harvest' those benefits. For example, a piece of infrastructure might facilitate economic development, but only if the regional authorities take advantage of the project to make that development; supply of an IT system might make working with government easier, but

only if it is utilised. Sometimes the causal route between the project output and the desired benefit is long and difficult to justify, for instance between the building of new prisons and the reduction of re-offending (see Chapters 5 and 2).

But it is not the officials themselves who actually execute the project. So far we have discussed only the public sector and the demands upon decision-makers. The project itself will be executed by the private sector, so at some point there needs to be a contract signed with a company or consortium – again trying to avoid 'perverse incentives'. This might be easy in the hypothetical situation where tactical success factors are easy to define and are completely aligned with the strategic aim of the project, which remains constant throughout. However, we have already seen that none of this is likely to be the case, and that some sort of partnership needs to be formed with the private sector. There are also likely to be other private companies with a strong interest in the project, even if they are not part of the project execution team.

Identifying and allocating risk within such outsourced contracts is often complex, and our understanding of these is having to develop to ensure that the public sector has appropriate contracts (Bloomfield et al. 2019). Even if we can identify the risks unambiguously, there is a trade-off between allocating responsibilities and risks between participants and enhancing collaboration. In Chapter 4, seeing project representations as 'boundary objects', the more these are defined prescriptively, the easier it is to allocate responsibilities, but the harder it is to produce collaboration. The solution to this recently has been collaborative governance and contractual forms – but the requirement for these often logically implies the selection of, or at least convergence into, a conceptual solution early in the front-end process ('paradox of the significance of front-end management'). Again, Chapter 4 looked at relational contractual arrangements which allow responsive actions to obstacles or 'real life'.

## 8.8 Reflecting on the project

As we have said above, public projects are carried out with a certain degree of transparency, and the public arena will want to know whether they have been given value for taxpayers' money. The 'public arena' in this case includes not just the general public – who may have particular slants on their views (see Chapter 2). It also includes formal auditing organisations (in the UK, the National Audit office) as well as governmental or parliamentary bodies (in the UK, this includes parliamentary committees). Indeed, Chapter 5 referred extensively to one series of hearings by a UK Parliamentary Select Committee.

An evaluation should stand back and consider the project against the success criteria, as laid out generically in Chapter 2, and again in Chapter 7.3. This was done in Norway by the Concept programme (as described in Samset & Volden 2016), with results laid out in Chapter 7. Achievement of cost/time targets can be evaluated quantitatively, although this can be problematic if

the final output differs from (or in some cases bears little resemblance to) the original plan, perhaps because circumstances changed during the project – which is not unusual for public projects. However, higher level criteria such as 'effectiveness', 'relevance' and 'sustainability', which might be difficult to quantify (let alone monetise), have to be largely evaluated subjectively.

There are significant problems with larger public projects in evaluating benefits ex post (see, for example, Williams et al. 2020). For projects having an economic impact, the effect is often indistinguishable from general changes in the economy (i.e. it is difficult to evaluate what would have happened without the project). As described above, some projects only facilitate benefits, leaving other bodies to 'harvest' those benefits. Where projects are part of a portfolio, it can be difficult to disentangle the effect of individual projects. This means that the clear, unambiguous allocation of benefits to a particular project might be very difficult in some circumstances and requires comparison with hypothetical counterfactual options.

However, despite all this, Chapter 7 shows a process which is operating well and has the capacity to contribute to greater delivery of projects, as well as ameliorating the effects of all ten paradoxes.

## 8.9 In conclusion

In conclusion, in this book we have looked at the reality of the genesis planning, launching and delivery of major public projects. There is plenty of advice and guidance for the public decision-maker, but actual practice appears not to be so simple. As Samset and Volden (2016) showed a few years ago, there seemed to be a number of curious 'paradoxes' causing projects to be launched in ways that were later seen as not of the best. Figure 8.1 shows these paradoxes and the way in which many flow from each other.

Looking more deeply into the front-end of the project showed a number of fundamental trade-offs in Chapter 4 which to some extent are unavoidable. It is important that a project understands, acknowledges and manages these trade-offs and steers a clear course.

Consideration of the 'paradoxes' has enabled us to understand them better, as well as the underlying causes – both from the environment and from the actors. Some aspects are incorrect behaviours that need to be understood and avoided. Some, however, need to be understood and managed as paradoxes, as argued in emerging paradox theories such as Schad et al. 2016 (see Chapter 4).

This chapter cannot do justice to the depth of each individual chapter, but has noted some themes which cut across all chapters.

The authors of the book hope that their discussions will help to produce more clarity for decision-makers – as well as public understanding of the decisions being made – so that some behavioural traps can be avoided, better decisions made in paradoxical situations, and so that we can plan and deliver projects that actually provide our countries with the benefits they need efficiently and effectively.

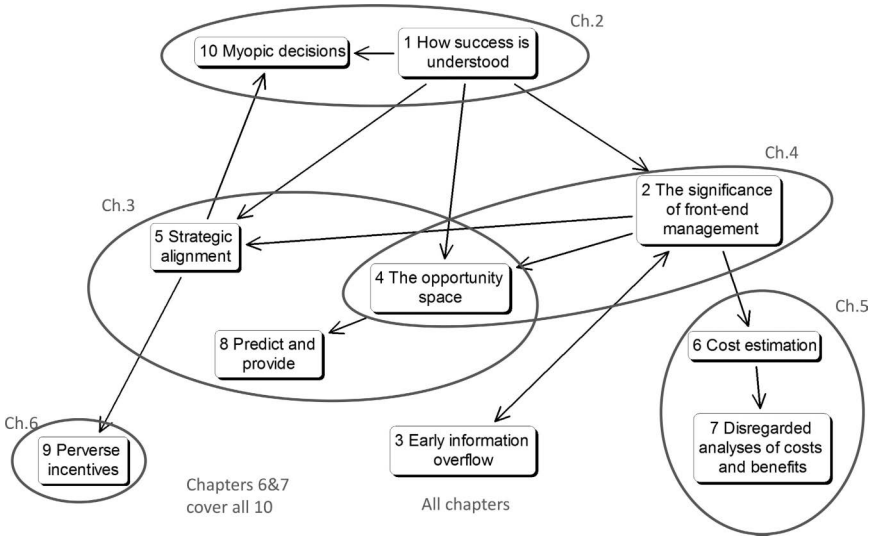


*Figure 8.1* Chapters and paradoxes.

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# Appendix

## Front-end definition of projects

### Ten paradoxes and some reflections regarding project management and project governance

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#### 1 Introduction

A large and increasing share of the activities taking place in private as well as the public sector is organised as projects. In private sector projects, the ultimate goal is to improve the company's profitability, either directly or indirectly, through improvements in its competitiveness. In public projects, the commissioner is the government, representing the entire society and its taxpayers. In such cases, the benefits of the project must be considered in a broader societal perspective, to ensure that the project provides value for money and contributes to the desired development.

There are many challenges facing public investment projects that must be overcome to achieve project success, such as lack of competence among planners, avoidance of hidden agendas during planning, underestimation of costs and overestimation of benefits, unrealistic and inconsistent assumptions, and how to secure essential planning data and adequate contract regimes. Many of these problems can be interpreted in terms of deficiencies in the analytical or political processes preceding the final decision to go ahead. Hence, the importance of the front-end decision-making phase must be recognized to strengthen project governance.

The term governance is derived from the Latin word *gubernare*, meaning 'to steer'. It refers to the administrative and process-oriented elements

of governing, whether undertaken by a government, market, or network, whether over a family, tribe, formal or informal organization, or territory, and whether through laws, norms, power, or language (Bevir, 2013). Governance is about processes of rule more than institutions of government. It relates to processes and decisions that seek to define actions, grant power, and verify performance. Different instruments are available to improve governance, ranging from legally binding regulations, to economic and other types of incentives, as well as information and skill development. The challenge in governance is to identify the optimal mix of different instruments.

Project governance refers to the processes, systems, and regulations that the financing party must have in place to ensure that projects are successful. This would typically include a regulatory framework to ensure adequate quality at entry, compliance with agreed objectives, management and resolution of issues that may arise during the project, and standards for quality review of key appraisal documents (Samset and Volden, forthcoming). These processes and regulations can often be described in terms of stage-gate phase models.

Project management refers to the processes established to organize and manage resources required to complete a project within defined scope, quality, time, and cost constraints.Whereas the literature on project management is substantial, project governance has only recently become an issue of importance in the project management community (e.g. Müller, 2009).

Peter Morris (1994) brought to our attention that in the early years, project management had an extremely narrow focus, reflected only in the project life cycle, and ignoring the critical front-end. He noted that as long as we only focus on the life cycle itself, we are missing the critical front-end and institutional elements (shown in his Management of Projects paradigm) that more accurately typify the responsibilities of the project owner and the project manager.

## 2 The present study

In the year 2000, the Norwegian Ministry of Finance introduced a governance regime for the country's largest public investment projects, the so-called Quality Assurance (QA) regime, in terms of a mandatory quality-at-entry scheme to meet such challenges. It is a simple stage-gate process with a top-down review of the quality of project proposals, which are typically the result of bottom-up processes of analysis and decision making in society. The Norwegian QA scheme includes two external reviews in the front-end: Quality Assurance of the conceptual solution (QA1) before Cabinet decision whether to start a pre-project, and Quality Assurance of the cost and steering frames (QA2) before the project is submitted to Parliament for approval and funding (see Fig. 1).

