

## Paradoxes and trade-offs in the front-end process of large public projects

Aubry, Monique; Floricel, Serghei; Gilchrist, Alicia; Kirkham, Richard J.; Samset, Knut; Wee, Bert Van; Volden, Gro Holst; Williams, Terry; Zwikael, Ofer

**DOI**

[10.1080/09537287.2025.2456959](https://doi.org/10.1080/09537287.2025.2456959)

**Publication date**

2025

**Document Version**

Final published version

**Published in**

Production Planning and Control

**Citation (APA)**

Aubry, M., Floricel, S., Gilchrist, A., Kirkham, R. J., Samset, K., Wee, B. V., Volden, G. H., Williams, T., & Zwikael, O. (2025). Paradoxes and trade-offs in the front-end process of large public projects. *Production Planning and Control*, 36(15), 2091-2108. Article 2456959. <https://doi.org/10.1080/09537287.2025.2456959>

**Important note**

To cite this publication, please use the final published version (if applicable).  
Please check the document version above.

**Copyright**

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

**Takedown policy**

Please contact us and provide details if you believe this document breaches copyrights.  
We will remove access to the work immediately and investigate your claim.

***Green Open Access added to TU Delft Institutional Repository***

***'You share, we take care!' - Taverne project***

**<https://www.openaccess.nl/en/you-share-we-take-care>**

Otherwise as indicated in the copyright section: the publisher is the copyright holder of this work and the author uses the Dutch legislation to make this work public.



## Paradoxes and trade-offs in the front-end process of large public projects

Monique Aubry<sup>a</sup>, Serghei Floricel<sup>a</sup>, Alicia Gilchrist<sup>b</sup>, Richard J. Kirkham<sup>c</sup>, Knut Samset<sup>d</sup>, Bert Van Wee<sup>e</sup>, Gro Holst Volden<sup>f</sup>, Terry Williams<sup>g</sup>, and Ofer Zwikael<sup>b</sup>

<sup>a</sup>School of Business and Management, Université du Québec à Montréal, Montreal, Canada; <sup>b</sup>Research School of Management, Australian National University, Canberra, Australia; <sup>c</sup>School of Engineering, University of Manchester, Manchester, United Kingdom; <sup>d</sup>Scanteam, Oslo, Norway; <sup>e</sup>Delft University of Technology, Delft, the Netherlands; <sup>f</sup>Concept Research Program, Norwegian University of Science and Technology, Trondheim, Norway; <sup>g</sup>Hull University Business School, University of Hull, Hull, United Kingdom

### ABSTRACT

The aim of this conceptual paper is to contribute to a better understanding of the front-end phase of large public projects, which is complex and non-linear. The point of departure relates to a number of paradoxes found along the way of the front-end. A processual approach is taken to follow the front-end over time. Considering a number of example vignettes, four paradoxes and subsequent trade-offs are discussed which affect the strategic decisions that need to be made. These are found to fit largely within four generic sub-processes identified in the front-end. Inspired from the paradox theory, we conceptualise paradoxes and trade-offs under the dynamic equilibrium model adapted for temporary organising such as large public projects. Main aim of this paper is to consider how decision-making can be improved, and managerial strategies developed that permit the acceptance of paradoxes and their resolution in a virtuous cycle leading to long term success.

### ARTICLE HISTORY

Received 19 October 2024  
Accepted 13 January 2025

### KEYWORDS

Front-end; processual approach; trade-off; paradox theory; decision-making

## 1. Introduction

Projects are an effective investment as they have the potential to enhance operations performance (Zwikael et al. 2022). In particular, the front-end stage of these projects is important because this is when managers select the best potential project from various proposals, define the project goals and scope, and ensure the project's alignment and effective coordination with the operations environment (Zwikael and Gilchrist 2024). During this stage, operations managers utilise their role in steering the front-end of projects before the responsibility temporarily transfers to a project manager for delivering its outputs. In particular, a clear front-end process can help managers in the operations environment to generate effective project ideas to resolve critical operations problems, set effective project goals, and develop a high-quality business case to enhance project investment decision making. The growing importance of effective management of the project front-end stage in operations management research and practice is the focus of this paper (Mirzaei, Mabin, and Zwikael 2024). However, the front-end stage is far from being well understood (Williams et al. 2019).

This paper focuses on large public projects. The 'vast majority of government policies are delivered through projects of various forms' (Infrastructure and Projects Authority 2017, Chief Executive introduction, p. 3) and it is by projects that governments achieve many of their objectives, implement policy and realise their strategies (Hodgson et al. 2019). Here we are talking about all types of major public projects: construction, transformation, military, IT, and so on.

In practice the benefits to the public are often not realised as expected (Flyvbjerg 2017). These challenges can often be traced back to the front-end of projects, where project objectives and their relationship with organisational strategy are set and approved (Miller and Lessard 2001).

There are different approaches as to how to define the project front-end (Williams et al. 2019). Zwikael and Meredith (2019) focus on project goal-setting activities before project approval and commencement. In a broader approach of the front-end, we may refer to Davies, MacAulay, and Brady (2019) as part of a delivery model. In this approach, the front-end planning phase (or development phase) is differentiated from the execution phase and includes '[...] when the sponsor and client define the overall strategic objectives or vision, shape the governance structure, secure financing, and prepare the contracting and procurement approach' (p.122). It is here that major decisions are made, and a poor front-end process means that solution selection and exploration and effective management of the planned project might all be poor: '[decision-making behavior] identifies how behaviors in the front-end and during execution are associated with poor performance in decision making'. (Denicol, Davies, and Krystallis 2020, p. 332).

The literature is unclear on the unique challenges of the front-end process in public projects, and in particular the paradoxes and trade-offs and their implications for decision-making. Schad et al. (2016) look in-depth at the increasing visibility in management study of paradox theory, defining a paradox generally as a 'persistent contradiction between

interdependent elements', and similarly quote Poole and Van de Ven (1989) as describing paradoxes as 'interesting tensions, oppositions, and contradictions between theories which create conceptual difficulties' (p. 564). These ideas are further expanded by Clegg, Da Cunha, and Cunha (2002), Smith and Lewis (2011) and Raisch, Hargrave, and Van De Ven (2018). 'Project studies' has also started to investigate these paradoxes as described below. What is of interest in this paper for consideration of paradox theory is that decisions must be taken at early stage of a project (under uncertainty) to advance the project within the constraints of time and budget. Under uncertainty, rational decision-making process (based on access to full information) has limitations. Therefore, in the context of front-end, decisions often refer to a choice between a limited number of competing alternatives. Following Byggeth and Hochschorner (2006), trade-off situations '[...] meaning compromise situations when a sacrifice is made in one area to obtain benefits in another' (p.420). A trade-off in the context of large public project front-end can be any decision to be made between competing alternatives under uncertainty: going with one alternative and sacrificing others. So, this paper therefore takes a 'paradox' view of the front-end of projects, looking for explanations of such paradoxes, and theorising the underlying trade-offs and the necessary decision-making and with less emphasis on the paradox emergence, thus building on previous work in this journal, including as far back as Riis and Pedersen (2003) and including for example Love et al. (2019). As recently in project studies, it takes a particular 'process' theoretical stance (Brunet, Fachin, and Langley 2021), which emphasises time by revealing the interrelated temporalities of front-end activity streams.

In this paper, the research team considered some cases in which they had been involved and identified some paradoxes within them. These are shown in vignettes below, each showing examples of a particular front-end process. The objective of the paper is thus to address the following research question: How can we understand front-end paradoxes? And how does this inform decision-making?

The structure of the paper is as follows. Firstly, a summary of the relevant literature considers the front-end of the project, the process view of projects and then specifically the paradox literature. The paper then explains the procedure taken in this study. Then, the paper looks at four different areas of paradoxes within projects and the underlying temporal logics to identify and illustrate a trade-off which affects the strategic decisions that need to be made. We then show the benefits of this way of looking at the front end and describe how decisions making can be improved by considering these paradoxes and trade-offs as part of a dynamic equilibrium model of organising (Smith and Lewis 2011).

The paper makes a theoretical contribution by giving a new way of looking at the project front-end: paradox theory offers sort of a 'hook' to understand the project's dynamics. It also has practical implications, both in explaining the paradoxical human behaviour we see in the front-end of projects and its consequences, and also in identifying generic strategic decisions that need to be made in each project front-end.

## 2. Literature and theoretical background

We will look at the background to this paper therefore by considering the literature on the 'project front end'. Since we wish to take a processual view of projects, the background to this will be discussed. And since this leads to the idea of 'paradoxes' in projects, the literature behind this idea will then be discussed.

### 2.1. The project front end

It is often said that the front end of a project is where the significant decisions are made, and 'one of the primary points where strategic success or failure for the project is set' (Edkins and Smith 2012, p. 138). And it is the strategic success of the project on which we are concentrating in this project: satisfying the underlying purpose of the project (Gil 2022) rather than the simple achievement of the 'iron triangle' of success (Davis 2014). It is for this reason that this paper is concentrating on that stage of the project – the period 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 (Williams et al. 2019). It is here particularly that project ideas are 'shaped' for successful competitive advantage projects by sponsors and project teams (Miller and Olleros 2000).

The front-end phase of large projects is a well-researched area, with well-cited papers (e.g. Edkins et al. 2013; Morris 2009; Williams and Samset 2010). It is well-known that good conceptual development and planning ('front end loading' in some industries) is essential for large projects (Merrow 2011; Miller and Lessard 2001). Generic content and description of elements in the front-end are also well-known. For example, Williams et al. (2019) gives a description of all the elements in the front-end, with a logical flow through: project purpose, concept appraisal and alternatives analysis, assessment, and setting up the project execution.

Moreover, public projects are often planned and delivered under national governance regimes (Brunet and Aubry 2016; Volden and Samset 2017a). Well-known examples include the UK's Gateway process and the Norwegian Quality Assurance System; Klakegg, Williams, and Shiferaw (2016) look at these two governance regimes and the system in the Netherlands concluding that 'efforts to improve major projects are giving rewards...[but] the need for continuous improvement and change is prominent'. (p. 282). The evidence is that as these regimes have developed, there is some improvement in large public projects: Volden and Samset (2017b) shows steady improvement in projects delivering within the Norwegian 'Quality Assurance' scheme, and Samset and Volden (2022) show continuing improvement in decision-making and keeping projects within budgets; while there isn't such evidence for the UK scheme, Vo et al. (2021) does show that delivery confidence of large and complex UK projects improves during the time that they are within the government's 'enhanced' governance scheme. However, there are issues with both of these government schemes (e.g. in the relation to strategy, responsibility for realisation of benefits, and mismatches with

government and budgetary cycles (Brookes et al. 2017)). And it is clear both that evidence points to at most limited success of many projects, and that the public perceives major public projects as frequently failing.

Williams et al. (2019) defines elements which make up the content of the front-end. However, firstly this defines individual elements separately; and secondly, this is normative in looking at what (it says) 'ought' to be found in the front-end. In contrast, this paper looks at this part of the project as an overall process and at what actually does happen when decision-makers, owners, users and other stakeholders get involved, often in unpredictable ways. There may be a misperception amongst the public of the front end of a project consisting of rational decisions being made at a single point of time; rather, the front-end is actually a journey of discovery and sense-making (Kreiner 2020), with humans identifying and exploring options and making decisions with bounded information (Florice et al. 2023). The project literature has gradually recognised the need to study the 'actuality' of how projects behave and how people behave within these projects (e.g. Cicmil et al. 2006) and this paper tries to bring this view into looking at the project front-end. There is some literature on why particular paradoxes occur, as referenced in Samset and Volden (2016) and the subsequent book exploring these (Williams, Samset, and Volden 2022).

To understand human behaviour and its sometimes unexpected consequences within projects, we need to think about the 'Front End' process over time. As discussed above, traditionally the project has been considered as an activity to carry out a defined task in a specified time, at a specified cost. However, the decision to initially look into a project, define what it might consist of and how it might be undertaken, and then decide to carry out the project, is a process that can take considerable time – many years in the case of some military projects, and even decades. This process will often not be straightforward as the front-end is a process of discovery – gaining knowledge and reducing epistemic risk as the project is clarified and defined (Florice et al. 2023). Furthermore, within the public sector, defining the project has to deal with a wide variety of stakeholders and political influences (Gil and Fu 2022); often the various stakeholders and decision-makers will not share common goals and indeed might be driven by a variety of cognitive, emotional and social reactions; the sense-making, analysis and decision-making during this period will therefore be even more of a complex process taking time (Flyvbjerg 2001).

## 2.2. Project processes

To represent the emergent nature of projects, a number of authors have looked into incorporating process thinking into the 'project actuality' ideas (Sergi, Crevani, and Aubry 2020), to give the 'process view' of how things change, in actuality, over time. The discussion above suggests that this would be just as appropriate, perhaps even more so, for the project front-end. The use of the process view in projects has been developing with a particularly highly cited paper by Langley et al. (2013), along with a Special Issue by Sergi, Crevani, and

Aubry (2020). Brunet, Fachin, and Langley (2021) described four different perspectives to study projects 'processually'. In this paper, we adopt mainly a perspective of the 'process as evolution': that is processes are described in terms of a series of phases or steps that are taken successively as the project evolves from one state to another.