In parallel to the QA regime, the Norwegian University of Science and Technology in year 2002 initiated the so-called Concept research programme, designed to focus on the front-end management of major public

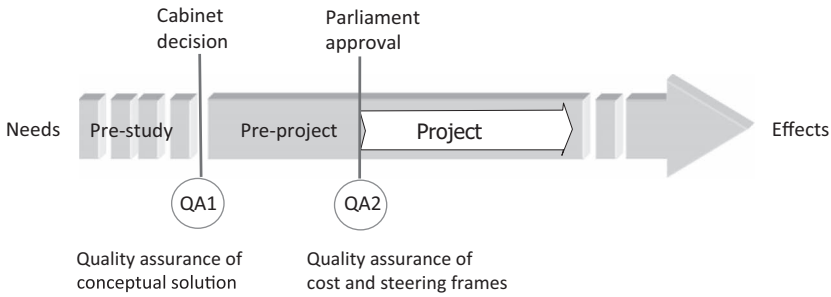



*Figure 1* The Norwegian Quality Assurance regime, a stage-gate phase model with two external reviews in the front-end of major public projects.
Source: Norwegian Ministry of Finance.

projects. The governance scheme clearly would be a unique laboratory for research on longitudinal data. It has allowed researchers to follow the largest public projects in Norway since 2002. The Concept programme works to develop the research frontier in the area of project governance. This is undoubtedly an interdisciplinary field, and the programme has conducted separate studies in areas such as public management, project management, portfolio management, economic analysis, planning, decisionmaking, risk analysis, contract management, the theory of incentives, applied logic, and judgmental assessment.

The idea was to broaden the perspective on projects. To quote Morris (2009:60), "effective management of projects is more than just execution-oriented project management. Projects are undertaken to create value and deliver benefits. Shaping the interaction between the sponsor's goals and the way the project (or programme) is to be developed, in the best way possible, absolutely crucial — probably one of the most important aspects of managing a project".

This understanding is an underlyingmotivator of our research. However, the approach has been inductive rather than deductive. It has been more of a probe into new areas than a process guided by precisely formulated and theoretically founded problems. The perspective has been on projects as means to create value and deliver benefits. Some studies had a focus on decisions, others on analysis, but all of them were meant to provide insight into what is here termed project governance.

Miller and Lessard (2000) contended that the front-end phase from inception and until the budget is approved by Parliament takes 6–7 years on average in major public investment projects. This is also the case in Norway. The subsequent implementation phase takes typically 3–5 years, and projects will have to be at least three years into their operational phase before an ex post evaluation can be undertaken. The Norwegian QA scheme has now been in operation for 14 years involving about 20 new projects each year. This means

that there is a tremendous time lag as regards availability of empirical data. During the early years of the programme, researchers were first left with the option to do theoretical desk studies, and then gradually shifting into more hands-on studies of procedures and practices in planning, quality assurance and decision making during the front-end phase as more projects were added. Only recently, empirical data are becoming available. At present, the total number of projects is about 260, of which only 50 have been implemented so far. In addition, not more than 10 projects have reached a degree of maturity that allow for ex post evaluations.

Fourteen years after the quality assurance scheme was introduced it has proved to have a positive impact on cost control, since almost 80% of the first 40 projects were completed below budget, which is quite remarkable (Samset and Volden, 2013a, 2013b). Getting to grips with the choice of conceptional solution and securing the strategic performance of projects may prove to be a much more complex matter. It is challenging, but no less interesting.

The present study draws on some research findings from the Concept programme, presented below in terms of ten paradoxes, all of which have implications for the theory of project management and project governance, as well as a concluding study that demonstrates some of their implications. The term "paradox" in this paper is used to describe situations with a counter-intuitive result, some of which are based on fallacious reasoning or incomplete or faulty analysis. These are the paradoxes of:

1 How success is understood
2 The significance of front end management
3 Early information overflow
4 The opportunity space
5 Strategic alignment
6 Cost estimation
7 Disregarded analyses of costs and benefits
8 "Predict and provide"
9 Perverse incentives
10 Myoptic decisions.

Their common denominator is that they all focus on the choice of conceptual solution. Each paradox is rooted in one or more studies in the programme, but also inspired by research findings presented in the biannual international Concept symposia on project governance. According to Pinto (2014), these symposia "... have provided much of recent theoretical and epistemological structure to the construct of project governance. Papers from these symposia have been on the leading edge of many of the insights we have on the current state of project governance".

The three first paradoxes are not rooted in empirical research, but in desk studies and literature reviews. The remaining seven (numbers 4–10) are based on cased studies involving 5–40 cases, most of them are major

public projects that have been subjected to external quality assurance under the Norwegian QA scheme. It should be noted that most of these studies are written in Norwegian only. The reports can be downloaded from the programme's website www.concept.ntnu. no, where also summary reports in English are available.

Since this paper can only provide brief snapshots of the studies, most of the references will have to be found in the underlying reports, and are only to a limited degree included in this paper.

## 3 The success paradox: success is measured in terms of tactical performance rather than strategic performance

The term "success", used as an indicator, is a highly complex and aggregated measure. More than two decades ago Pinto and Slevin (1988) concluded that: "the concept of project success has remained ambiguously defined both in the project management literature and, indeed, often within the psyche of project managers… Until project management can arrive at a generally agreed upon determinant of success, our attempts to accurately monitor and anticipate project outcomes will be severely restricted".

"Success" may be interpreted differently by various individuals and institutions. It may be measured differently in different types of projects, and different individuals tend to assess the success of the same project differently depending on their preferences, values and to what degree they are affected by the project. In addition, the degree of success is time-dependent. For instance, Shenhar et al. (2001) offer a chronological sequence of events as a compound definition of project success: (1) meeting time, budget, and other requirements, (2) impact on the customer, (3) benefit to the performing organization, and (4) preparing the future. The project's stakeholders do not necessarily share the same view of success. The project manager typically sees his job successfully accomplished when the project is done on time, within budget, and to specifications. The users will be concerned about the immediate effects of the project, and the investor or commissioner will typically be more concerned with the long-term economic viability.

Success as a generic term means to gain advantage, superiority, accomplishment, achievement or added value. Measuring success will have to look beyond the immediate outputs of the project to assert the anticipated and wider impact in a longer-term perspective. A hospital will ultimately have to be assessed in terms of its health benefits. An industrial project might be judged essentially in financial terms, and an infrastructure project in term of its utility.

The assessment of success can be in absolute or in relative terms — that is in relation to what was agreed versus what was realistically achievable. Ambition is expressed in terms of the project's stipulated objectives. Its effectiveness is a direct measure of what has been actually achieved. Clearly, success measured in absolute terms may give a misleading conclusion if objectives are

unrealistically ambitious. By measuring in relative terms, that is in relation to what could reasonably be expected as compared with experiences in similar projects — the same project might possibly be considered a success.

The media tend to give unsuccessful projects more publicity than successful ones. However, their perspective is highly restricted. The number one criterion of failure in the media is cost overrun; number two is delay in time. Truly, a much wider view needs to be taken on the success and failure of projects. The initial choice of project concept is of critical importance. This represents the one key decision of many made during the lifetime of a project, which is likely to have the largest impact on long-term success or failure Williams (2008). Here, by "the project concept" we mean much more than just the technical solution — it includes the entire business case, all of the various organisations involved, and the various mechanisms and arrangements involved in the inter-organisational relationships, see Miller and Hobbs (2009).

Here, it is necessary to distinguish between the projects' tactical and strategic performance. Success in tactical terms typically means meeting short-term performance targets, such as producing agreed outputs within budget and on time. These are essentially project management issues. Strategic performance, however, includes the broader and longer-term considerations of whether the project would have a sustainable impact and remain relevant and effective in its operational phase, throughout its lifespan. This is essentially a question of getting the business case right, or, in short, of choosing the most viable project concept.

This is illustrated in Fig. 2. Tactical performance is a question of how the project is implemented, i.e. how inputs are converted into outputs. These are measures of its efficiency, here measured in terms of the cost, timing and

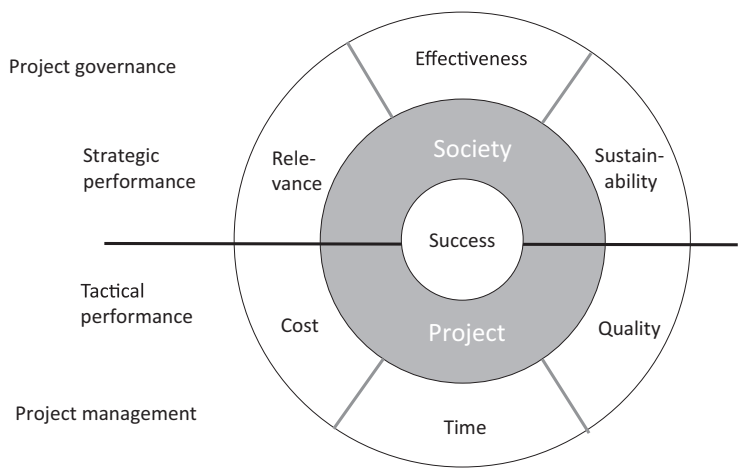



*Figure 2* Successful projects. Tactical performance is a question of delivering the project outputs as planned, while strategic performance is the worth or utility of the project as seen in a long-term perspective (Samset, 2014).

quality of deliverables. Strategic performance is a question of how the project performs after the outputs have been delivered. This will have to be monitored with the more compound measures mentioned above, which would cover the broader and longerterm perspectives and to a lesser degree involve focusing on technology and management issues, but more on societal and economic aspects.