Ben Abdallah et al. (2022) adopted a process perspective to assess the success and performance of project 'front-end, or 'project development', which they say 'can be seen as the collective political, strategic and social effort to create, maintain, and stabilise a precarious, fragile network of firms, agencies, experts, funding partners, and stakeholders that would conduct, coordinate and support project execution' (pg. 687). Here success is seen as sufficient convergence of stakeholders to bring about the decision to engage in the next project phase, that is, the execution.

As mentioned above, the front end (and subsequent stages) of complex projects is a process of discovery, which concerns not only stakeholders' needs, expectations and power, but also properties and trends of the relevant natural, technical and socioeconomic project environments. Often, information about these environments is scarce and cannot be obtained in a cost-effective manner because relevant objects are hardly accessible (e.g. submarine oil deposits) or require extensive activity (e.g. drilling, destructive tests, high computing power) (Hall, Davis, and Blockley 1999). Therefore, at least until getting access and starting to prepare project sites or even execute the project, developers need to use information about these aspects that is incomplete, ambiguous, fragmentary, possibly tacit and dispersed among local actors, especially about the possible reactions of neighbouring communities and ecosystems, public opinion, etc. Even when access is possible, due to their temporality and complexity, the phenomena of interest require a certain, hardly compressible time for observation, measurement, effect detection, sensemaking, validation and representation elaboration (Hernes, Feddersen, and Schultz 2021). Therefore, even using agile methods, many projects face a trade-off between investing additional cost and time to improve available knowledge or going ahead with imperfect knowledge, and making decisions in conditions of uncertainty and ambiguity.

Moreover, legitimate decisions about the project require, at least in an ostensive manner, justifications that appear to be based on robust knowledge and credible projections (Seijger et al. 2016; Suchman 1995). The way knowledge is represented and communicated to stakeholders alters its signification and significance, and helps or harms the legitimacy of decisions based on it. For example, what stakeholders perceive and learn about the project depends on whether knowledge is represented in abstract versus concrete or simple versus complex ways (Florice et al. 2011); on the meanings and credibility attached to it through logical and rhetoric connections, and narrative structures (Ninan and Sergeeva 2021; Suddaby and Greenwood 2005), for example the kind of values, goals and discourses to which the project is assumed to contribute (Brewer 2019; Esposito, Terlizzi, and Crutzen 2022); and, finally, on the extent and timing of diffusion, for example the kind of media and coverage used and

the moment of release in relation to political calendars and other relevant events (Liu et al. 2016). A good example is given by the California High-Speed Rail project, initiated on promises to reduce road congestion and air traffic, reduce pollution and greenhouse gases, and give economic benefits away from the coast: here, 'early political buy-in and public accolades quickly delegitimized realists cautioning against the preliminary pseudo-budgets that assumed better-than-best case scenarios' (Pinto 2023).

More importantly, knowledge production and representation construction is a lengthy process, with gradual accumulation and path dependency, but also repeated iterations and sudden, direction-swinging discoveries and insights (Florice, Michela, and Piperca 2016; Samset and Volden 2016; Zhu and Mostafavi 2017). Moreover, representations themselves not only 'fix' (codify) the acquired knowledge but also generate new learning and additional insights by giving a set of vague ideas, an expression that can be perceptually examined and manipulated. New means such as Building Information Modelling (BIM) and virtual reality, and associated modelling and simulation capabilities, extend the precision and the range of available manipulations of project representations. In addition to older means such as drawings and mock-ups, this places representations at the core of learning processes, including exploratory envisioning of various forms and futures, integration of various disciplinary perspectives, and co-creation with stakeholders (Comi and Whyte 2018; Ewenstein and Whyte 2009; Yoo, Boland, and Lyytinen 2006). The quasi-tangible nature of representations and the various changes and manipulations to which they are subjected, give them an aura of objectivity, which increases their robustness as a basis for decision making.

However, while these processes unfold, the world also changes around the project; these changes are more or less well captured by ongoing knowledge production. When captured through representations, they risk upsetting their stability and painfully acquired confidence and coherence in the overall assemblage of project representations. An example of how long and extensive the process of representation elaboration, validation and stabilisation may become is the Lyon-Torino railroad tunnel project that passes under the Alps to link France and Italy, in which studies and debates have raged for over 30 years, not only regarding the nature of rock through which the tunnel must be built, but particularly regarding its economic viability (Massiani and Maltese 2022). During this time, due to globalisation and geopolitical the patterns of traffic in Europe project have changed in significant ways, while climate changes and the environmental transition movement shifted the relevance of the project goals and means, and hence the costs and benefits that can be attached to it.

We will therefore take a process view of the project 'Front End' and examine what insights can come from taking this view in answering the research questions about the challenges, trade-offs, paradoxes and counter-productive behaviours within the front-end process in large public projects – and as well as paradoxes that can be resolved and counter-productive behaviours that may be avoided.

### 2.3. Project paradoxes

Interest in the idea of looking at 'paradoxes' within projects has increased over the past few decades. Interestingly, early research on paradoxes in management and organisation studies came out from observations on the existence of a diversity of values associated to performance and effectiveness (Cameron 1986; Quinn and Rohrbaugh 1983). Jarzabkowski and Lê (2017) show how contradictions and paradoxes naturally occur and conceptualise the idea of 'paradox' as a characteristic of the complexity of everyday life, which is socially constructed and responded to. Indeed, this approach is action-oriented, as it seeks out the contradictions and 'managing paradoxes becomes a shared responsibility, not only of top management, but across organisational levels' (Andriopoulos and Lewis 2009 pg. 685). Investigation of paradoxes has expanded over time to a variety of organisational situations (Clegg, Da Cunha, and Cunha 2002; Poole and Van de Ven 1989; Schad et al. 2016; Raisch, Hargrave, and Van De Ven 2018) such as production (Riis and Pedersen 2003; Zwikael and Gilchrist 2024) and is now recognised as a *paradox theory* (Smith and Lewis 2011; Smith et al. 2017) and *paradox system* (Lewis and Smith 2022). These ideas emphasise the coexistence of contradictory ideas within a project and a recognition of the need to find an appropriate balance-point within these tensions (Schad et al. 2016; Smith and Lewis 2011).

Paradoxes is one of the avenues that project studies adopted in pluralistic situations found in projects including in the front-end of major projects (Braun and Lampel 2020; Davies and Brady 2016; DeFillippi and Sydow 2016; Samset and Volden 2016), and clearly understanding these paradoxes and their implications can be seen to be important for both project managers and policy-makers commissioning projects as they both have to make decisions under uncertainty (van Marrewijk et al. 2008). These authors argue to include 'issues of power, ambiguity, and paradoxes for studying project management' p. 599. Implications for the management of projects seen as grounded in complex contexts and for their managers facing multiple issues, tensions and conflicts in their everyday work, call for competences to work under contradictory constraints, for example concerning sustainability (Sabini and Alderman 2021).

The idea behind the paradox theory suggests that paradoxes are inherent to organisational context, some are salient, others latent. Smith and Lewis (2011) also proposed an equilibrium model to describe the cyclical and processual oscillations over time between tensions. Interestingly, these authors also suggested a resolution of paradoxes in two ways: into a vicious cycle (continuity of tensions) or into a virtuous cycle where managerial strategies are put in place to embrace paradoxical situations and then, work on a resolution by establishing some sort of an 'equilibrium' between the different positions. And it is through this acceptance and resolution that sustainability is attained over the long term. The interest of this model for this paper comes from the active management role to work on resolving tensions. Indeed, in the context of large public projects, tensions among the different stakeholders are unavoidable;

within this equilibrium approach, project managerial strategies come to paradox resolution in the form of trade-offs.

This is to say that there are actions for navigating through paradoxes. In line with this paradox thinking, Sabini and Alderman (2021), using sustainability and short-term project objectives paradox, identified managerial strategies for the acceptance of paradoxes and for their resolution as separation or synthesis of opposite terms. Moreover, Gaim, Clegg, and Cunha (2022), based on the case of the construction of the Sydney Opera House, push further the theoretical application of acceptance of multiplicity in a dialogical interaction towards a solution. For these authors, not only the dialogue opens up to a solution but brings with it co-creation of something new: ‘Projects are scenes of paradoxes. Architectural projects such as the Sydney Opera House are no different. Given the involvement of strong actors with strong preferences, there are some lessons regarding the paradoxes that arose and how they were (mis)managed. [...] dialogue is imperative because paradox persists, and that is where the creative responses reside’ (p.410).

More recently, Lewis and Smith (2022) developed further their thoughts into a system to integrate the different approaches to the study of paradoxes, in other words how to navigate paradox. An important dimension to consider in the system is the research mindset as being dichotomous (either-or) or paradoxical (both-and) depending on the tensions studied. In this paper, we will explore paradoxes as they emerge in the front-end process with a focus on how trade-offs come to balance the paradoxical tension.

### 3. Research design and procedure

The overall research design for this conceptual paper embraces a qualitative approach to explore the particular paradoxical situations occurring in the front-end of large public projects. In particular, this paper takes an opportunity to study how paradoxes are lived in their context. The research questions ‘how’ suggest that front-end processes will be unfolded by activities over time following (Langley 1999). Guided by an initial structure, the authors went through writing vignettes concerning cases they had studied or been involved in and the issues and paradoxes encountered. They also took into account the specific project paradoxes found by Samset and Volden (2016). Out of this and subsequent discussions, four key trade-offs were identified which are discussed below. What is of interest for the front-end is that strategic decisions must be taken in order to make the project going on. And in context of paradoxes, decisions often refer to ‘balances’ or ‘trade-offs’ between the two poles of

these paradoxes, particularly around processes of representations construction (Aubry and Floricel 2022).

These trade-offs go throughout the project front-end. However, it will be seen that they occur at different intensity during the front-end. Williams et al. (2019) define four main processes making up the front-end; different types of knowledge are required to be produced in each of these processes, and we will find that each trade-off is particularly relevant to a particular one of these processes. Table 1 shows these processes, and the elements of knowledge to be included in the front-end mapped with the processes to produce the appropriate knowledge. Of course these are not independent processes, but are inter-related, and indeed paradoxes go across the different processes. Floricel et al. (2023) shows a similar approach.

### 4. The dynamics of strategic decisions at the front-end: paradoxes and trade-offs

Normative processes of the front-end often refer to strategic decision-making as being rational and sequential (Williams et al. 2019). In doing so, they are silent on how events and activities taking place in the front-end interfere with decision-making. In a plural context such as large public projects, strategic decisions are the fruit of dynamic interactions among stakeholders leading to trade-off. In this section, we will explore four trade-offs which are illustrated with cases. There are probably more of these trade-offs, but these four represent, in our view, the most significant to highlight the dynamics of strategic decisions in the front-end.

#### 4.1. Trade-off 1: Pluralism versus Core support

The first trade-off identified might be termed *Pluralism versus Core support*. On the one hand, the project needs to gain all the knowledge it can from multiple stakeholders with different views and different understandings. On the other hand, it also needs to concentrate on the needs and requirements of the ‘client’, normally the Government department. But this very consultation with the stakeholders can alter the social dynamics of the front-end, and can produce ideological pressure-groups and dilute the client’s understanding of the project’s purpose. Further, involving a diversity of stakeholders may also mean higher costs and additional claims and side-payments, which may increase costs and deviate the project from its primary function (Gil and Fu 2022). So, there is an important balance to be struck between concentrating on the client and increasing the adherence of key supporters, and widening the participatory consultation to find all relevant stakeholders and increase their acceptance or even

**Table 1.** Mapping front-end elements of knowledge with processes.

Elements of knowledge to be included in the front-end (see Williams et al. 2019)		Processes in the front-end to produce knowledge
1	Project purpose	The process of defining need and project success
2	Concept appraisal and alternatives analysis	The process of gathering information about alternative solutions and selection
3	Assessment	The process of specifying the chosen solution(s) <ul style="list-style-type: none"> <li>• Sub-process of estimation (ex-ante estimation coming in both the second and third process)</li> </ul>
4	Setting up the project execution	The process of designing the implementation process of the project

involvement in order to prevent surprising, often violent contestations and movements against the project later on.