One example of tactically inefficient projects but viable in strategic terms could be the University Hospital in Oslo, Norway. Due to emerging new technologies and added responsibilities, captured during the engineering phase after the budget was decided, it was completed a year behind schedule and with considerable cost overrun, adverse newspaper reports and a public inquiry. No doubt that cost overrun was considerable in absolute terms, but in relative terms, it was equivalent to only a few months' operational costs for the hospital, and therefore insignificant in a lifetime perspective. The overall conclusion after a few years of operation was that the University Hospital was a highly successful project; and it would perhaps be unfair to suggest that initial decisions should be able to capture problems at this level of precision.

More serious by far is when a project fails in strategic terms, even if it successfully produces the intended outputs. It means that the choice of concept turns out to be the wrong one in relation to the problem at hand. In some cases, it may create more new problems than it solves, in others the initial problem no longer exists once the project is completed. One such example is an on-shore torpedo battery built inside the rocks on the northern coast of Norway in 2004 (Samset, 2008a, 2008b). The facility was huge and complex, designed to accommodate as many as 150 military personnel for up to three months at a time. It was officially opened as planned and without cost overrun. Already one week later it was closed down by Parliamentary decision, since it was obvious to all involved that a potential enemy would not expose its ships to such an obvious risk; the concept had long since been overtaken by political, technological and military development. What was quite remarkable was that this project, which can only be characterized as a strategic failure, got much less negative attention in the media than the University Hospital, possibly because it was a success in tactical terms.

Clearly, a successful project is one that delivers its outputs and significantly contributes to the fulfillment of agreed objectives. Moreover, it should have only minor negative effects, its objectives should be consistent with needs and priorities in society, and it should be viable in the sense that the intended long-term benefits resulting from the project are produced. These requirements were first formulated for USfunded international development projects by the United States Agency for International Development (USAID) in the 1960s, and subsequently endorsed by the United Nations (UN), the Organization for Economic Co-operation and Development (OECD), and the European Commission (EC) (USAID, 1980). They comprise five requirements or success factors that have to be fulfilled, i.e.: the project's efficiency, effectiveness, relevance, impact and sustainability. These are tough requirements

that go far beyond the issues that usually are covered by the media or indeed by many planners and decision-makers.

Applied as standard requirements both up-front and ex post when projects are evaluated would be likely to improve project governance considerably in the future.

## 4 The paradox of the significance of front end management: less resources are used up front to identify the best conceptual solution (project governance), than to improve tactical performance during implementation (project management)

Projects are exposed to uncertainty in varying degrees and this is often used to explain their failures. Uncertainty characterises situations where the actual outcome of a particular event or activity is likely to deviate from the estimate or forecast value. Uncertainty may have many and various causes, related to the situation itself: the design of the project, the time perspective, available information, the implementation of the project, etc. (Marshall and Ritchie, 1993). Obviously, decisionmaking becomes difficult when uncertainty is high. Availability of relevant information reduces uncertainty from the decisionmaker's point of view. It is widely believed that uncertainty is highest at the initial stage, when the project concept is conceived, and that it tends to reduce rapidly as information accumulates over time.

This line of thought is illustrated in Fig. 3. It follows that the utility of adding information is at its highest in the earliest stage. It is also commonly believed that the decision-maker's flexibility and the cost of making amendments are opposites. This is visualized with a similar graph. Decision-makers can juggle with different ideas and strategic solutions to a problem in the initial stages, but once decisions are being made, essential choices become locked, and it is more difficult and expensive to change the overall design. Therefore, major issues such as agreeing on the most effective solution to a problem and the choice of concept need to be dealt with as early as possible — later on is too late. Less essential issues such as avoiding major cost overrun can be handled later, for example when the final budget is agreed.

In Fig. 4, the distinction is made between the front-end and the implementation phase. The graph suggests that the potential to reduce uncertainty and risk is the largest up-front, and decreases substantially when the project is implemented. It is a paradox therefore that most of a project's planning resources may be spent on detailed planning and engineering, while too little is usually spent on getting the idea right from the start where the potential to reduce uncertainty by means of adding information is the largest. The paradox is that most resources are used to reduce uncertainty during the implementation phase, where the potential is much less.

Recent literature has highlighted the front-end phase including the project definition, as important for ensuring strategic project success (see for example

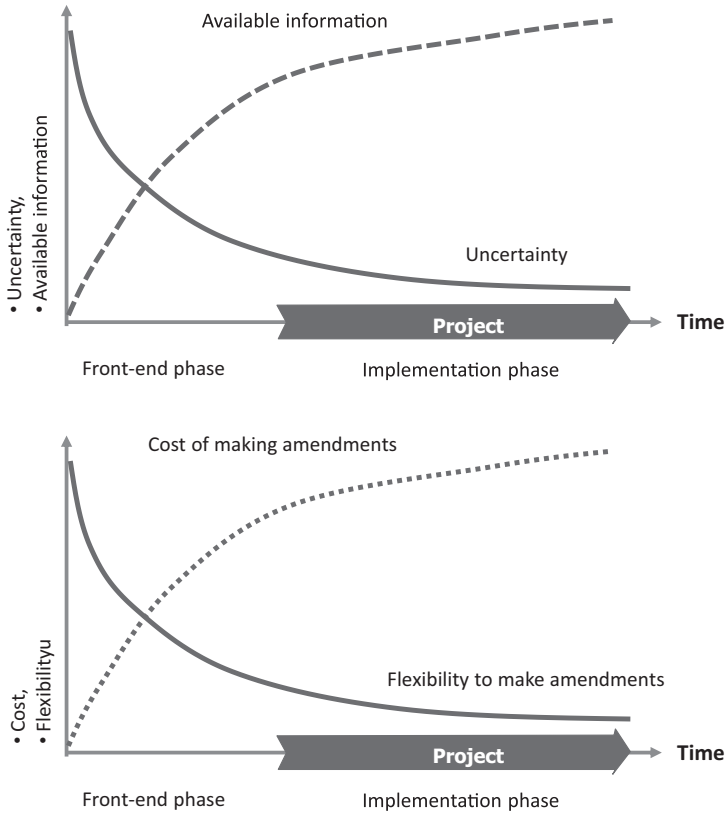



*Figure 3* People's conception of how uncertainty is affected by information and how flexibility to make amendments is restricted by cost, as time passes in a project.
Source: Authors.

Merrow, 2011; Morris, 2013). Where projects fail strategically, it is likely that the problem can be traced back to decisions in the earliest phases, when the initial idea was conceived and developed. What happens during the front-end phase is therefore essential for a project's success. A study by the World Bank based on a review of some 1125 projects concluded that 80% of the projects with a satisfactory "quality-at-entry"[1] were successful, while only 35% of those with an unsatisfactory quality-at-entry achieved success (World Bank, 1996). Improved front-end management is therefore likely to pay off in a wider life cycle perspective, as evinced by the IMEC study (Miller and

1 Quality-at-entry was used as an indicator to characterize the identification, preparation and appraisal process that the projects had been subjected to upfront.

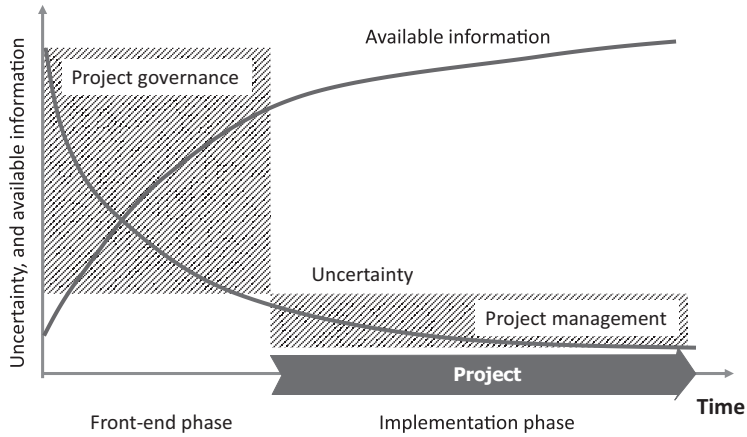



*Figure 4* The project life cycle. Uncertainty is greatest in the front-end phase and diminishes as more and better information is acquired for making decisions.
Source: Samset (2010).

Lessard, 2000). One way of improving quality-at-entry is by challenging initial ideas and applying simple analyses, extracting and making use of previous experience from similar undertakings, and consulting with stakeholders. Jordan et al. (1988) argued that 15% of the time and resources in projects should be spent on front-end work, whereas Miller and Lessard (2000) suggested up to 35%.

In most cases the key issue at the earliest stage is to shed sufficient light on the underlying problem that provides the justification for the project, and the needs that the project is meant to satisfy. Detailed information about possible alternative solutions is less relevant. This illustrates what seems to be a major dilemma, since most projects originate as one specific solution to a problem, while the problem itself may not be analysed sufficiently, and alternative solutions may not have been considered at all. Typically, the preferred concept originates in the mind of one individual, based on intuition and experience, rather than systematic analysis of problems, needs, requirements, etc. Most of the information generated is associated only with the initially identified solution (Whist and Christensen, 2011).

A second dilemma is that this information, which may be very detailed and specific, tends to lock decisions into the initially preferred concept — to the extent that this will inevitably be the one that is finally chosen. It is all too rare that alternative concepts are identified and analysed to the extent that they get a fair trial in the subsequent decision process.

## 5 The paradox of early information overflow: decisions are based on masses of detailed information up front rather than carefully selected facts and judgmental information relevant to highlight the essential issues

It follows from the above that the front end phase is when fundamental choices are made, uncertainty is at its highest freedom to choose is at its optimum, and available information is most restricted. Adding information, therefore, makes sense — but only to a certain degree. The crucial issue is not the volume but what type of information is needed.