This is particularly true in the first process of the front-end, of defining need and project success. Similar to Williams et al. (2019), it is clear that a project should start with what prompted the need for the project, sometimes called the 'project trigger': the problem or opportunity that informs what we are actually trying to achieve in our project (Zwikael and Smyrk 2019). This should also include a justification for why the larger society (i.e. the taxpayers) ought to provide it. As discussed in the literature above, success is multi-faceted, but primacy should be given to the underlying objective for doing the project. If we concentrate on the 'iron-triangle' tactical objectives of the project (time/cost/scope) this misses the point of the project, which is that a part of Government wants (or needs) to realise target benefits set in the project business case. However, this benefits turn is not simple in the public sector, where establishing a strategic project aim is difficult and complex. There will be a wide range of heterogenous stakeholders with different aims and asymmetric perceptions; often it will be difficult to specify, let alone quantify targets for the 'public good'; this implies the additional difficulty of comparing these disparate benefits with a single 'cost' in a cost-benefit analysis. There will often be a wide range of political factors. The turbulent socio-economic environment around the project might change perceptions of its target and its success – and anyway, while the process of the front end is proceeding, there will often be a mismatch with the budgetary or political time-cycles. The benefit that is being sought from the project will often not be there to be effective by the end of the project, but there will be another party responsible for reaping the benefits from the project perhaps in a 'business-as-usual' phase (e.g. Whyte and Nussbaum 2020).

The goals and decisions of projects are also related to the implementation of public policies, for example regarding investment priorities and governance. Particular projects become testbeds and pathbreakers of such policies. This relates project decisions to policy elaboration processes and to political processes such as electoral cycles and campaigns and discourse elaboration, and, more broadly, to issues such as power and social movements (Sanderson and Winch 2017).

While this is what should happen, research often shows a concentration in the front-end on tactical (or 'project management') success rather than strategic (or 'project') success (e.g. Vo et al. 2021). Samset and Volden (2016) used empirical data on a range of Norwegian projects to identify ten 'paradoxes', and observed a general effect that less effort and resources were used up-front to identify the best conceptual solution than to improve tactical performance during implementation, which they called the 'paradox of the significance of front-end management'. For projects which are open to public scrutiny, immediate demonstrations of success and control are often more pressing than the demonstration of longer-term benefit. This is perhaps why it is easier to concentrate on the well-defined and more-easily-defensible 'tactical' success criteria (i.e. project management success): estimating and setting

tactical targets is known and comfortable and avoids the underlying aims of the project. Defining a 'project' with tactical success measures also gives stability in a world where the perceptions and even meanings of the objectives of the project might be disputed and changing – even if that stability is unhelpful and leads to dysfunctional behaviour. Samset and Volden (2016) term this concentration on the short-term the 'success paradox', and this can lead to short-sighted decisions being made.

Having said that, since 'success' in public projects is generally a mixture of the quantifiable and the more subjective, governments or financially responsible contractors are likely to be generally disinclined to identify precise quantifiable metrics by which they can be later judged; a famous case in 2015 led to AECOM paying \$200million to creditors from overestimated road traffic forecasts (Odeck and Welde 2017). In the case of the Dutch Betuweroute (van Wee 2022), a dedicated rail freight line connecting the Port of Rotterdam to the German hinterland, opened in 2007; the project was proposed about two decades earlier because of the assumed shortage of capacity on the (then) current rail network. In this case, it was not made explicit what 'success' would mean, not even in tactical terms, simply 'notions' of the benefits of extra capacity, and strategic advantages of a better rail hinterland connection.

A particularly distinctive feature of projects in the public sector is that they have social and political aspects, so we need to gain views from multiple stakeholders, with different views of 'success'. For many of these stakeholders (including government), 'success' may be ill-defined, ambiguous, unquantifiable. This means there is often a need to explore the 'who' of public projects; furthermore, stakeholders, their interests and their influence change over time. In this vein, the New Stakeholder Theory offers novel and precise tools for understanding stakeholder involvement in five areas: organisational formation, resource development, claims on value, governance, and performance (Gil 2022; McGahan 2021). The theory argues that stakeholder participation requires enough potential upside than outside opportunities.

These stakeholders will often come with a wide range of heterogenous aims and objectives. Stakeholder engagement, establishing their success criteria and balancing them, is difficult and time-consuming; it can give results that the commissioning department might not like, or indeed the requirements might be mutually conflicting. An example is the UK 'A303', a road-tunnel beneath a World Heritage site; the Government agency's analysis 'map' (given in Williams, Samset, and Volden 2022, pg. 18) shows the wide spread of stakeholders and the high level of heterogeneity of perceptions of benefits and success criteria, from environmental and heritage to travel times; this gives a useful basis to considering the purpose of the scheme and measuring its success. This can make alignment of the project with the strategic goals particularly difficult, leading to Samset and Volden (2016)'s 'paradox of strategic alignment', where there is lip-service paid to the need for alignment of objectives in the project but often the logic of how (and whether) the project will work towards these objectives is unclear.

A related challenge is that some groups only face the benefits of the project, but bear no cost of risk, in which case they lack the incentive to discuss the broader costs and benefits to society, and rather prefer to jump to the more specific iron triangle objectives, cf. the ‘paradox of perverse incentives’. Sometimes public debate on the perceived need is lacking altogether, as in the ‘Betuweroute’ case above (van Wee 2022): the debate started with a solution, the Betuweroute, and next different stories underpinning why the project would be needed emerged, ranging from capacity shortage, to economic advantages, congestion on motorways, and environmental advantages.

#### 4.2. Trade-off 2: Knowing versus Exploring

As the understanding of the needs of the project grows, the process of understanding the solution space has to proceed. In this, the candidate solutions to the ‘problem’, ‘opportunity’ or ‘need’ have to be generated or identified in some way. Then, data has to be gathered about solutions to be able to inform the decision-makers as to which solution(s) to pursue. This process is one of ‘inquiry’ in the underlying sense of Dewey’s philosophy: the ‘controlled or directed transformation of an indeterminate situation’ into one that we can resolve (quoted in Hickman 1997 first page) – defining precisely the problem, developing proposals for its resolution, determining the tools to decide between the proposals and then testing them.

We start with a problem that is by definition ill-defined, with epistemic uncertainty (or ‘wicked’, Roth and Senge 1996): the ambiguities involved require assumptions and generic project experience. Different disciplines and different organisations bring different types of knowledge, and choices have to be made about different types of enquiry; serendipity, creativity, and Hirschman’s ‘Hiding Hand’ (Hirschman 1967 discussed in Ika 2018) all play a part. But then there is an important decision-point: when to move from exploring solutions to developing detailed knowledge about a subset of candidate solutions. If more time is spent exploring different solutions, then those solutions cannot be sufficiently fleshed out, analysed and compared. However, a move too quickly to specifying solutions might mean that the choice of solution is inadequately made: in particular, as understanding centres around one core candidate option there is path dependency; further, accumulated concrete knowledge is generally specific to one particular solution and is ‘sticky’: it cannot be used to inform the analysis of other solutions.

This shows the second of our trade-offs, which might be termed *Knowing versus Exploring*: that is, the trade-off between producing reliable knowledge about each candidate solutions on the one hand, rather than exploring a broad variety of opportunities/options on the other hand. This comes as a necessary part of the process of gathering information about solutions and selection.

Samset and Volden (2016) in their analysis of Norwegian cases, identify the ‘Paradox of the unexplored opportunity space’, where the choice of conceptual solution is often

made without systematically scrutinising the ‘opportunity space’ or set of possible solutions first. They see in their cases the decision described above being made much too early, before a suitable set of candidate solutions had been identified, analysed and compared. Indeed, in Samset, Andersen, and Austeng (2014) 17 major Norwegian public projects are studied, and eleven already had a choice of concept when the front end commenced, a choice determined more by political decision makers than by analysts. Similarly, in the ‘Betuweroute’ case above (van Wee 2022), the concept was chosen before the project.

A common reason for this is the nature of politics and politicians. Cicmil and Braddon (2012) discuss how large-scale multi-party public projects, often in the public eye and exposed to general scrutiny, have an ‘aura’, promising great engineering or societal benefits, and often borne from human vanity or ambition. These authors describe these as ‘glory projects’ and explain how the decision-makers can often be swayed by these impressions into making rapid and ill-conceived decisions, analysing flaws in the governance of a well-known UK health IT project, ‘Lorenzo’. A further political problem is the short-term nature of political planning, so that while a project might be looking to long-term viability, the political pressures lead to a short planning horizon and sub-optimal decisions – what Samset and Volden (2016) call ‘the paradox of myopic decisions’.

It is perhaps worth noting here that the aim of this process is not necessarily to generate as much information as possible. Samset and Volden (2016) point out the ‘paradox of early information overflow’: in some of their cases, decisions were based on ‘masses of detailed information up front rather than carefully selected facts and judgmental information relevant to highlight the essential issues’ (p. 302). It is clear that in the process of inquiry at this point, indeterminism is at its highest, and so exploring unclear and ill-defined ideas to very small detail can clearly be inappropriate, and decisions can be confused by large amounts of detailed information – information which can often anyway quickly become out of date. Therefore, as this process proceeds, care must be taken to collect the most useful and relevant data to hone the definition of the need and the potential solutions.

One defense against these over-rapid choices is the discipline of a logical process. Such a process can ensure that project investment decisions are not rushed and follow a structured process of development and appraisal, which is led by multiple and diverse stakeholders (see for example the description of a process based upon that followed by Australian Defence in Zwikael and Gilchrist 2024).

One final comment: there is an ongoing specific sub-process of estimation in the project analysis stage, both rougher estimation of candidate solutions and more detailed estimation of selected solutions. Better estimation can improve the validity of solution selection, but it is expensive to produce equally deep knowledge about a broad range of solutions; reflecting the difficulties of Knowing discussed above, with its danger of path dependency and lock-in. But estimation is

particularly relevant to the next trade-off, so this is discussed in the next section.

### 4.3. Trade-off 3: Evaluating versus shaping

As sufficient information is gathered about candidate solutions to be able to make a choice of solution (assuming that politics and other not necessarily rational reasons have not dictated the choice of solution already), then the process of specifying the chosen solution(s) can gather pace. Rather than this being a single activity at a single point of time. In actuality, humans are researching and learning about the options: sense-making in an environment of complexity; epistemic uncertainty – and possibly an environment of change, as have discussed. And it is often assumed that the humans carrying out this activity are disinterested analysts; in practice, cognitive and emotional effects come into play, or social attitudes or reactions. The most obvious manifestation of this is in so-called ‘strategic misrepresentation’ or ‘underdeveloped assumptions’, where forecasts of costs and benefits are slanted in particularly ways, particularly where those that benefit from the project are not the ones paying for it.

For public projects specifically, we have another trade-off here. Analysts can look at a project need in society, and consider how to develop proposed solutions that will address that need. However, in the public sector, decision-makers can shape the societal environment itself to make it more amenable to the solution. There is therefore a trade-off, which we can call ‘*Evaluating versus shaping*’, depending on how much effort is spent on each of these activities: effort producing a detailed evaluation of solutions on the one hand, versus efforts leveraging a particular solution to shape the world around and make the project a compulsory passage point towards this future. In this respect, instead of reflecting a passive given future (such as in the ‘predict-and-provide’ strategy of Samset and Volden 2016), representations become actionable future-making tools (Comi and Whyte 2018). Visual artefacts such as help-information websites, prototypes, and other visual illustrations, all contribute to imagine a representation of the project that shape the future and to sway public opinion in support of the venture (See for example Transport for London 2024).

Another example is Réseau Express Métropolitain (REM, in Quebec, Canada) case study, under a public-private partnership (PPP) mode. The PPP mode not only brings private investments and risk sharing in infrastructure projects, it also makes it possible to override public governance rules in the management of these projects. The REM project went through an accelerated development process, mostly due to strong political backing that resulted in a law being adopted by the provincial parliament, which sheltered the project from many possible contestations mainly to ease land acquisition. The accelerated selection of a conceptual design, followed by the quite rapid selection of two consortia for the two main contracts, and eventually backed by energetic public consultation process led to a virtual lock-in of the project on a given solution and organisational-contractual structure that

enabled a rapid start of execution (Florice et al. 2023). However, this rapid process, including the selection of solutions that largely reused existing infrastructures, led developers to overlook key risks, such as explosives that remained in a reused tunnel since its construction 100 years earlier, as well as the complexity of local coordination. While the project progressed steadily despite the pandemics and supply chain disruptions, it eventually resulted in significant delays and the withdrawal by the provincial government of a second stage of the project from the authority organisation. The interest of this case in regard to the paradox ‘Evaluating versus shaping’ is that temporality should be taken into consideration: going with a PPP into an accelerated front-end process gives a short-term impression of ‘success’ by a rapid start of execution. The trade-off was made to shaping one solution instead of evaluating other alternatives being locked-in. The negative impacts only appeared after execution have started.

A key element of the front-end process is the estimation of costs and benefits. Again, the important view we wish to bring in this paper is estimation as a process, from the beginning of the front-end to a hopefully developed and refined project estimate at the end. There are a number of features of estimation of both costs and benefits that are well-known in public projects. The first is the tendency towards over-optimism in projects (both costs and benefits), written about extensively (notably Flyvbjerg et al. 2003) but subject to considerable debate particularly in recent years (e.g. Ika, Love, and Pinto 2022). Specific to UK public projects, the National Audit Office (2013) has issued a useful guide to the causes of over-optimism including areas of independent challenge/accountability; complexity; behaviour/incentives; the impacts of stakeholders and weakness in the evidence base. Furthermore, the estimation of benefits in a public project is more complicated than might be the case in a private company. The evaluation of social or public value is never simple, since ‘public value’ needs to include all significant ways in which citizens benefit from a project, many of which may be qualitative (e.g. the effect on community cohesion), and even where quantitative (e.g. traffic flows or increased access to services) might be difficult to which to give a monetary value (see Kirkham (2022) for a discussion of social value or ‘public value’). And these are before we consider the different perceptions of ‘value’ that different stakeholders will have (sometimes contradictory), and the difficulty of establishing causality between projects and benefits, and the need to decide on a timescale over which benefits are judged. Indeed, these difficulties can reduce the confidence of decision-makers in the cost/benefit estimation process, and Samset and Volden (2016) talk about the ‘paradox of disregarded analyses of costs and benefits’ as decision-makers disregard analysts’ work and use other aspects to make their decisions (e.g. political agenda).

Samset and Volden (2016) also point to the ‘paradox of perverse incentive’, where availability of public funding with no financial obligations for the beneficiaries may cause perverse incentives and result in counter-productive projects. In the Betuweroute case-study described above, the port of

Rotterdam supported the project but did not have to pay; proponents of the line came with excessively low cost estimates. In the initial 1990 plan, the Betuweroute was announced to cost 1.1 billion euro; the final costs were 4.7 billion Euros. The initial estimates were deliberately way too low. A few years after the initial cost estimate van Wee (1994) warned that the costs would probably be more than four times higher than the announced costs.

But these difficulties – significant though they are – don't fully reflect the nature of the estimation as a process over the whole front-end. Initial estimates are made at the start of the project, which by necessity will be informed by little data. This leaves the opportunity for over-optimism or manipulation of estimates to skew the choice of solution (and indeed to help ensure the case for project approval). And once the decision to proceed is taken, and a solution is chosen, 'lock-in' can occur, and this can lead to 'escalation of commitment' (e.g. Keil, Depledge, and Rai 2007), particularly as politicians do not want to lose face. Throughout the process, the public is looking for simplicity and deterministic estimates, and often do not see the need for uncertainties or contingencies; this can prompt the project team into reductionist thinking in what is often a complex problem-situation. During, and after, the project, the focus for the project team and government generally is on the final cost estimate, which forms the budget for the project; the early cost estimates can be forgotten, even though it was on these that significant decisions about the project were made – what Samset and Volden (2016) call the 'cost estimation paradox'. And it is these early cost estimates which are often kept in the minds of the media and the public. Indeed, while the move from the initial estimate and final estimate might appear simply as further evaluation, an initial under-estimate can be a case of 'shaping' public opinion to make it more supportive of the solution. And while Flyvbjerg's promotion of Reference Class Forecasting (Flyvbjerg 2008) might be seen simply as an analytical tool, perhaps the knowledge that a contingency (based upon Reference Class Forecasting) will be imposed upon any estimate (as for example is done in the UK, see Williams et al. 2020) might motivate under-estimation or such 'game-playing' behaviour by project proponents. A further complication for the process of estimation is that this operates in parallel with parliamentary and budgetary cycles, and changes in government ministers, so the guidance and instructions can vary significantly (indeed, can contradict earlier instructions) as the decision-making process proceeds.

#### 4.4. Trade-off 4: Allocation versus Collaboration

As we turn to the process of designing the implementation of the project (mostly towards the end of the front end, although important decisions can still be taken early in the phase, and there is a process of refining and defining the implementation phase), we see another trade-off, which we might call *Allocation versus Collaboration*. This trade-off describes the balance that needs to be struck between efforts to develop the project deliverables for an unambiguous

allocation of responsibilities and risks between the participants in a project on the one hand, and efforts to create conditions for a collaborative elaboration and implementation of project deliverables and solutions on the other. Efforts towards highly developed project deliverables will distract from, and indeed might be counter-productive to, developing that collaborative relationship with aligned motivations. Indeed, detailed representations and their related fixed-price contracts create rigid structures and refrain collaboration, which is problematic in a context of uncertainty and complexity (see the 'paradox of significance of front-end management', Samset and Volden 2016).

It is beneficial to ensure the motivations of the various parties are aligned to achieve what becomes to be regarded as the aims of the project. The project moves from the front end, is given approval to proceed, moves into implementation, and thence handed over to use within the permanent organisation, or becomes part of 'business as usual'. Just as clarity is needed in distinguishing the tactical project-management success objectives from the strategic aims of the project, so it is important to have clarity in who is accountable for achievement of these different objectives. And as we have discussed above, concentrating on tactical achievement (on time/budget delivery of the approved project) can be at the detriment to strategic success, so giving accountability only for the implementation stage can have a similar effect. The UK system tries to alleviate this by having the Senior Responsible Owner signing a letter accepting accountability to Parliament for delivery of the project, and these letters emphasise the criticality of the role in the delivery of the longer-term project benefits. However, this does not get over problems such as: can a project director be responsible for what happens to the project after delivery? Who is responsible for 'harvesting' project benefits? Can benefits be disentangled from the general economic environment? What about the emergent and sometimes fluid nature of benefits? And what happens when the public sector partner's motivations change?

The obvious area where alignment is needed is between the implementation organisation – often a private sector partner, brought in to implement the project – and the Government department. The implementation organisation will try to achieve the project success objectives as defined at the end of the front-end. The project delivery mechanism therefore needs to align the contractor's motivations with the motivations and aims of the government department, which need to be written into any agreement before implementation. Commonly understood 'best practice' in project procurement suggests that front-end deliverables, ideally the detailed form of the physical infrastructure objects, or at least the anticipated benefits, functionalities, performance and solutions, should be developed as carefully and fully as possible. This will help allocate risk between parties, define a fixed-price contract, and limit exposure to over-runs. But this also implies a rift in the deliverable definition and execution planning process as such approaches bestow most responsibility for the front-end elaboration of deliverables on the client side, while limiting opportunities to collaborate with the contractor/implementation organisation in searching for the best solutions.

In particular, efforts to elaborate solutions before the bidding process, which, among others, enable the allocation of risks based on more precise contractual specifications and essentially fixed price contracts, cut in two the process of solution elaboration, which, ideally, should integrate the knowledge of owners, construction contractors, equipment suppliers and infrastructure operators (Hobbs and Andersen 2001). Among others, implementation parties may be reticent to contribute their knowledge before a contract is awarded to them, and may be apprehensive about being held responsible for the possible failures of jointly elaborated deliverables and solutions. In addition, a clear allocation of risk creates a rigid framework of opposing interests, which, during execution, discourages contractor collaboration, precludes the project from taking advantage of opportunities for innovating and incorporating new solutions, and, in a turbulent and uncertain environment, may lead to conflicts and protracted judicial battles (Gann, Davies, and Dodgson 2017). Therefore, the infrastructure domains have witnessed a general move towards approaches that foster collaboration in the front-end or use relational/incomplete (Hart 2017) contracts for execution. These include framework agreements, integrated design projects, cost plus or target cost contracts, and integrated project delivery (Walker and Rowlinson 2019). These seek to mitigate or overcome these problems of rigidly specifying design risks by encouraging collaboration to work towards success of the project outcomes, take advantage of innovation opportunities and avoid contractual conflicts, but

possibly weaken cost control incentives (Hobbs and Andersen 2001; Chiochio et al. 2011).

## 5. Discussion

This paper has looked at the front-end of large public projects. We have tried to take a process view of the front-end, and used this both to try to explain some actuality of the paradoxes we observe, and also to identify some trade-offs, which represent generic decisions that need to be taken in order for the project to progress. Older thinking traditionally saw the front end as a separate phase, whose dynamics, if indeed recognised, were not always recognised as impacting the main project; however, the process view enables us to see the outworkings of these dynamics. In this section, we want to discuss two theoretical aspects resulting from this paper.

### 5.1. Navigating paradoxes in the front-end: a process approach

As part of our consideration of paradoxes, we drew out four processes that make up much of the front-end (see Figure 1). We saw how these processes all go through much of the front-end, but represent different degrees of activity, and are important at different organisational levels, at different time-points throughout the front-end. Figure 1 offers a mapping of the paradoxes observed in actual projects by Samset and Volden (2016), identified with the four trade-offs as they are

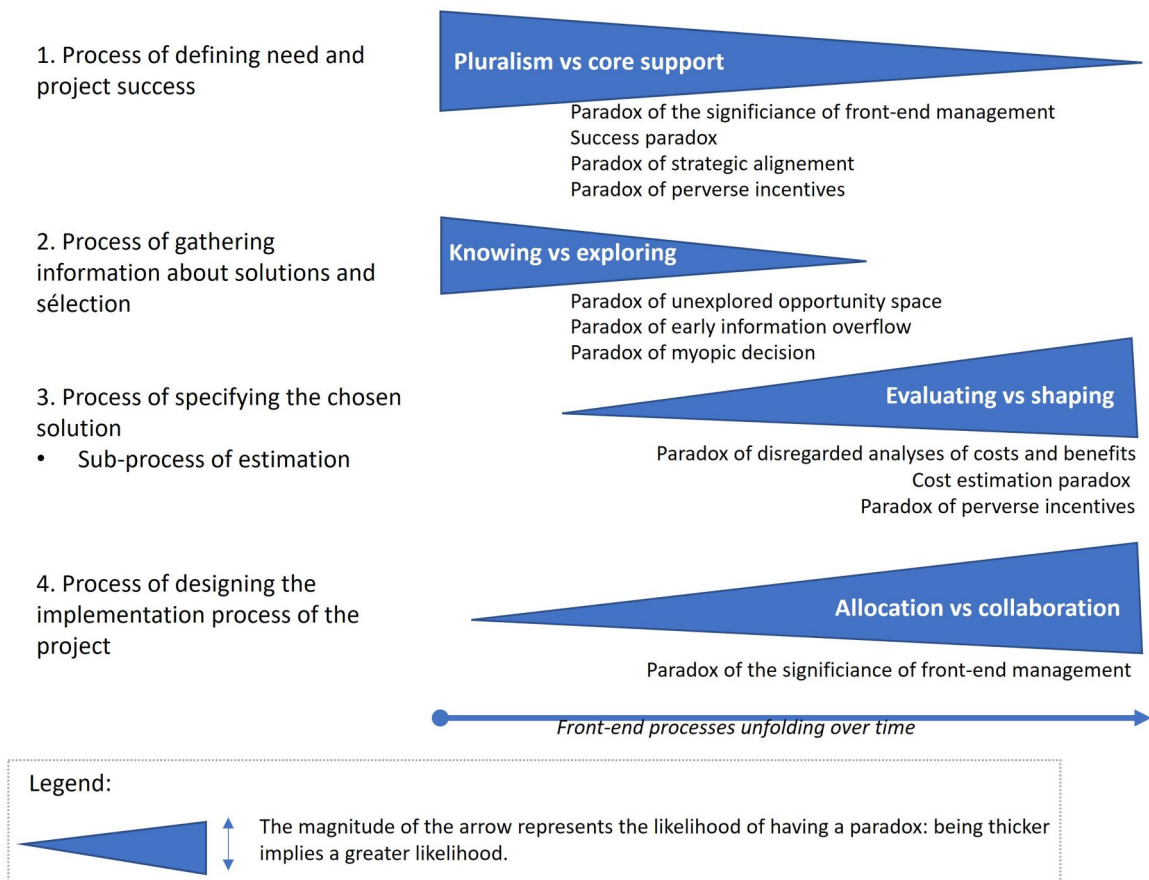


Figure 1. Navigating paradoxes in the front-end processes.

positioned in the front-end process where left to right denotes time within project. It is important to note that other paradoxes may exist outside the ones identified here.

Taking this view helps to understand how going through these processes. Each of them is not a single point in time in which an activity is carried out; rather each of them shows a process of sense-making, discovery, negotiation, analysis and decision-making. This process view helps to explain the dynamics of these paradoxes.

In their paper, *In praise of paradox persistence*, Gaim, Clegg, and Cunha (2022) argue that paradoxes do not disappear when a consensus is found: 'The tension between the competing demands does not cease to be paradoxical; it is only temporarily suppressed (Sundaramurthy and Lewis 2003 cited in Gaim, Clegg, and Cunha 2022, p.397). This means that instead of considering paradoxes in the front-end as unique situations solved by solutions to make them disappear, paradoxes persist over time and resist attempting to erase them.