But contrary to the idea depicted in Fig. 3 the sheer amount of available information upfront might not be the issue. In the initial phase of a project the priority is to establish an overall perspective, and to analyse the problem in its context, considering the needs and priorities of stakeholders, users and affected parties, in order to come up with a sensible strategy. Opportunities and risks should be considered. Experience suggests that creativity, imagination and intuition can be more valuable at this stage than large amounts of data.

Decision making may be complex, unstructured, and affected by chance. Analysis may be biased or inadequate. Decisions may be affected more by political priorities than by rational analysis. Political priorities may change over time. Alliances and pressures from individuals or groups of stakeholders may change. The amount of information is large and may be interpreted and used differently by different parties. The possibility for disinformation is considerable.

Another aspect is that the early selection of a concept tends to survive decision-making, regardless of process, expertdriven rationalistic or more open-ended and democratic. This makes a strong case for proper research to identify the most viable concept up front. However, time factor, complexity and lack of predictability also imply that the outcome of rationalistic planning upfront tends to alter over time.

Exact quantitative information tends to be more affected by time than the choice of concept. On the one hand it is obvious that the higher the precision, the more rapidly information is outdated.[2] It is tempting to speak of the "half-life of information", see Fig. 5. For instance, exact information about the demand in a fast-developing market will have limited value after months, or even weeks. On the other hand, there are many examples to suggest that qualitative assessments tend to remain valid for much longer. Consider the assessment of users' fundamental preferences within a market segment. While

2 We need of course to make a distinction between lasting information, for example physical data on the one hand, and less durable information such as economic estimates on the other hand.

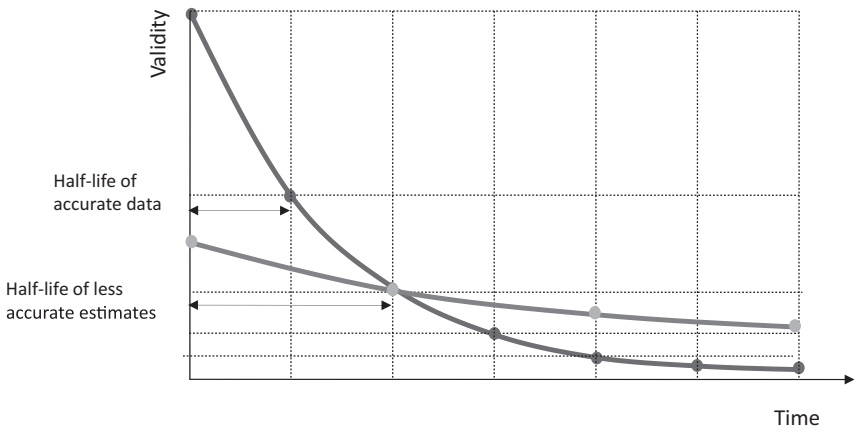



*Figure 5* Half-life of information. Validity tends to decrease over time during the front-end phase. More rapidly for accurate data than for less accurate estimates.
Source: Samset (2010).

it might not be possible to make a valid prediction of the actual demand three years into the future, it may be judged that demand will continue for a long time and can therefore be relied upon in strategic planning up front.

This suggests that restricted quality of information upfront may not be a major problem, since the need for precise information is low. It increases as the time for detailed planning approaches. In other words, the utility of exact information tends to reduce with the time-span. The opposite seems to be more of a problem: when decision-makers are confronted with an abundance of detailed information at an early point in time it may result in what is referred to as "analysis paralysis". This problem is discussed by Williams (2008). And besides, the cost of collecting information on a specific topic usually increases progressively with the amount of information collected. This is because more information requires more in-depth studies or more wide-ranging information searches. On the other hand, the gain in utility of additional information tends to decrease. This is because there is usually a critical amount of information that is needed to get the necessary insight in a situation: Additional information will be of limited use. Maximizing the utility/cost-ratio will set a limit to the amount of information that is useful (Jessen, 2012).

This emphasizes the need to invest in relevant information at the earliest stage of a project, while at the same time limits the search to what is useful for decision-making at this stage. A targeted search for information regarding the main uncertainties likely to affect the project is more cost-effective than

an unguided search, since it makes it possible to increase the share of relevant information and reduce the total amount.

## 6 The paradox of the opportunity space: the choice of conceptual solution is made without systematically scrutinizing the opportunity space up front

Every project is initiated to solve some problem or meet some needs. And every project faces a choice of concept in terms of how to solve this problem. Consequently, a key task in the early phase of a project is to identify possible ways to solve the problem it has been mandated to solve (setting up the opportunity space), furthermore to evaluate alternative concepts (limiting the opportunity space), and decide on the one best suited. There is much evidence to suggest that this is not always how things are done.

One problem is that planners are discipline experts with an inherent tendency to emphasize some aspects of the matter and downplaying others. The same may apply to organization undertaking the planning; its rules, procedures, etc. This is the reason for path dependency (Dosi, 1997; Margolis and Liebowitz, 2000); systematically choosing some solutions while avoiding others, even if these conflict with rational choices.

The situation become even more complex since these decisions are made at the intersection between the professional and political, in other words in-between what is rationally sound and politically possible. In the end, the complexity of the decision situation depends very much on whether there is an agreement about what one wants to achieve and what are the best means to this end (Christensen, 1985).

A case study of 17 major public projects was carried out to explore the use of the opportunity space, i.e. how it was defined, the type of conceptual alternatives identified and the effect on decisions (Andersen et al., 2014). It was found that in 11 cases the choice of concept had in reality already been made when the front-end process started, only in six cases, truly unique alternatives were identified. In most projects the analytic focus was narrowed to detailed project-specific issues at the expense of overall societal aspects. In half of the projects, the opportunity space was restricted to such a degree that real alternatives were excluded. There was a strong degree of path dependency where the alternatives represented a continuation of the current solution or variations over a theme.

It was emphasized that these processes take place on the borderline between the professional and political spheres, especially since the political backdrop is what exerts the most restricting effect on the opportunity space.

While the analytical process is largely within the realm of the professional constituency where the intention is to expand the opportunity space to allow identifying the best alternatives, the decision still remains with the political level. And the processes and decisions at this level are not always rational, as

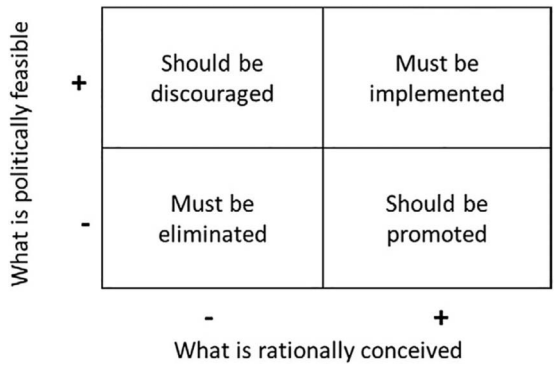



*Figure 6* Categories of projects within the opportunity space.
Source: Whist and Christensen (2011).

illustrated in Fig. 6. The two dimensions of rationally derived and politically feasible span four categories:

- The win/win projects score well on both dimensions and "must be implemented" (hydro power plant with no environmental downsides)
- Rational projects, but which are not politically mature, where a quality-at-entry approach, such as the Norwegian Ministry of Finance QA regime can aid in the decision process to get these promoted (close down nuclear power plants)
- Politically acceptable, even desired, but poorly conceived projects, these should be stopped, and the QA regime can help clarify the financial realities and thus kill such initiatives (Olympic games in a small country)
- The lose/lose projects have no support in either direction and should never go further (private exploration of space).

A separate case study of 23 major public investment projects (Whist and Christensen, 2011) went deeply into how the analytical and political processes interacted during the frontend phase, in order to understand how this affected the outcome of the projects. It was found that the majority of projects started out with a predetermined solution. In about half the cases an unambiguous problem analysis was nevertheless carried out, and in one third of the cases new problems were introduced during the front end phase, Fig. 7. The result was that two third of the projects were initiated with the same conceptual solution as the initial one, while in one third of the cases the conceptual solution was a different or changed substantially. Ten of the projects were considered relevant in relation to needs in society. Nine of these had a

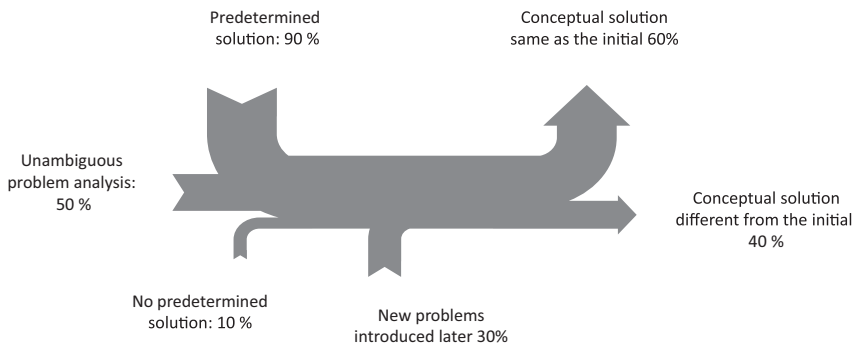



*Figure 7* Path dependency in defining and agreeing on conceptual solutions up front. Source: Authors.

comprehensive problems analysis up front, and the Government had been a central actor in seven of them, while only in two of the thirteen projects were considered less relevant.