This way of looking at paradoxes through process pushes further the theorisation on the front-end in two ways. First, paradoxes are not just a symptom of discordance in a point of time leading often to counterintuitive out-turns (Samset and Volden 2016). While these authors have revealed a first level of knowledge on the existence of paradoxes in the front-end of projects, this paper extends this first approach to understanding the underlying dynamics of paradoxes. Second, it builds on recent development of the paradox theory to integrate its persistence and its dialogic approach in the resolution of paradoxes. Taking a process view permits us to go beyond the paradoxes as 'things' and to look at how to navigate paradoxes, in other words, what is really done, what happens in the actuality of the front-end.

### 5.2. Resolving paradoxes in the project front-end: the managerial strategies

Interestingly, the paradox theory which has developed over the last decade (Smith and Lewis 2011) offers an alternative

interpretation of paradoxes and trade-offs in the context of front-end development. Indeed, for these authors, paradoxes are just frequent phenomena in complex organisations, and trade-offs are the approach taken to resolve these paradoxes. For example, several project studies in the public sector revealed problematic situations in front-end related to difficulties to establish trade-off and to take decision (Florice et al. 2023; O'Leary and Williams 2013; van Marrewijk et al. 2008). In other words, the set of paradoxes in Samset and Volden (2016) mentioned above are not exceptional but are more likely 'normal' in complex organisations such as project organising (DeFillippi and Sydow 2016; van Neerijnen, Tempelaar, and van de Vrande 2022). The main question is how to break a paradoxical situation to succeed in the project and to avoid unexpected or counter-intuitive outcomes. Smith and Lewis (2011) authors also proposed a 'dynamic equilibrium model of organising, which depicts how cyclical responses to paradoxical tensions enable sustainability—peak performance in the present that enables success in the future' (p. 381). Figure 2 illustrates the dynamic equilibrium model adapted to the project front-end.

In each front-end process, we observe how paradoxical tensions find their way towards a resolution which is, in the specific case of project front-end, based on a trade-off. Following Smith and Lewis (2011) in their quest to establish a foundation to the paradox theory, we wish to emphasise the active role of managerial strategies in resolving paradoxes in the context of large public infrastructure projects. There are two major alternatives approaches to managing organisational tensions such as earlier organisational theories research [e.g. Taylor, 1972 (1911)] and contingency theory (e.g. Galbraith 1977). The former's assumptions are based on one best way to be successful and the latter's assumptions suppose a consistent alignment with environment. In a context of strong and frequent organisational contradictions and tensions, Smith and Lewis (2011) suggested to adopt a different set of assumptions that are: 'Contradiction is inherent and can be powerful to enable peak performance if harnessed

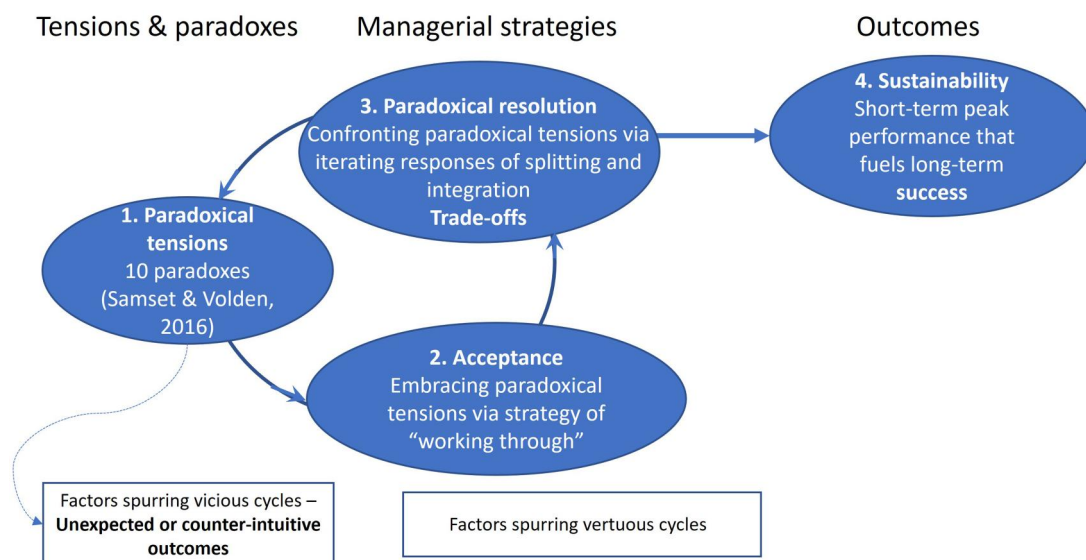


Figure 2. Dynamic equilibrium model of organising for project front-end adapted from Smith and Lewis (2011).

(p. 395). A paradox perspective on organisational tensions requires for the management to act and make decision under different assumptions: 'Doing so requires management that can attend to complexity, engage ambiguity, and enables uncertainty' (p.396).

Once tension or paradox is observed, the first managerial strategy before entering into the resolution, is acceptance of paradoxical tensions. The search of resolution is done by working through the different options. This cycle may repeat itself a few times before reaching the 'equilibrium' in the form of consensus. This means that it takes time and effort to reach this point of equilibrium. When acceptance occurs and the paradox resolved, there is a positive outcome of sustainability in terms of short-term peak performance and long-term success. This is a virtuous cycle which may continue on a next paradoxical tension. Success is what is expected from the project front-end. However, it can happen that there is no acceptance nor a resolution of the paradoxical tension. For example, in the case a decision is taken unilaterally as exemplified in some of our vignettes above; this situation translates in a vicious cycle leading to unexpected and counter-intuitive outcomes.

What is of interest in this paper is to emphasise the managerial implication into the solving of paradoxes, to improve decision-making and develop managerial strategies that accept and resolve paradoxes in a virtuous cycle rather than entering in a vicious cycle. Smith and Lewis (2011) identified three managerial strategies leading to sustainability: acceptance of paradoxical tensions, then response of splitting or integration. Interestingly, this framework has already been used in project studies among others to navigate the sustainability paradox (Gaim, Clegg, and Cunha 2022). These authors pushed the framework further in searching for 'how' to make these managerial strategies in action. With the Sydney Opera House example, they insisted on a dialogical approach to solve paradoxes. In the same manner, we will explore the four trade-offs identified above as to how to solve the paradoxes based on managerial strategies and actions.

Sustainability in the context of temporary project organising may seem by itself paradoxical. Smith and Lewis (2011) refer to general management and organisation theory when presenting sustainability. However, temporalities may be taken into consideration when facing tensions and paradoxes in the front end of infrastructure projects in two different ways. First, trade-offs in the front-end may impact execution of the project over a longer term providing (or not) sustainability to the project. Second, learning to navigate over tensions and paradoxes may help the project organising and other organisations around the project to face unavoidable tensions and paradoxes in a positive way and improve practices (Brady and Maylor, 2010).

### 5.2.1. Pluralism versus Core-support

We have highlighted the importance of stakeholder engagement in public projects. But while there might be a desire to gather all stakeholder views and opinions, there is also a core objective in the minds of the project commissioner (i.e.

the government department). Stakeholder engagement may bring different, even opposite views on the project (Lehtinen and Aaltonen 2020). This is not a simple balance: the very act of gathering stakeholder views will change the social environment around the project and affect the outside influences upon the project, in many different ways. There is firstly a strategic judgement here as to the extent of stakeholder consultation in the light of these effects.

Thus, we need to develop strategies for managing conflicting interests and expectations, and using these to define the project better, without diluting a project's core objectives. This requires a process managed from the centre. Examples can be seen in the benefits-based work on the 'Stonehenge' project (Williams 2022, 17–19), which seeks to define project benefits across the stakeholders, and their evaluation in a coherent structure, keeping the main project objective at its core, in collaboration with the stakeholders. A grand challenge in Albert-Cromarias and Pinglot (2024) brings together the organisations concerned, identifying tensions between divergent needs and using this to inform the articulation of the project. There is also work within the Planning discipline to facilitate collaboration (see Lindhout, van Dijk, and van der Vaart 2024).

Mega-projects provide issues bringing together organisations with perhaps conflicting views. Indeed, Gil and Fu (2022) 'link substantive cost hikes to ... early negotiations to agree a value proposition that unifies a core group of autonomous actors under a shared form of governance' and proposes ways that the sponsor or promotor can keep a lead role in negotiations in order to reduce this effect; Gil and Pinto (2018) show an organisational architecture where the sponsor has authority to make decisions covering high-order choices, but 'shares the authority over the local choices with groups of autonomous stakeholders', and gives practical guidance as to its success. International projects bring particular issues here, with the culture of the core team not always conducive to bringing together heterogenous views (see eg Tchumtcha Wembe 2023).

### 5.2.2. Knowing versus Exploring

There is evidence that generally front-ends in the public sector err on the side of jumping into a solution, or a limited set of solutions, without fully exploring possible alternatives. It is important to explore the full range of possible opportunities and options – but at the end of the front-end, the chosen solution needs to be fully worked-out and understood. So, it is a strategic decision as to how much effort at any point in the process should be put into exploring options and how much into gaining knowledge about the potential of each of those.

We have discussed the dilemma of balancing exploration with detailed knowledge, and have emphasised particularly the importance of a process to avoiding premature decisions on solutions. The project needs to feel that it has 'enough' information to proceed – but this often does not mean a large quantity of information. Samset (2009) (indeed the whole book containing this chapter) discusses how to making essential choices at the start of a project with scant

information; he emphasises that it is not the quantity of information that is the determinant in the move to solution selection, but the quality and usefulness of that information, including its timeliness; indeed, ‘when decision-makers are confronted with an abundance of detailed information at an early point in time, it may result in why is referred to as ‘analysis paralysis’” (pg 26). As we discussed above, this is the ‘paradox of early information overflow’ (Samset and Volden 2016). Here the work of Gigerenzer (2004) on fast heuristics are useful, and Love, Ika, and Pinto (2024) provide a range of practical tools for cost-estimating and decision-making at the start of construction projects.

### 5.2.3. Evaluating versus shaping

In public projects particularly, this refers to the strategic decision as to how much effort at any point in the process should be put into objective evaluation of the proposed solution, as opposed to efforts to leverage a particular solution to shape the future environment of the project – an idea which will be context- and project-specific. Again, this is a strategic decision for the project. This trade-off considers the context in which the project will take place and the balance of efforts between influencing such context for a positive reception on one hand and, on the other hand, being passive and continue developing the details of one specific

solution. In the case of controversial projects, this trade-off helps to understand the need for activities leveraging the project and shaping the context (Comi and Whyte 2018) at the expanses of delaying the advancement of other activities related to the development of one specific solution. The trade-off adds to the stakeholder’s engagement theory (e.g. Aaltonen et al. 2024) by the attention given to the project management action as to make a decision as to whether developing communications and a variety of visual artefacts or to adopt a passive attitude regarding the context and to continue working on a chosen solution.

### 5.2.4. Allocation versus Collaboration

This is the perhaps more well-known trade-off between developing representations of the project able to unambiguously fix the relationship between the parties, and efforts to create a collaborative relationship. This again requires a strategic decision to be taken by the project. This trade-off underscores the importance of aligning motivations and the challenges of rigid structures. Palacios, Gonzalez, and Alarcón (2014) provides a structured exploration of generic types of delivery systems using different contract types in construction, including Partnering, Alliancing and Relational Contracts, with some guidance as to which are more appropriate in different circumstances. These collaborative types of relationship are

**Table 2.** Mapping of front-end processes, paradoxes and strategic decisions.

Processes	Paradox	Trade-off: consensual strategic decision	Examples of managerial strategies for resolution: acceptance, separation or synthesis
1. The process of defining need and project success	Pluralism vs core support	Strategic decision on the extent of stakeholder consultation. <i>How wide to consult, with whom, and the degree to which this consultation is allowed to divert the project from its core aims?</i>	Acceptance: Acknowledge the different possible levels of consultation and work collectively through an assessment framework to get the most of stakeholders within time constraint. Separation: Develop parallel strategies for stakeholder consultation in a cyclical approach rather than sequential. Synthesis: Adopt flexible planning to support the solution adopted.
2. The process of gathering information about alternative solutions and selection	Knowing vs exploring	Strategic decision on efforts to explore options or to gain more knowledge on their potential. <i>How much to explore different possible solutions at the expense of learning about particular candidates?</i>	Acceptance: Acknowledge the variety of possible solutions and the efforts constraints. Separation: Adopt a work strategy to enable both approaches in parallel. Develop a value scale to quickly assess and discard solutions. Synthesis: assess the value of new information regarding the value of going on with the current information.
3. The process of specifying the chosen solution(s) – which includes ex-ante estimation, although that actually forms part of Process 2 also	Evaluating versus shaping	Strategic decision on efforts to detail solutions or to leverage a solution to shape the future environment. <i>How much effort is put into evaluation rather than shaping?</i>	Acceptance: Acknowledge both needs: getting enough details on different solutions and leverage one solution over the others. Separation: Adopt a strategy to progressively stop detailed work on several solutions and start leveraging the most promising solution. Synthesis: assess constantly the potential of solutions to answer the need and invest efforts in the most promising solution.
4. The process of designing the implementation process of the project	Allocation vs collaboration	Strategic decision on efforts to fix the representation of the project or to develop collaborative relationships <i>To what degree the final public-private partnership can be collaborative?</i>	Acceptance: Acknowledge the need for collaboration while keeping some activity under unique control. Separation: Assess the value of collaboration for activities and work the planning consequently. Synthesis: Work the planning collaboratively keeping certain activities under a unique control, but knowledgeable on both sides.

particularly useful where the system is complex, but Roehrich and Lewis (2014) show empirically that simplified contractual governance is a more effective way of addressing project complexity, perhaps as working agreements, inter-personal relationships and relational governance. In all delivery arrangements, the key to this decision is the allocation of risk, and Tran and Molenaar (2015) for example provides a tool to help allocate risks appropriately. More discussion in this area is given in Williams et al. (2019).

Each of these trade-offs thus identifies a strategic decision for the project. Thus for example a strategic view has to be taken as to how wide to consult, with whom, and the degree to which this consultation is allowed to divert the project from its core aims; a strategic view has to be taken as to how much to explore different possible solutions at the expense of learning about particular candidates; how much effort is put into evaluation rather than shaping; and the degree to which the final public-private partnership can be collaborative. Table 2 provides a mapping of the four front-end processes, the associated trade-off, the expected strategic decision to be taken, and example of managerial strategies for paradox' resolution.

This paper has addressed large public projects, and it is from this arena that the data and observations are taken. Some of these observations are more appropriate to public projects: the actions of political decision-makers; the turbulent socio-economic environment; the ability to shape the views of external stakeholders; the public partner/private partner relationship. However, the general points of the treatment of the front-end as a process, and the generic strategic decisions that need to be taken in the light of this, relate to any sort of project.

## 6. Conclusions

This paper took as its starting point, cases in which the authors had been involved (and the observations of Samset and Volden 2016), taking the process view promoted by authors such as Langley et al. (2013) and Sergi, Crevani, and Aubry (2020), and considering the research question as *How can we understand front-end paradoxes? And how does this inform decision-making?* We have tried to understand and conceptualise paradoxes through the dynamic equilibrium model of organising (Smith and Lewis 2011). The paradoxical tensions identified in the course of the project front-end enter a cycle where acceptance of paradoxes and search for a resolution may lead to sustainability in terms of short-term peak performance and long-term success. This is within a virtuous cycle. Paradoxes may also follow a vicious cycle where the outcome may rather be unexpected or counter intuitive. This approach to understand paradoxes is only possible when observing the project front-end within a process view where the focus is put on activities and events unfolding over time.

Looking at these activities as processes showed how the front-end develops in an environment of uncertainty, complexity and turbulence. It enables us to see why some of

these paradoxical out-turns happen. Then by showing the generic trade-offs that were implied in these processes, we have showed how some of these could be explained by strategic decisions taken on these trade-offs. Practically, we have pointed to four sets of generic strategic decisions that need to be made for every project; we have then explored some of the ramifications of those decisions when we see the processes work out throughout the front-end. This has enabled us to consider managerial strategies that can be applied for the resolution of those paradoxes, using the acceptance/separation/synthesis model. The aim of this is to aid decision-makers 'steering the front-end of projects' as described in the first paragraph of this paper.

There are two main limitations in this paper. The first one is that the paper focuses on public projects. While these projects represent huge investments, with particularly characteristics such as the wide and heterogeneous stakeholder base, other projects in the private sector may provide rich data to enhance the conceptualisation of paradoxes and their resolution. The second limitation concern the illustrative vignettes used to describe the paradoxes and trade-offs in the four front-end processes: while these cases provide some concrete reality to illustrate a variety of situations, they can limit the contextual elements for a better understanding.

As future directions in line with this paper, we see opportunities to study more in depth the project front-end within a process perspective. Given the crucial role of the front-end and its impact on the project end-result, there is a need to know more on how it develops in the real world practices, for example how estimation practices take place in the front-end, how stakeholders are engaged in the project. This is in line with Geraldini and Söderlund (2018) call to undertake project studies within an engaged scholarship approach.

In this paper we focused on public projects; even if we think our findings apply to a variety of projects, it would be good to scrutinise the front-end in a wider variety of projects. Finally, the dynamic equilibrium model of governing (Smith and Lewis 2011) refers mainly to permanent organisations. We think that the conceptualisation of paradoxical tensions can be further developed for temporary organisations. Maybe the virtuous and vicious cycles could be explored in more detail to better understand the relation between the front-end and the final outcome of the project.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This paper was not funded, but is based upon the work done by the authors in developing the book Williams TM, Samset K & Volden GH (2022) *The Front-end of Large Public Projects: Paradoxes and Ways Ahead*. Routledge, Abingdon UK, which was supported by the Concept Research Programme at the Norwegian University of Science and Technology, which in turn is funded by the Norwegian Ministry of Finance.

## Notes on contributors



**Monique Aubry** holds a Ph.D. in project management. She is associate professor at the Department of Management at Université du Québec à Montréal (UQAM). She pursues her research on two main topics: the development of megaprojects and organizing for projects. In 2020, she was awarded the PMI Research Achievement Award for her entire career; in 2012, she received the IPMA Research Award for her research on Project Management Offices. Over

the last few years, she acts as external adviser on the management of public projects for several ministries and public organisms in the province of Quebec.



**Serghei Floricel** is professor in the Department of Management at University of Quebec in Montreal (UQAM), where he teaches project development and feasibility. His research focuses on the planning and organising of complex projects and on innovation processes. He has published in *International Journal of Project Management*, *Project Management Journal*, *R&D Management*, and *Research-Technology Management*. He was Research Director for the

Managing Innovation in the New Economy (MINE) program, and PI for five other research projects. He holds a BEng from the Technical University of Civil Engineering of Bucharest, Romania, and MBA and a Ph.D. in Administration from UQAM.



**Alicia Gilchrist** is a Lecturer in Project Management at the Australian National University. Her research interests include the project front-end, stakeholder relationships and project cognition. Dr Gilchrist has published in refereed journals, including the *International Journal of Project Management* and *IEEE Transactions on Engineering Management*. Alicia has also held registration as a psychologist.



**Richard J. Kirkham** is Deputy Director of the Thomas Ashton Institute and a Reader in civil engineering at The University of Manchester. He is an active researcher in project studies, particularly focusing on government major projects and in whole-life appraisal of buildings/infrastructure (incorporated into ISO15686-5). He has a major government advisory role, particularly in government projects (with an ESRC secondment to the Cabinet Office in the IPA's

Portfolio Insight Team, and on Project X) and more recently in winning the SALIENT project on resilience. Richard leads a number of research projects on enhancing the management of major infrastructure projects and resilience.



**Knut Samset** recently retired as professor of project management at the Norwegian University of Science and Technology (NTNU), where he founded the Concept Research Programme and was its Director for 20 years. He is also the founder and senior partner of Scanteam, an international consultancy based in Oslo, Norway. Samset's academic background is in engineering and social science, and he holds a PhD in risk management. He has extensive experience in

technology assessment, future studies, international development assistance, project management and evaluation.



**Bert van Wee** is Emeritus professor in Transport Policy at Delft University of Technology, the Netherlands, faculty Technology, Policy and Management. His main interests are in long-term developments in transport, in particular in the areas of accessibility, land-use transport interaction, (evaluation of) large infrastructure projects, the environment, safety, policy analyses and ethics. In 2020, he received the Professor of Excellence Award of Delft

University of Technology.



**Gro Holst Volden** is the current Director of the Concept Research Programme on Front-end Management of Major Investment Projects, at NTNU in Trondheim. She holds a Master's degree in economics and a PhD in project management. Her areas of expertise are within project governance, public decision processes, and appraisal and evaluation of major public investments. Volden has prior experience from the consulting industry as well as government

administration in Norway.



**Terry Williams** background was operational research, initially in the defence industry, then concentrating on risk/project management. He has worked in three business schools: Strathclyde, Director of the Southampton Management School, Dean of Hull University Business School. He is now Professor Emeritus. He has held various consultancy posts, including supporting multi-\$bn post-project arbitration claims and managing risk, and multiple research

contracts, including with the UK Infrastructure & Projects Authority. He has 100 journal articles (h-index 57), and various books. He sits on PMI's Academic Insight Team and is PMP, and was on the UK REF panels 2014 and 2021.



**Ofer Zwikael** is a Professor of Project Management at the Australian National University. His five books and more than 250 scholarly peer-reviewed papers have been recognized through research awards from the Academy of Management, British Academy of Management, Project Management Institute, International Project Management Association, Emerald, and the Australian Institute of Project Management. Professor Zwikael has been named in

a Stanford University study as being in the top two per cent of scientists worldwide for his career. His research on project benefits management has been funded by major organizations, including the Australian Department of Defence and the Project Management Institute.

## References

- Aaltonen, K., R. Derakhshan, F. Di Maddaloni, and R. Turner. 2024. "Stakeholder Engagement: Theoretical and Methodological Directions for Project Scholarship." *International Journal of Project Management* 42 (7): 102649. <https://doi.org/10.1016/j.ijproman.2024.102649>.
- Albert-Cromarias, A., and A. Pinglot. 2024. "An Analysis of Stakeholders' Aspiration Needs for Grand Challenges." *Management Research Review*. Advance online publication. <https://doi.org/10.1108/MRR-08-2023-0611>.