These studies, and the examples mentioned, first and foremost illustrate the unpredictability of the political system in a mature democracy; a well developed, rational decision basis is no guarantee for a rational choice of concept. It was concluded that a scheme with external quality assurance of the decision basis provided to the political level had proved to have some positive effect in terms of helping make some choices more rational.

While the analytical part of the decision-making processes overall was rather weak, the participation of and control with the participating actors was considerable in these projects. From experience we know that a bad starting point may be adjusted through a successful decision-making process, even when the original idea was quite wrong. We also know that in many cases this does not happen.

This study demonstrated that there are many hurdles for any project. Democratic decision-making processes, particularly those which take long time, are complex and difficult to predict, and many will claim that this is a necessary part of democracy. If this is taken as a premise, the study suggested that the biggest potential for improvement lies in strengthening the analytical process. What would seem to be a reasonable compromise in front end analysis and quality assurance of major projects would be that the first step should be to identify and eliminate the worst alternatives. These are low hanging fruits and proper action can give a high reward with little effort. The next step should be to seek for good alternative concepts, but within reasonable limits, and not necessarily crave for the best, since the case will nevertheless be handed over to decision makers to conclude.

## 7 The paradox of strategic alignment: strategy and alignment of objectives are highlighted as essential concerns, but in most cases the internal logic of causalities and the probabilities of realization are erroneous

Alignment of objectives is the exercise to define the basic logical structure outlining the project by following the causal link from the basic needs of users and society, through defined goals to the delivery of project results (outputs), their outcome (effects) and long-term benefits after the project is terminated (purpose). This needs to be done before starting significant work on a project or programme. Unfortunately, this is not always done and can result in significant underperformance compared to expectations (Cooke-Davies, 2011).

Any large projects, and particularly major public investment projects, are initiated in order to produce benefits for their owners (society). Many authors have studied success factors and predictors of failure, notably Morris and Hough (1987), Pinto and Slevin (1988), Miller and Lessard (2000), Flyvbjerg et al. (2003), and Hopkinson (2007). The available literature provides several different answers to why things go wrong and what could bring success in projects. Earlier literature tended to focus narrowly on the outputs in terms of cost, time and quality, whereas more recent literature may offer a wider perspective. For example, Morris and Jamieson (2005) study the processes, practices and people issues involved in moving from corporate strategy to projects. Their results are promising, though only based on four case studies. A common feature is that when projects' strategic success is low, the problem possibly lies in the early phases of the project and at the governance level (the owner perspective).

Some studies on international development projects have provided insight in this area. An analysis of a large sample of such projects concluded that most of the uncertainties affecting these projects were internal and not contextual, for a large part associated with aspects of management and the fundamental project design (Samset and Haavaldsen, 1998). Consequently, the suggestion was that most of the problems ought to be met early, i.e. in the pre-study phase.

Youker (1999) concluded that the lack of shared objectives and agreement on the objectives of a project was one of the biggest problems facing international development projects. A study of alignment of objectives in development projects based on a sample of 30 international aid projects, concluded that most of the projects had design faults at all levels, and no projects were without faults. Typical problems identified were insufficient resources, and too many and unrealistically ambitious goals (Samset, 2006).

The same analysis was repeated on a sample of 17 large public investment projects in Norway (Andersen et al., 2014). A project strategy will always be a hierarchy of goals that are interlinked in cause-and-effect chains that

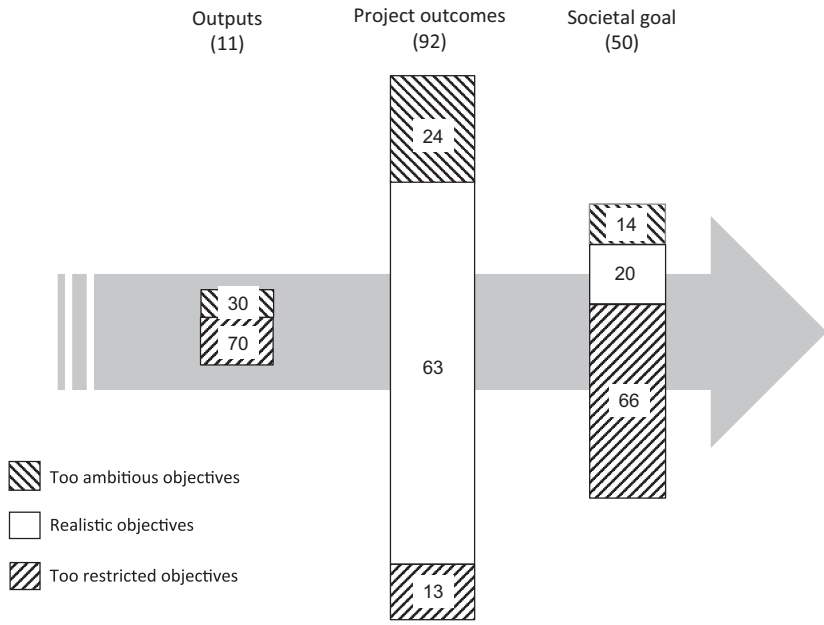



*Figure 8* Assessment of the goals in the sample of projects in terms of location in the goal hierarchy and their level of ambition (Samset et al., 2014a, 2014b).

illustrate the ambition levels for a project, as well as their realism. Objectiveswere analysed in terms of their internal causality, and ambition. Complex statements were broken down in several single objectives.

The study found that in most of the Norwegian projects the goals are consistent with the needs, but there were shortcomings when it comes to achieving reasonable levels of clarity and ambition, as shown in Fig. 8. For instance, when a project to acquire defence equipment presents "*stability within the international legal system*" as a societal goal and a limited road construction project expects to result in "*increased settlement*", we intuitively understand that the distance between cause and effect is too large and that the goals are too ambitious for the given project.

Fig. 8 compiles the findings from the study and breaks down the percentages of goals across the different goal levels. Of the total 152 goals presented by the 17 projects, by far most of these were defined as project outcomes with the majority of the remaining goals being societal goals. About a quarter of the project outcomes were in reality societal goals, while two thirds of the presented project outcomes actually were project outcomes. Also, a small portion of the social goals are completely unrealistic, while a small set of the project outcomes were in reality project outputs, i.e., specifying aspects of the

project's deliverables. In total, none of the projects avoided erroneous definitions of goals, but they performed better than the international development studies mentioned above. But clarity seemed to be the largest problem. Five of the projects had in reality no societal goals whatsoever, while others had too many. One project had as many as seven societal goals. In such a case, the strategy is of little help to focus the efforts and clarify the purpose of the project. Regarding project outcomes, the majority of projects had 3–9 project outcomes, two projects even more than 10.

The purpose of formulating an objective is principally to clarify the direction for that which is sought. The scope also needs to be stated so one may know when an objective is attained. Multiple objectives may confuse if they all don't point in the same direction. This is particularly evident if the objectives also conflict with each other. Objectives should give rise to common understanding among and motivation of all parties involved in or affected by a project. On one hand, this means that objectives should be unambiguous and realistic. On the other hand, to motivate, they also have to be well founded, to the degree that they are accepted. Moreover, the objectives should limit the enterprise or the strategy. This means that the resources allocated and the results anticipated should correspond.

In looking at customary practice in planning projects, the threshold for improvement seemingly is very low and the possibilities of marked improvement accordingly are great. Regardless, practice indicates a need for more concise formulation of objectives in the front end phases of projects, at any rate to establish common understanding of where a project is going and how it will get there.

## 8 The cost estimation paradox: the focus is on the final cost estimate (the budget), while early cost estimates are overlooked

We have already discussed how planners devote less attention to identifying the best conceptual solution than to improving tactical project success. This is understandable to some extent because planners find it easier to relate to tangible and quantified success criteria such as cost and time, than to multidimensional and qualitative assessments of societal benefits. However, the investment cost is tangible and concrete, and crucial both to the choice of concept and to tactical success. Although cost uncertainty is higher in the early stages, it too is tangible and manageable (e.g. Austeng et al., 2005). Planners should therefore be strongly committed to establishing a rough but realistic cost estimate in the early phase, for comparison with project benefits.

Under the auspices of the Concept research programme a study of cost estimates in projects' initial phase has been conducted (Welde et al., 2014). The study explored a sample of 12 projects to determine the basis for and how the first cost estimates came about and developed during the whole period from the first initiative that was taken until the project was approved

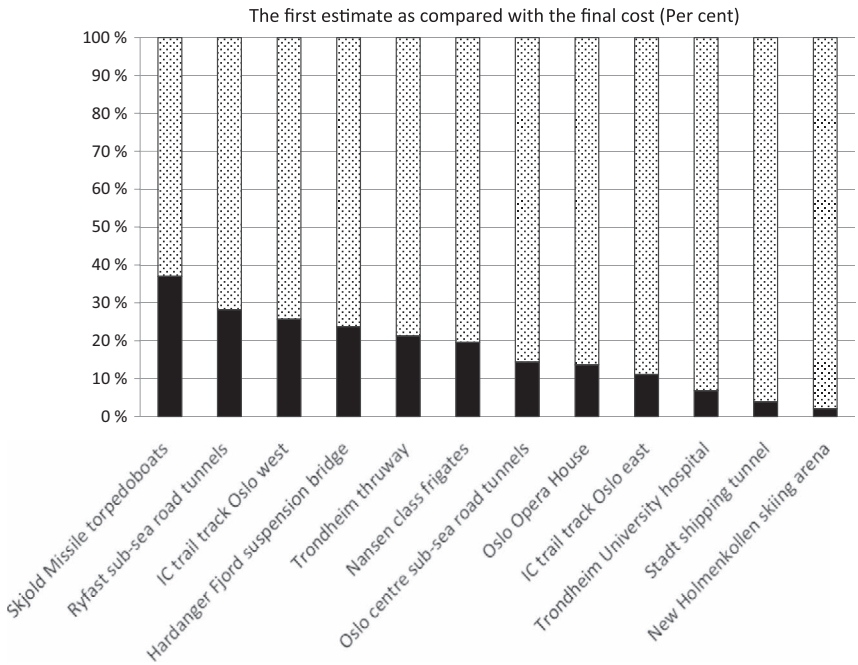



*Figure 9* The earliest cost estimate as a percentage of the final cost, for 12 Norwegian projects.
Source: Welde et al. (2014).

by Parliament. As shown in Fig. 9 the first cost estimate in all 12 cases was far below of what was ultimately approved as the projects' final budget. The increase in cost estimates during the front-end phase ranged from +70% to almost +1300%, with an average of +650%. By comparison, the cost increase during the implementation phase was much less, and some projects were even completed below budget; the variation ranged from −19% to +186%.