- Andriopoulos, C., and M. W. Lewis. 2009. "Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation." *Organization Science* 20 (4): 696–717. <https://doi.org/10.1287/orsc.1080.0406>.
- Aubry, M., and S. Floricel. 2022. "Undertaking the Project Front End." In *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*, edited by T. Williams, K. Samset, and G. H. Volden. Oxon, UK: Taylor and Francis.
- Ben Abdallah, S., S. El-Boukri, S. Floricel, P. A. Hudon, M. Brunet, M. C. Petit, and M. Aubry. 2022. "A Process-Oriented Framework to Measure Development Performance and Success of Megaprojects." *International Journal of Project Management* 40 (6): 685–702. <https://doi.org/10.1016/j.ijproman.2022.06.005>.
- Brady, T., and H. Maylor. 2010. "The improvement paradox in project contexts: A clue to the way forward?" *International Journal of Project Management* 28 (8): 787–795.
- Braun, T., and J. Lampel. 2020. "Introduction: Tensions and Paradoxes in Temporary Organising: Mapping the Field." In *Tensions and Paradoxes in Temporary Organizing*. Leeds, UK: Emerald.
- Brewer, A. M. 2019. "A Bridge in Flux: Narratives and the Policy Process in the Pacific Northwest." *Review of Policy Research* 36 (4): 497–522. <https://doi.org/10.1111/ropr.12343>.
- Brookes, N., D. Sage, A. Dainty, G. Locatelli, and J. Whyte. 2017. "An Island of Constancy in a Sea of Change: Rethinking Project Temporalities with Long-Term Megaprojects." *International Journal of Project Management* 35 (7): 1213–1224. <https://doi.org/10.1016/j.ijproman.2017.05.007>.
- Brunet, M., and M. Aubry. 2016. "The Three Dimensions of a Governance Framework for Major Public Projects." *International Journal of Project Management* 34 (8): 1596–1607. <https://doi.org/10.1016/j.ijproman.2016.09.004>.
- Brunet, M., F. Fachin, and A. Langley. 2021. "Studying Projects Processually." *International Journal of Project Management* 39 (8): 834–848. <https://doi.org/10.1016/j.ijproman.2021.10.006>.
- Byggeth, S., and E. Hochschorner. 2006. "Handling Trade-Offs in Ecodesign Tools for Sustainable Product Development and Procurement." *Journal of Cleaner Production* 14 (15–16): 1420–1430. <https://doi.org/10.1016/j.jclepro.2005.03.024>.
- Cameron, K. S. 1986. "Effectiveness as Paradox: Consensus and Conflict in Conceptions of Organizational Effectiveness." *Management Science* 32 (5): 539–553. <https://doi.org/10.1287/mnsc.32.5.539>.
- Chiocchio, F., D. Forgues, D. Paradis, and I. Iordanova. 2011. "Teamwork in Integrated Design Projects: Understanding the Effects of Trust, Conflict, and Collaboration on Performance." *Project Management Journal* 42 (6): 78–91. <https://doi.org/10.1002/pmj.20268>.
- Cicmil, S., and D. Braddon. 2012. "Fading Glory? Decision-Making around the Project—How and Why 'Glory' Projects Fail." In *Project Governance: Getting Investments Right*, edited by T. Williams and K. Samset, 221–255. London: Palgrave Macmillan.
- Cicmil, S., T. Williams, J. Thomas, and D. Hodgson. 2006. "Rethinking Project Management: researching the Actuality of Projects." *International Journal of Project Management* 24 (8): 675–686. <https://doi.org/10.1016/j.ijproman.2006.08.006>.
- Clegg, S. R., J. V. Da Cunha, and M. P. Cunha. 2002. "Management Paradoxes: A Relational View." *Human Relations* 55 (5): 483–503. <https://doi.org/10.1177/0018726702555001>.
- Comi, A., and J. Whyte. 2018. "Future Making and Visual Artefacts: An Ethnographic Study of a Design Project." *Organization Studies* 39 (8): 1055–1083. <https://doi.org/10.1177/0170840617717094>.
- Davies, A., and T. Brady. 2016. "Explicating the Dynamics of Project Capabilities." *International Journal of Project Management* 34 (2): 314–327. <https://doi.org/10.1016/j.ijproman.2015.04.006>.
- Davies, A., S. C. MacAulay, and T. Brady. 2019. "Delivery Model Innovation: Insights from Infrastructure Projects." *Project Management Journal* 50 (2): 119–127. <https://doi.org/10.1177/8756972819831145>.
- Davis, K. 2014. "Different Stakeholder Groups and Their Perceptions of Project Success." *International Journal of Project Management* 32 (2): 189–201. <https://doi.org/10.1016/j.ijproman.2013.02.006>.
- DeFillippi, R., and J. Sydow. 2016. "Project Networks: Governance Choices and Paradoxical Tensions." *Project Management Journal* 47 (5): 6–17. <https://doi.org/10.1177/875697281604700502>.
- Denicol, J., A. Davies, and I. Krystallis. 2020. "What Are the Causes and Cures of Poor Megaproject Performance? A Systematic Literature Review and Research Agenda." *Project Management Journal* 51 (3): 328–345. <https://doi.org/10.1177/8756972819896113>.
- Edkins, A., J. Galdi, P. Morris, and A. Smith. 2013. "Exploring the Front-End of Project Management." *Engineering Project Organization Journal* 3 (2): 71–85. <https://doi.org/10.1080/21573727.2013.775942>.
- Edkins, A., and A. Smith. 2012. "Designing the Project." In *Project Governance: Getting Investments Right*, edited by T. Williams and K. Samset. London, UK: Palgrave Macmillan.
- Esposito, G., A. Terlizzi, and N. Crutzen. 2022. "Policy Narratives and Megaprojects: The Case of the Lyon-Turin High-Speed Railway." *Public Management Review* 24 (1): 55–79. <https://doi.org/10.1080/14719037.2020.1795230>.
- Ewenstein, B., and J. Whyte. 2009. "Knowledge Practices in Design: The Role of Visual Representations Asepistemic Objects." *Organization Studies* 30 (1): 07–30. <https://doi.org/10.1177/0170840608083014>.
- Floricel, S., S. Ben Abdallah, P.-A. Hudon, M.-C. Petit, and M. Brunet. 2023. "Exploring the Patterns of Convergence and Divergence in the Development of Major Infrastructure Projects." *International Journal of Project Management* 41 (1): 102433. <https://doi.org/10.1016/j.ijproman.2022.102433>.
- Floricel, S., J. L. Michela, M. George, and L. Bonneau. 2011. *Refining the Knowledge Production Plan: Knowledge Representations in Innovation Projects*. Newtown Square (PA): Project Management Institute.
- Floricel, S., J. L. Michela, and S. Piperca. 2016. "Complexity, Uncertainty-Reduction Strategies, and Project Performance." *International Journal of Project Management* 34 (7): 1360–1383. <https://doi.org/10.1016/j.ijproman.2015.11.007>.
- Flyvbjerg, B. 2001. *Making Social Science Matter: Why Social Inquiry Fails and How It Can Succeed Again*. Cambridge (UK): Cambridge University Press.
- Flyvbjerg, B., N. Bruzelius, and W. Tothengatter. 2003. *Megaprojects and risk: an anatomy of ambition*. Cambridge (UK): Cambridge University Press.
- Flyvbjerg, B. 2008. "Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice." *European Planning Studies* 16 (1): 3–21. <https://doi.org/10.1080/09654310701747936>.
- Flyvbjerg, B. 2017. "Introduction: The Iron Law of Megaproject Management." In *The Oxford Handbook of Megaproject Management*, 1–18. Oxford (UK): Oxford University Press.
- Gaim, M., S. Clegg, and M. P. Cunha. 2022. "In Praise of Paradox Persistence: Evidence from the Sydney Opera House Project." *Project Management Journal* 53 (4): 397–415. <https://doi.org/10.1177/87569728221094834>.
- Galbraith, J. R. 1977. *Organization Design*. Reading, Massachusetts: Addison-Wesley Publishing Company.
- Gann, D. M., A. Davies, and M. Dodgson. 2017. "Innovation and Flexibility in Megaprojects: A New Delivery Model." In *The Oxford Handbook of Megaproject Management*, edited by B. Flyvbjerg, 313–338. Oxford, UK: Oxford University Press.
- Galdi, J., and J. Söderlund. 2018. "Project Studies: What It is, Where It is Going." *International Journal of Project Management* 36 (1): 55–70. <https://doi.org/10.1016/j.ijproman.2017.06.004>.
- Gigerenzer, G. 2004. "Fast and Frugal Heuristics: The Tools of Bounded Rationality." In *Blackwell Handbook of Judgment and Decision Making*, edited by D. Koehler and N. Harvey. Blackwell Publishing: Oxford.
- Gil, N. 2022. *The Purpose of a Megaproject*. In *Megaprojects: A Theory of Purpose, Value Creation and Value Distribution*. Manchester, UK: Alliance Manchester Business School.
- Gil, N., and Y. Fu. 2022. "Megaproject Performance, Value Creation, and Value Distribution: An Organizational Governance Perspective." *Academy of Management Discoveries* 8 (2): 224–251. <https://doi.org/10.5465/amd.2020.0029>.
- Gil, N., and J. K. Pinto. 2018. "Polycentric Organizing and Performance: A Contingency Model and Evidence from Megaproject Planning in the UK." *Research Policy* 47 (4): 717–734. <https://doi.org/10.1016/j.respol.2018.02.001>.
- Hall, J. W., J. P. Davis, and D. I. Blockley. 1999. "Uncertainty Analysis of Coastal Projects." In *Coastal Engineering 1998*, 1461–1474. <https://doi.org/10.1061/9780784404119.108>.

- Hart, O. 2017. "Incomplete Contracts and Control." *American Economic Review* 107 (7): 1731–1752. <https://doi.org/10.1257/aer.107.7.1731>.
- Hernes, T., J. Feddersen, and M. Schultz. 2021. "Material Temporality: How Materiality 'Does' Time in Food Organizing." *Organization Studies* 42 (2): 351–371. <https://doi.org/10.1177/0170840620909974>.
- Hickman, L. A. 1997. "Inquiry: A Core Concept of John Dewey's Philosophy." *Free Enquiry* 17 (2). Retrieved November 25, 2022. <https://secularhumanism.org/1997/03/inquiry-a-core-concept-of-john-deweys-philosophy/>.
- Hirschman, A. O. 1967. *Development Projects Observed*. Washington DC: The Brookings Institution.
- Hobbs, B., and B. Andersen. 2001. "Different Alliance Relationships for Project Design and Execution." *International Journal of Project Management* 19 (8): 465–469. [https://doi.org/10.1016/S0263-7863\(01\)00048-5](https://doi.org/10.1016/S0263-7863(01)00048-5).
- Hodgson, D., M. Fred, S. Bailey, and P. Hall. 2019. "Introduction." In *The Projectification of the Public Sector*. 1st ed., edited by D. Hodgson, M. Fred, S. Bailey, and P. Hall, 1–18. New York (NY): Routledge.
- Ika, L. A. 2018. "Beneficial or Detrimental Ignorance: The Straw Man Fallacy of Flyvbjerg's Test of Hirschman's Hiding Hand." *World Development* 103: 369–382. <https://doi.org/10.1016/j.worlddev.2017.10.016>.
- Ika, L. A., P. E. D. Love, and J. K. Pinto. 2022. "Moving beyond the Planning Fallacy: The Emergence of a New Principle of Project Behavior." *IEEE Transactions on Engineering Management* 69 (6): 3310–3325. <https://doi.org/10.1109/TEM.2020.3040526>.
- Infrastructure and Projects Authority. 2017. "Infrastructure and Projects Authority Annual Report 2017." Accessed November 27, 2024. [https://assets.publishing.service.gov.uk/media/5a74cf13e5274a3cb28675a9/IPA\\_Annual\\_Report\\_2017.pdf](https://assets.publishing.service.gov.uk/media/5a74cf13e5274a3cb28675a9/IPA_Annual_Report_2017.pdf).
- Jarzbowski, P. A., and J. K. Lê. 2017. "We Have to Do This and That? You Must be Joking: Constructing and Responding to Paradox through Humor." *Organization Studies* 38 (3–4): 433–462. <https://doi.org/10.1177/0170840616640846>.
- Keil, M., G. Depledge, and A. Rai. 2007. "Escalation: The Role of Problem Recognition and Cognitive Bias." *Decision Sciences* 38 (3): 391–421. <https://doi.org/10.1111/j.1540-5915.2007.00164.x>.
- Kirkham, R. J. 2022. "Estimating." In *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*, edited by T. Williams, K. Samset, and G. H. Volden, 99–129. Oxon, UK: Taylor and Francis.
- Klakegg, O. J., T. Williams, and A. T. Shiferaw. 2016. "Taming the 'Trolls': Major Projects in the Making." *International Journal of Project Management* 34 (2): 282–296. <https://doi.org/10.1016/j.ijproman.2015.03.008>.
- Kreiner, K. 2020. "Conflicting Notions of a Project: The Battle between Albert O. Hirschman and Bent Flyvbjerg." *Project Management Journal* 51 (4): 400–410. <https://doi.org/10.1177/8756972820930535>.
- Langley, A. 1999. "Strategies for Theorizing from Process Data." *The Academy of Management Review* 24 (4): 691–710. <https://doi.org/10.2307/259349>.
- Langley, A. N., C. Smallman, H. Tsoukas, and A. H. Van de Ven. 2013. "Process Studies of Change in Organization and Management: Unveiling Temporality, Activity, and Flow." *Academy of Management Journal* 56 (1): 1–13. <https://doi.org/10.5465/amj.2013.4001>.
- Lehtinen, J., and K. Aaltonen. 2020. "Organizing External Stakeholder Engagement in Inter-Organizational Projects: Opening the Black Box." *International Journal of Project Management* 38 (2): 85–98. <https://doi.org/10.1016/j.ijproman.2019.12.001>.
- Lewis, M. W., and W. K. Smith. 2022. "Reflections on the 2021 AMR Decade Award: Navigating Paradox Is Paradoxical." *Academy of Management Review* 47 (4): 528–548. <https://doi.org/10.5465/amr.2022.0251>.
- Lindhout, N. A., T. van Dijk, and G. van der Vaart. 2024. "Are we in Agreement? Process Architecture Considerations as a Tool for Navigating Stakeholder Perspectives in Favor of Consensus-Building in Land Consolidation Projects." *Planning Practice & Research*: 1–22. <https://doi.org/10.1080/02697459.2024.2431767>.
- Liu, Z. Z., Z. W. Zhu, H. J. Wang, and J. Huang. 2016. "Handling Social Risks in Government-Driven Mega Project: An Empirical Case Study from West China." *International Journal of Project Management* 34 (2): 202–218. <https://doi.org/10.1016/j.ijproman.2015.11.003>.
- Love, P. E., L. A. Ika, and J. K. Pinto. 2024. "Smart Heuristics for Decision-Making in the 'Wild': Navigating Cost Uncertainty in the Construction of Large-Scale Transport Projects." *Production Planning & Control* 35 (16): 2286–2303. <https://doi.org/10.1080/09537287.2023.2248942>.
- Love, P. E. D., J. Smith, F. Ackermann, Z. Irani, W. Fang, H. Luo, and L. Ding. 2019. "Houston, we Have a Problem! Understanding the Tensions between Quality and Safety in Construction." *Production Planning & Control* 30 (16): 1354–1365. <https://doi.org/10.1080/09537287.2019.1617908>.
- Massiani, J., and I. Maltese. 2022. "Thirty Years of Socio-Economic Evaluation of the Lyon–Turin High-Speed Rail Project." *Research in Transportation Economics* 94: 101123. <https://doi.org/10.1016/j.retrec.2021.101123>.
- McGahan, A. M. 2021. "Integrating Insights from the Resource-Based View of the Firm into the New Stakeholder Theory." *Journal of Management* 47 (7): 1734–1756. <https://doi.org/10.1177/0149206320987282>.
- Merrow, E. W. 2011. *Industrial Megaprojects: Concepts, Strategies, and Practices for Success*. Hoboken, NJ: John Wiley & Sons.
- Miller, R., and D. Lessard. 2001. "Understanding and Managing Risks in Large Engineering Projects." *International Journal of Project Management* 19 (8): 437–443. [https://doi.org/10.1016/S0263-7863\(01\)00045-X](https://doi.org/10.1016/S0263-7863(01)00045-X).
- Miller, R., and X. Ollerros. 2000. "Project Shaping as a Competitive Advantage." In *The Strategic Management of Large Engineering Projects*, edited by R. Miller and D. R. Lessard. Cambridge, MA: The MIT Press.
- Mirzaei, M., V. J. Mabin, and O. Zwikael. 2024. "Customising Hybrid Project Management Methodologies." *Production Planning & Control*: 1–18. <https://doi.org/10.1080/09537287.2024.2349231>.
- Morris, P. W. G. 2009. "Implementing Strategy through Project Management: The Importance of Managing the Project Front-End." In *Making Essential Choices with Scant Information: Front-End Decision Making in Major Projects*, edited by T.M. Williams, K. Samset and K. Sunnevåg. Basingstoke, UK: Palgrave.
- National Audit Office. 2013. "Over-Optimism in Government Projects." <https://www.nao.org.uk/wp-content/uploads/2013/12/10320-001-Over-optimism-in-government-projects.pdf> retrieved on 24th November 2022.
- Ninan, J., and N. Sergeeva. 2021. "Labyrinth of Labels: Narrative Constructions of Promoters and Protesters in Megaprojects." *International Journal of Project Management* 39 (5): 496–506. <https://doi.org/10.1016/j.ijproman.2021.03.003>.
- O'Leary, Tim, and Terry Williams. 2013. "Managing the Social Trajectory: A Practice Perspective on Project Management." *IEEE Transactions on Engineering Management* 60 (3): 566–580. <https://doi.org/10.1109/TEM.2012.2228206>.
- Odeck, J., and M. Welde. 2017. "The Accuracy of Toll Road Traffic Forecasts: An Econometric Evaluation." *w101*, 73–85. <https://doi.org/10.1016/j.tra.2017.05.001>.
- Palacios, J. L., V. Gonzalez, and L. F. Alarcón. 2014. "Selection of Third-Party Relationships in Construction." *Journal of Construction Engineering and Management* 140 (4): B4013005. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0000701](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000701).
- Pinto, J. K. 2023. "Is This How Big Things Get Done?" *International Journal of Project Management* 41 (5): 102484. <https://doi.org/10.1016/j.ijproman.2023.102484>.
- Poole, M. S., and A. H. Van de Ven. 1989. "Unsing Paradox to Build Management and Organization Theories." *The Academy of Management Review* 14 (4): 562–578. <https://doi.org/10.2307/258559>.
- Quinn, R. E., and J. Rohrbaugh. 1983. "A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis." *Management Science* 29 (3): 363–377. <https://doi.org/10.1287/mnsc.29.3.363>.
- Raisch, S., T. J. Hargrave, and A. H. Van De Ven. 2018. "The Learning Spiral: A Process Perspective on Paradox." *Journal of Management Studies* 55 (8): 1507–1526. <https://doi.org/10.1111/joms.12397>.
- Riis, J. O., and F. L. Pedersen. 2003. "Managing Organizational Development Projects by Paradoxes." *Production Planning & Control* 14 (4): 349–360. <https://doi.org/10.1080/0953728031000117940>.
- Roehrich, J., and M. Lewis. 2014. "Procuring Complex Performance: Implications for Exchange Governance Complexity." *International Journal of Operations & Production Management* 34 (2): 221–241. <https://doi.org/10.1108/IJOPM-01-2011-0024>.
- Roth, G., and P. Senge. 1996. "From Theory to Practice: research Territory, Processes and Structure at an Organizational Learning