The study is a first probe into the matter of early cost estimation. More research is needed to determine the extent of the problem and its implications. However, it indicates that initial underestimation may be significant and result in the approval of projects that otherwise should have been rejected in the early stages. The authors considered it likely that at least 5 of the 12 projects would have been screened out at an early stage if the first estimate had been at a realistic level as compared with what was the final cost. The question is of course hypothetical, but there is no doubt that underestimation of costs at an early stage can have dramatic implications for project selection and is probably a far more severe problem than cost overruns in the implementation phase. Hence, it is clearly a paradox that so little attention is devoted to the initial estimate.

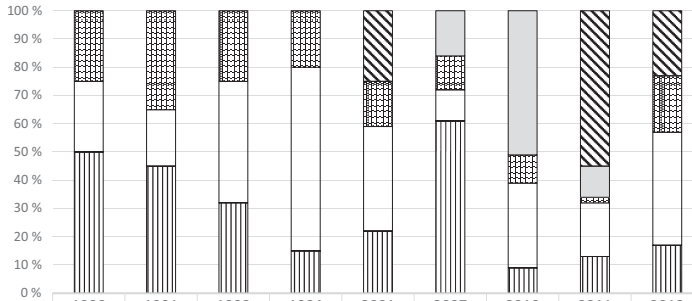
The report discusses possible reasons for the substantial underestimation in early phases. An often used distinction is made between political, technical, and cognitive reasons (e.g. Flyvbjerg, 2005). It may be very difficult to prove that the cause is political, but in several of the projects there were clear indications that the first estimate was deliberately low in order to increase the chance of the project idea being considered. This corresponds well with other studies that have attempted to prove that costs are underestimated deliberately to make the projects appear more attractive (e.g. Flyvbjerg, 2007; Mackie and Preston, 1998; Wachs, 1987; Welde et al., 2014). Wachs (1989) discusses how the most effective planner is sometimes the one who can cloak advocacy in the guise of scientific or technical rationality. In other cases the total investment was split between several projects that would have to be approved separately in sequence. However, in the most of the projects there were also different cognitive reasons why costs had been underestimated up front. Over-optimism is a well-known phenomenon in cognitive research literature, see e.g. Kahneman and Tversky (1979). Further, the study discusses measures to reduce the problem of early underestimation, such as systematic recording of early cost estimates, the use of reference projects, of stochastic costestimation techniques, increased provisions for uncertainty to account for possible scope changes, and third party review at an early stage.

## 9 The paradox of disregarded analyses of costs and benefits: detailed estimation of cost and benefits is commonly done up front, but disregarded by decision-makers, who tend to emphasize other aspects

A substantial amount of resources is devoted in major investment projects to establish a decision basis. Detailed Cost–Benefit Analyses are often performed, and complex models are developed to simulate traffic volumes and other inputs to these analyses. However, there are indications that decision-makers have little confidence in Cost Benefit Analysis in Norway.

The transport sector is a special case. In this sector there is a long tradition of using Cost Benefit Analysis. A recent study conducted by the Concept research programme, Welde et al. (2013) studied the significance of Cost–Benefit Analysis in the final prioritization of road projects in Norway and Sweden, where the approaches to such analyses in the two countries are very similar and unit prices are of the same magnitudes. The study revealed that the Cost–Benefit ratio had no significant impact on the selection of projects in Norway. On the contrary, many unprofitable projects were realized, such as spectacular tunnels and bridges in sparsely populated areas. By contrast, in Sweden, the results of the Cost–Benefit Analyses had somewhat more influence on the selection of road projects. Clearly, in the case of Norway there must have been other factors thatweremore important but that were not included in the analyses.

One explanation for low confidence in the Cost–Benefit Analyses could be weaknesses and shortcomings in the methodology, see e.g. Næss (2006, 2012).




| | 1990 | 1991 | 1993 | 1994 | 2001 | 2007 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|
| Other benefits | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 55 | 23 |
| Residual Value | 0 | 0 | 0 | 0 | 0 | 16 | 51 | 11 | 0 |
| Safety at sea | 25 | 35 | 25 | 20 | 16 | 12 | 10 | 2 | 20 |
| Coastal express line | 25 | 20 | 43 | 65 | 37 | 11 | 30 | 19 | 40 |
| Sea transport and fishery | 50 | 45 | 32 | 15 | 22 | 61 | 9 | 13 | 17 |

*Figure 10* Percentage of the total monetized benefits in nine different Cost–Benefit Analyses of the Stad shipping tunnel, showing how much weight was placed on the various components.
Source: Kvalheim (2014).

The trend is however that more and more effects are included in the analysis, and the empirical basis for estimating realistic values is improving. See for example Vickerman (2008) on the inclusion of so-called wider economic benefits from transport infrastructure projects. Another explanation for low confidence could be strategic use of analyses to promote a desired result. One study, by Kvalheim (2014), examined a special case where nine Cost–Benefit Analyses had been made of one project, a shipping tunnel on the west coast of Norway. This study found a remarkable lack of consistency between analyses. The analyses were performed between 1990 and 2012, and the Cost–Benefit ratio varied from 0.2 (highly unprofitable) to almost 1.0, and even exceeded 2.0 (highly profitable) in an 'optimistic calculation' provided in one of the reports. The analysis reporting the most positive number was funded by local stakeholders, with no financial obligations. An interesting finding was that the relative weight put on different benefit components varied noticeably, as shown in Fig. 10. This underscores the credibility of such studies. By 2014, the tunnel project had still not been approved for funding or finally rejected.

Not all effects of an investment project may be quantified and expressed in monetary terms. Nevertheless, if they are relevant to the decision they should be systematically reviewed as much as the net present value. Norway is often regarded to be at the forefront internationally when it comes to including non-monetized impacts in Cost Benefit Analyses. However Bull-Berg et al. (2014) reviewed a practice regarding nonmonetized impacts in more than 100 economic analyses in Norway. With a few important exceptions, their findings are rather discouraging. The section presenting non-monetized impacts in the economic analysis is characteristically short, and not based

on transparent methodology and well-documented processes. The study concluded that there is substantial potential for improvement and a need for guidance.

The paradox in this case is that so much effort is devoted to the calculation of a net present value that decision-makers may not find useful or credible. Clearly, planners should focus more on non-monetized impacts in economic analyses, as well as other complementary analyses such as cost-effectiveness analysis, impact evaluation, and multi-target criteria analysis. In addition, competence requirements are crucial to ensure high-quality analyses.

The above situation is mirrored in the World Bank, which made wide use of Cost Benefit Analyses for decades to demonstrate its reputation as a knowledge bank and its commitment to measuring results and ensuring accountability to taxpayers. However, according to the World Bank (2010), the percentage of projects justified by a Cost Benefit Analyses has been declining, and the Cost–Benefit ratio is now rarely mentioned in policy documents. These results are explained by a decline in adherence to standards as well as increased difficulty in applying Cost Benefit Analyses in new sectors where traditionally it has not been applied and where benefits can hardly be quantified. The situation is that economic assessments are not performed at all. The World Bank concludes that there is a need to recognize the difficulties in quantifying benefits, but at the same time quality, rigour, and objectivity must be ensured because poor data and poor analyses are misinforming and do not lead to improved results.

## 10 The paradox of "predict and provide": the tendency is to choose a "predict-and-provide" strategy rather than explore alternative solutions

Different perspectives can be taken when evaluating the need for an investment project. As discussed by Næss (2005), public planners tend to use a predict-and-provide approach. When confronted with capacity problems, the planners, who are often engineers, almost always recommend increased capacity based on estimates of future demand. However, unsurprisingly, there is often excess demand for public services and infrastructure offered free-of-charge to citizens. The need should not be defined narrowly as a need to increase capacity but rather as a need to solve the congestion problem. The latter allows for a variety of measures, including demand regulation, congestion pricing, and legal and informative measures, most of which are far cheaper than a construction project to expand capacity.

Our suggestion that needs should be considered in a broader perspective is supported by Odhage (2012), who studied early project planning in Swedish road projects. He found that the planners were never truly interested in finding and developing measures that would reduce the need for transport. This is obviously an example of path dependence, and Odhage asked the timely question 'Can one expect anything different from a process that is run by the transport administration and concerns transport issues?'

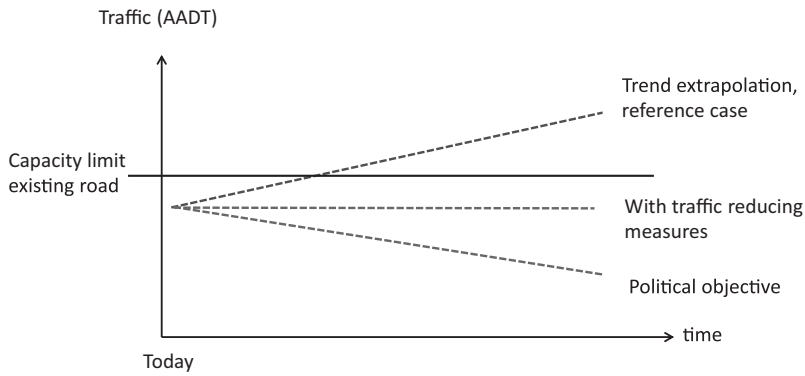



*Figure 11* Traffic development in different scenarios, illustrating that the need for an infrastructure project follows from the assumption that capacity should adapt to demand.

Source: Authors.

Further, in many cases there are political goals for a development that is quite the opposite of a predict-and-provide strategy. Næss (2005) distinguishes between (1) needs defined by national-level political objectives, (2) market-based needs as measured by demand or willingness-to-pay, and (3) the needs of different stakeholder groups. As noted, public planners tend to narrow down the identification of needs to the second demand, while ignoring the broader spectrum of needs, and even political goals to reverse the demand trend. A country with high ambitions to reduce the emission of greenhouse gases will view increased traffic (i.e. growing demands for roads) as a problem.[3] Similarly, in the university system, a purely demand-based approach probably would not necessarily lead to a distribution of graduates in line with society's need for expertise in different disciplines.

The paradox in this case occurs when needs and benefits assessments in public infrastructure projects are decoupled from overriding political priorities and goals, possibly because such overriding societal goals are conflicting and multidimensional. The result of this is that issues such as scaling and capacity of infrastructure projects, highly political choices, are left to planners, who (i) have a tendency to define the problem narrowly as absence of capacity, and (ii) use readily available estimates of demand as a reference for adjusting capacity. There is obviously a need for project owners (the government) to clarify what needs should be taken as a starting point for planners, and to express them as clear objectives for the project. Only if the development given by trend extrapolation is a clearly desired one can the predict-and-provide strategy be readily used in individual projects, as illustrated in Fig. 11.

3 In a separate study, Hagen (2010) discusses economic measures as accounting for external effects on the environment.

## 11 The paradox of perverse incentives: public investments with no financial obligations for the target group may cause perverse incentives and result in counterproductive projects

The state often appears as a generous donor on behalf of taxpayers when financing projects that benefit specific groups or geographical regions. Such projects may be initiated either by the beneficiaries themselves or by the state out of pure altruism. There are indications that such projects often prove unsuccessful in strategic terms, and we should not be surprised by this. When a project does not entail financial obligations for recipients, there is no incentive to opt for the most socially beneficial or cost-effective alternative. Different actors may have a vested interest in certain projects being chosen.

The term perverse incentives refers to the situation where one or more actors are motivated to make choices resulting in a project that is a complete failure seen in retrospect. The theoretical basis is the principal-agent theory (e.g. Jensen and Meckling, 1976; Laffont and Martimort, 2002). There is a huge amount of literature on incentive problems in general, but less in relation to state-funded investment projects. A pivotal study in the field has been published by Ostrom et al. (2001), who demonstrate serious problems with perverse incentives in Swedish-funded aid projects that resulted in the waste of public funds and adverse side effects such as corruption.

Norway is a special case because the local government is financially weak and dependent on the state to finance local infrastructure. The State is rich due to revenues from the exploitation of petroleum resources. Whist and Christensen (2011) demonstrate how the early phase of state-funded investment projects in Norway is often characterized by 'local rationality' and complex coalitions. Samset et al. (2014a, 2014b) explored the phenomenon of perverse incentives in nine Norwegian state-funded projects, to illustrate

| Project | Type of project | Year completed | Total cost (mill. NOK) | State-funded without liabilities for beneficiaries | Operational success | Tactical success | Strategic success |
|---|---|---|---|---|---|---|---|
| Hvaler-tunnelen | Subsea road tunnel | 1989 | 200 | No | Yes | Limited | Limited |
| Linesøya | Bridge | 2011 | 250 | Minimal | No | No | No |
| St. Olavs Hospital | Hospital | 2014 | 13 000 | Minimal | No | Limited | Limited |
| Turkana Fisheries (Kenya) | Development aid | 1990 | 1 500 | Yes | No | No | No |
| OL Lillehammer | Sports event | 1994 | 7 500 | Yes | Limited | Yes | No |
| E16 Lærdalstunnelen | Road tunnel | 2000 | 1 050 | Yes | Yes | Limited | No |
| Lofast | Subsea road tunnel | 2007 | 1 367 | Yes | Yes | Limited | No |
| Rock city | Cultural building | 2013 | 50 | Yes | Limited | No | No |
| Stad skipstunnel | Shipping tunnel | Not yet | 1 800 | Yes | n/a | n/a | Not likely |

*Figure 12* Selected findings from Samset et al. (2014a, 2014b), one aid project and eight Norwegian state-funded investment projects without liabilities for the target group.

how perverse incentives might occur, what the causes and consequences might be, and what could be done to avoid them. One aid project served as a reference case to demonstrate how wrong things can go. The study revealed that half of the Norwegian projects scored very poorly, particularly in a strategic perspective (Fig. 12). Some of these projects clearly would not have been prioritized had the recipient been required to contribute to the funding. Several projects were classed as supersized because they were 'freeof- charge'. Moreover, Samset et al. (2014a, 2014b) found that costs were being underestimated and benefits overestimated in advance.

The problem of perverse incentives is twofold: (1) actors who act out of self-interest, and (2) a financing party that fails to reveal that. Measures to solve or mitigate the problem should therefore also be twofold: (1) aligning recipients' objectives with national objectives, through requirements such as co-financing and local risk taking, and (2) reducing the information asymmetry by introducing, for example, by information control, external review, and public hearings. The Norwegian quality assurance regime is thus a measure that is expected to reduce the problem of perverse incentives.

## 12 The paradox of myopic decisions: long-term viability is the intention but the planning horizon is too short, resulting in sub-optimal choices that one will regret later

Probably the most crucial strategic success criterion for an investment project is that it is viable and sustainable, i.e. that project net benefits are likely to continue in the long run (OECD, 2000).

Viability can only be determined in the very long run. Samset (2012) studied 10 projects from history, and found that only a few were still considered highly successful and thus viable more than 100 years after completion, whereas others had been closed down after a short time. Needs and priorities in society may change over the years, and therefore a project's viability is contingent upon its ability to adapt to changing needs. Ironically, one of the most viable projects in the study was the Eiffel Tower, which was built for no other purpose than to be an exhibition object to showcase France as a leader in science and technology, but which later became one of the greatest tourist attractions in the world.

Since viability can only be determined in the long run, an assessment of viability ex ante must have a long-term perspective and the planner must be able to think creatively about possible future scenarios. It is not sufficient that the project is feasible and relevant on the opening day; planners must consider whether it will continue to be so throughout its lifetime. Lædre et al. (2012) studied 24 appraisal reports of major public projects from the periods 2005–2011 with respect to their assessments of viability. The results were rather disappointing: needs and benefits were most often assessed in a short-sighted and static perspective; trends were extrapolated without discussing

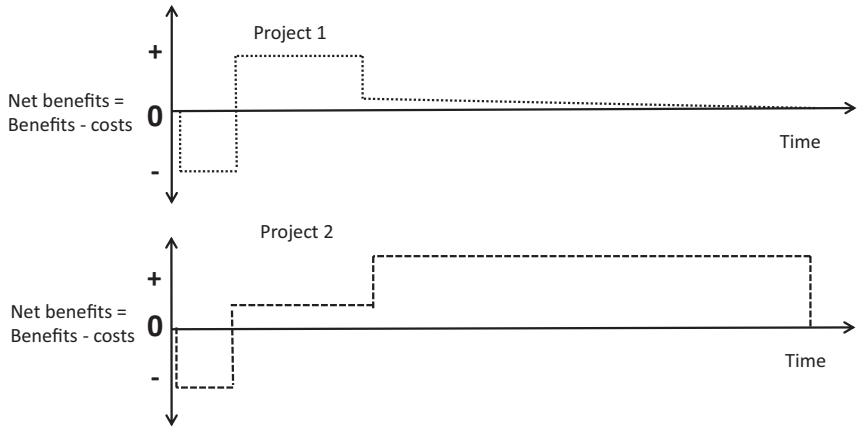



*Figure 13* Illustration of myopic decisions. Two projects with identical investment cost have different net benefit flows throughout their life-time. In a long-term perspective it is clear that project 2 is more viable, but a myopic planner would emphasize short-term effects and choose project 1. For example, investments in preparedness and prevention capacities are often very low, something that one regrets later when a disaster strikes.

Source: Authors.

alternative scenarios; most attention was devoted to tangible effects, ignoring non-monetized impacts; and significant risk factors, such as political risk, were not identified and discussed. Such practice may lead to myopic decisions, which we are likely to regret in the future, as illustrated in Fig. 13.

However, Lædre et al. (2012) also noted that no single analytical tool is able to comprehend all aspects of a project's viability ex ante. In particular, a Cost–Benefit Analysis, although intending to capture all economic impacts of a project, cannot provide sufficient analysis of viability, one important reason being the use of a discount rate. Therefore, in order to assess viability properly, several complementary tools combining quantitative and qualitative approaches are necessary. A separate study by Hagen (2011) goes further into the question of how the Cost–Benefit Analysis, through the use of a discount rate, leads to short-termism and neglect of future generations. However, Hagen also shows that it may be appropriate to use a decreasing discount rate over time. This would in fact increase the planning horizon and thus mitigate the problem.