- Centre." *Journal of Organizational Change Management* 9 (1): 92–106. <https://doi.org/10.1108/09534819610107349>.
- Sabini, L., and N. Alderman. 2021. "The Paradoxical Profession: Project Management and the Contradictory Nature of Sustainable Project Objectives." *Project Management Journal* 52 (4): 379–393. <https://doi.org/10.1177/87569728211007660>.
- Samset, K. 2009. "Projects, Their Quality at Entry and Challenges in the Front-End Phase." In *Making Essential Choices with Scant Information: Front-End Decision Making in Major Projects*, edited by T. Williams, K. Samset and K. Sunnevåg. London, UK: Springer.
- Samset, K., B. Andersen, and K. Austeng. 2014. "To Which Extent Do Projects Explore the Opportunity Space? A Study of Conceptual Appraisals and the Choice of Conceptual Solutions." *International Journal of Managing Projects in Business* 7 (3): 473–492. <https://doi.org/10.1108/IJMPB-08-2013-0038>.
- Samset, K., and G. H. Volden. 2016. "Front-End Definition of Projects: Ten Paradoxes and Some Reflections regarding Project Management and Project Governance." *International Journal of Project Management* 34 (2): 297–313. <https://doi.org/10.1016/j.ijproman.2015.01.014>.
- Samset, K., and G. H. Volden. 2022. "Chapter 7 Closing the Loop: ex-ante and Ex-Post Evaluation in Order to Learn from Mistakes and Successes." In *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*, edited by T. Williams, K. Samset and G. H. Volden. Oxon, UK: Taylor & Francis.
- Sanderson, J., and G. Winch. 2017. "Public Policy and Projects." *International Journal of Project Management* 35 (3): 221–223. <https://doi.org/10.1016/j.ijproman.2016.12.001>.
- Schad, J., M. W. Lewis, S. Raisch, and W. K. Smith. 2016. "Paradox Research in Management Science: Looking Back to Move Forward." *Academy of Management Annals* 10 (1): 5–64. <https://doi.org/10.5465/19416520.2016.1162422>.
- Seijger, C., H. S. Otter, J. van Tatenhove, and G. Dewulf. 2016. "Socially Robust Knowledge in Coastal Projects." *Environmental Science & Policy* 55: 393–407. <https://doi.org/10.1016/j.envsci.2015.03.004>.
- Sergi, V., L. Crevani, and M. Aubry. 2020. "Process Studies of Project Organizing." *Project Management Journal* 51 (1): 3–10. <https://doi.org/10.1177/8756972819896482>.
- Smith W.K., Lewis M.W., Jarzabkowski P. and Langley A., eds. 2017. *The Oxford Handbook of Organizational Paradox*. Oxford (UK): Oxford University Press.
- Smith, W. K., and M. W. Lewis. 2011. "Toward a Theory of Paradox: A Dynamic Equilibrium Model of Organizing." *Academy of Management Review* 36 (2): 381–403.
- Suchman, M. C. 1995. "Managing Legitimacy: Strategic and Institutional Approaches." *The Academy of Management Review* 20 (3): 571–610. <https://doi.org/10.2307/258788>.
- Suddaby, R., and R. Greenwood. 2005. "Rhetorical Strategies of Legitimacy." *Administrative Science Quarterly* 50 (1): 35–67. <https://doi.org/10.2189/asqu.2005.50.1.35>.
- Sundaramurthy, C., and M. W. Lewis. 2003. "Control and Collaboration: Paradoxes of Governance." *The Academy of Management Review* 28 (3): 397–415. <https://doi.org/10.2307/30040729>.
- Taylor, F. W. 1972 (1911). "The Principles of Scientific Management." In *Scientific Management*, edited by F. W. Taylor. WestPort, Conn.: Greenwood Press.
- Tchumtcha Wembe, P. 2023. "Managing Stakeholders in Engineering Procurement Construction Management Projects in Africa by Chinese Project Managers." *International Journal of Construction Management* 23 (2): 329–337. <https://doi.org/10.1080/15623599.2020.1868091>.
- Tran, D. Q., and K. R. Molenaar. 2015. "Risk-Based Project Delivery Selection Model for Highway Design and Construction." *Journal of Construction Engineering & Management* 141 (12): 1–9.
- Transport for London. 2024. "Elizabeth line." Retrieved November 7, 2024, from <https://tfl.gov.uk/modes/elizabeth-line/?intcmp=68761>.
- van Marrewijk, A., S. R. Clegg, T. S. Pitsis, and M. Veenswijk. 2008. "Managing Public–Private Megaprojects: Paradoxes, Complexity, and Project Design." *International Journal of Project Management* 26 (6): 591–600. <https://doi.org/10.1016/j.ijproman.2007.09.007>.
- van Neerijnen, P., M. P. Tempelaar, and V. van de Vrande. 2022. "Embracing Paradox: TMT Paradoxical Processes as a Steppingstone between TMT Reflexivity and Organizational Ambidexterity." *Organization Studies* 43 (11): 1793–1814. <https://doi.org/10.1177/01708406211058640>.
- van Wee, G. P. 1994. "Betuweroute: geringe Invloed op Nederlandse Emissies." *Verkeerskunde* 6: 14–15.
- van Wee, G. P. 2022. "Incentives and Politics: The Perverse Incentives Paradox: root Cause of Many Other Paradoxes; the Case of the Dutch Betuweroute." In *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*, T. Williams, K. Samset, and G. H. Volden, 130–157. Oxon, UK: Taylor & Francis.
- Vo, H., R. J. Kirkham, T. M. Williams, A. Howells, R. Forster, and T. Cooke-Davies. 2021. "An Empirical Study of Assurance in the UK Government Major Projects Portfolio: From Data to Recommendations, to Action or Inaction." *International Journal of Managing Projects in Business* 14 (4): 865–897. <https://doi.org/10.1108/IJMPB-10-2019-0242>.
- Volden, G. H., and K. Samset. 2017a. "Governance of Major Public Investment Projects: Principles and Practices in Six Countries." *Project Management Journal* 48 (3): 90–108. <https://doi.org/10.1177/875697281704800306>.
- Volden, G. H., and K. Samset. 2017b. "Quality Assurance in Megaproject Management, the Norwegian Way." In *The Oxford Handbook of Megaproject Management*, edited by B. Flyvbjerg, 406–428. Oxford: Oxford University Press.
- Walker, D., and Rowlinson, S., eds. 2019. *Routledge Handbook of Integrated Project Delivery*. London (UK): Routledge.
- Whyte, J., and T. Nussbaum. 2020. "Transition and Temporalities: spanning Temporal Boundaries as Projects End and Operations Begin." *Project Management Journal* 51 (5): 505–521. <https://doi.org/10.1177/8756972820919002>.
- Williams T., Samset K. and Volden G. H., eds. 2022. *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*. Oxon, UK: Taylor & Francis.
- Williams, T. M. 2022. "Project Success." In *The Front-End of Large Public Projects: Paradoxes and Ways Ahead*, edited by T. Williams, K. Samset and G. H. Volden. Oxon, UK: Taylor & Francis.
- Williams, T., and K. Samset. 2010. "Issues in Front-End Decision Making on Projects." *Project Management Journal* 41 (2): 38–49. <https://doi.org/10.1002/pmj.20160>.
- Williams, T., H. Vo, M. Bourne, P. Bourne, T. Cooke-Davies, R. Kirkham, G. Masterton, P. Quattrone, and J. Valette. 2020. "A Cross-National Comparison of Public Project Benefits Management Practices—the Effectiveness of Benefits Management Frameworks in Application." *Production Planning & Control* 31 (8): 644–659. <https://doi.org/10.1080/09537287.2019.1668980>.
- Williams, T., H. Vo, K. Samset, and A. Edkins. 2019. "The Front-End of Projects: A Systematic Literature Review and Structuring." *Production Planning & Control* 30 (14): 1137–1169. <https://doi.org/10.1080/09537287.2019.1594429>.
- Yoo, Y., R. J. Boland, Jr, and K. Lyytinen. 2006. "From Organization Design to Organization Designing." *Organization Science* 17 (2): 215–229. <https://doi.org/10.1287/orsc.1050.0168>.
- Zhu, J., and A. Mostafavi. 2017. "Discovering Complexity and Emergent Properties in Project Systems: A New Approach to Understanding Project Performance." *International Journal of Project Management* 35 (1): 1–12. <https://doi.org/10.1016/j.ijproman.2016.10.004>.
- Zwikael, O., and A. Gilchrist. 2024. "A Structured Process for the Fuzzy Front-End of Complex Projects." *Production Planning & Control*: 1–10. <https://doi.org/10.1080/09537287.2024.2320766>.
- Zwikael, O., and J. Meredith. 2019. "The Role of Organizational Climate in Setting Project Goals." *International Journal of Operations & Production Management* 39 (12): 1281–1294. <https://doi.org/10.1108/IJOPM-02-2019-0150>.
- Zwikael, Ofer, Raghuvar Dutt Pathak, Florence Y. Y. Ling, Sergei Titov, Zafar Husain, Bhavya Sharma, Chin Yang Tay, and Danny Samson. 2022. "Variation in Project Management Practices across Borders." *Production Planning & Control* 33 (13): 1270–1282. <https://doi.org/10.1080/09537287.2020.1858362>.
- Zwikael, O., and J. R. Smyrk. 2019. *Project Management: A Benefit Realisation Approach*. London, UK: Springer-Verlag.