The paradox in this case is that the emphasis on viability as a success criterion is far from reflected in project appraisals. Projects that are meant to last for decades and sometimes centuries may have significant impact on economic, environmental, and social development, yet they are still assessed in a short-term and static perspective. Lædre et al. (2012) offer some

recommendations for how to obtain a broader and more long-term perspective in project appraisals. They involve shifting the analyst's attention away from detailed estimations of investment cost to estimating future benefit flows and corresponding risk. Undoubtedly, evaluating a project's viability ex ante can be challenging, but the alternative of finding out about its unviability too late is worse.

## 13 Discussion

Governance regimes for major investment projects comprise the processes and systems that need to be in place on behalf of the financing party to ensure successful investments. What happens during the front end phase is essential. Peter Morris (2011:7) writes that "It is evident from an extensive amount of research that management of the front-end definitional stages of projects is of overwhelming importance to their ultimate outcome yet we have little empirical data to suggest how best management competencies here should be improved."

Project governance has only recently become an issue in the project management community. In order to move forward in this field we have to find answers to what would be the optimal mix of regulations, economic means and information in improved governance regimes. What seems to be an issue for the project management community is to lift their perspective beyond the delivery of the project itself and onto the broader issues of the project's utility and effects. It is obviously not only about the quality of analyses up front but also about decision processes. To arrive at the optimal conceptual solution based on rational analysis is of little worth if it is not the one chosen.

The Concept programme did a pilot project on a sample of cases to illustrate this (Samset, 2008a, 2008b), which was followed up with a more in depth study to explore the quality and interaction between analysis and decisions during the front end phase (Whist and Christensen, 2011) and a broader followup of the pilot (Samset and Volden, 2013a, 2013b). The result is displayed in Fig. 14, where the flaws for the individual projects are plotted with "X". The summary row at the bottom are marked to signify whether they are considered relevant as seen in relation to needs and priorities in society (white colour) or not (black). Each project is represented with one column. The columns are sorted from left to right according to the observed number of flaws. The resulting pattern suggests that the least relevant projects have a lot of flaws in their analytic and decision making processes (between five and ten). The ones that are regarded relevant on the other hand have much less flaws (between one and four).

The studies concluded that there is a strong tendency to choose the initial concept and stick to it, almost regardless of how bad it is. Also, there is an overwhelming inertia. Once the train has been set in motion — it is always impossible to stop. This goes a long way to explain the red projects on the left hand side. Further there is a third common tendency, that incremental

| | Project number | | | | | | | | | | | | | | | | | | | | | | | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analysis | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | |
| Alternative concepts have not been scrutinized | X | X | X | X | X | X | X | X | X | | | X | | X | X | X | | | X | | X | | | 15 |
| Strategic underestimation of expected costs | X | X | X | X | | X | X | X | X | X | X | | X | | | | X | | | | | | | 12 |
| Inadequate/limited analysis of problems and needs | X | X | X | X | | X | X | | X | X | X | | X | | | | X | | | | | | | 11 |
| Lack of realistic objectives and justification | X | X | X | X | | X | X | X | X | | | X | | | | X | | | X | | | | | 11 |
| Tactical splitting up and sequencisng of project | X | | | | X | | X | | X | X | | | | X | X | | | X | X | | X | | | 10 |
| Predictable surprises not taken into account | X | | | X | | X | | | | X | | X | | X | | | | | | | | | | 6 |
| Decisions | | | | | | | | | | | | | | | | | | | | | | | | |
| Disagreement regarding objectives and justification | X | X | X | X | X | X | | X | X | | X | X | X | | | X | | X | | | | | | 13 |
| Expert advice overruled by political preferences | X | X | X | X | X | X | | X | | X | X | | X | | | X | X | X | | | | | | 13 |
| Long lasting front end phase with shifting priorities | X | X | X | | X | | X | X | | X | | X | | X | | | X | | | X | | X | | 12 |
| Repeated playoff in political decision process | X | X | | | X | | | | | | | | X | | X | | | | | | | | X | |
| Perverse incentives - benefits without liability | | | | X | | | X | X | | | | | | | X | | | | | X | | | | |
| Political horse-trading between competing parties | | | X | | X | | | | | | X | | | | | | | X | | | | | | 4 |
| Sum | 10 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 1 | 1 | |
| Relevance of the project | | | | | | | | | | | | | | | | | | | | | | | | |

*Figure 14* There is a consistent tendency that projects that are considered relevant have less flaws in the analysis and decision making processes up front (Samset, 2008a, 2008b).

improvements of an inferior solution are preferred rather than fundamental change.

On the other hand experience also suggests that the opportunity space is usually larger than envisioned — and it is often largely unexplored. What was evident, however, was that the green projects seemed to have been exposed to more vigorous analyses and decision processes that were less affected by disagreements, political preferences, lengthy processes and repeated playoffs in the political decision processes.

## 14 Conclusions

This paper reports from several in-depth case studies of major public projects, and identifies a number of paradoxes that could guide further research. In various ways the paradoxes point to two types of problems, i) problems of efficiency in terms of delays and cost overrun, and ii) more fundamental problems that have to do with the project's strategic success (choosing the wrong concept). Project management as a discipline should be concerned with both problems. To quote Peter Morris: "The discipline needs to be less inward looking: more relevant, not just to the sponsor's needs but to society's challenges in general. We can foresee several changes in the years ahead in the ways projects and programs will be managed, but the obvious immediate needs are to focus more on improving sponsor value and on shaping the context in which projects and programs are formed and implemented" (Morris, 2013:23).

Many of the problems facing major public investment projects can be interpreted in terms of deficiencies in the analytic or the political processes preceding the final decision to go ahead, and the complexity and uncertainties

affecting these processes. In particular, the fundamental problems with strategic success could typically be traced back to deficiencies in the earliest preparatory phases of the project. The role of the front-end phase in ensuring project success is therefore crucial, as highlighted in the literature (Merrow, 2011; Morris, 2013).

Project governance is the processes, systems, and regulations that the financing party must have in place to ensure that projects are successful, strategically as well as tactically. Many organisations have introduced stage-gate phase models, also the Norwegian Ministry of Finance, who introduced a QA scheme to ensure the best choice of concept (QA1) and efficient project implementation (QA2) in year 2000. Our research indicates that QA2 has already led to improved cost control. It is still too early to conclude that QA1 has improved the choice of conceptual solutions and projects' strategic success, but there is evidence to suggest that an independent review of the project appraisal documents at a very early stage has a positive effect. There are many fundamental challenges that will have to be dealt with, such as tactical budgeting in local communities and responsible agencies at various levels, which is done in order to increase the chance to obtain government funding for a project. Another challenge is to ensure a transparent and democratic process and avoid adverse effects of stakeholder's involvement and political bargaining. But also to make the process predictable is a major challenge. The QA regime attempts to remedy these problems.

One salient conclusion from the research is that ex post evaluation should be an essential element in any project governance scheme. When a project succeeds at all levels, it should be imperative to ask what was done right. Correspondingly, one should learn from mistakes. However, experience shows that the use of evaluations for learning purposes is limited, and this is particularly true in the public sector (Samset and Christensen, 2012). The tendency is to look ahead with the concern of how to spend next year's budget, rather that look in the rear mirror to learn from experience.

As a lead part of the current trailing research on Norwegian public projects, the Concept research programme has since its inception been concerned with project evaluation and evaluation methodology as evidenced in several studies, including those by Olsson (2005), Andersen et al. (2007), and Volden and Samset (2013). The latter is a summing-up of four pilot evaluations of so called QA projects. It recommends that systematic ex post evaluations of public investment projects should be carried out to learn from experience, not least how they perform in a strategic perspective, with the aim to improve public investment projects in the future. Under the auspices of the programme therefore, a number of the major investment projects are now being evaluated, and this will continue in the years to come. Fig. 15 shows some main results for the first nine projects.

Clearly, projects may fail even when formal rules for planning and decision making have been adhered to. Democratic decision-making processes, particularly the long lasting ones, are complex and the outcome difficult to

| Project | Efficiency (tactical project success) | Effectiveness (strategic project success) |
|---|---|---|
| Svinesund national border control facility | ☆ ☆ ☆ | ☆ ☆ ☆ |
| Sandvika-Asker inter-city rail line | ☆ | ☆ ☆ |
| Momarken-Sekkelsten, section of a highway | ☆ ☆ | ☆ ☆ |
| Skjold class missile torpedo vessels | ☆ ☆ | ☆ |
| Eiksund road system | ☆ ☆ ☆ | ☆ ☆ ☆ |
| Lofast road system | ☆ ☆ ☆ | ☆ ☆ |
| E6 Riksgrensen-Sv.skogen, section of a highway | ☆ ☆ ☆ | ☆ ☆ ☆ |
| NAV ICT basic project | ☆ ☆ ☆ | ☆ ☆ |
| Svalbard Science Center | ☆ ☆ ☆ | ☆ ☆ |

*Figure 15* Main results from ex post evaluations of nine Norwegian investment projects (three stars = high success, two = medium success, one = unsuccessful). For more detailed results, see the evaluation reports, available on www.ntnu.no/concept.

predict. Many will claim that this is a necessary part of democracy. If this is taken as a premise, one could conclude that the biggest potential for improvement lies in strengthening the analytical process, as well as making decision processes transparent.

## Conflict of interest

None.

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