MSc thesis

Unveiling Value: An Analysis of Benefit Management Practices and Improvement Potentials in Dutch Infrastructure

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Summary

This research casts a discerning lens on Benefit Management within Dutch infrastructure projects, endeavouring to bridge the gap between theoretical frameworks and their practical real-world application. The aim is to augment value realization and ensure efficient resource utilization to maximize project benefits.

Infrastructure projects, distinguished by their scale and complexity, are integral to societal advancement, providing essential facilities like roads and railways. However, their extended duration, coupled with inherent risks and uncertainty, pose substantial challenges in delivering the promised benefits. Benefit Management emerges as a strategic approach to identify, plan, and realize project benefits, ensuring alignment with strategic goals. Yet, the focus on benefits often wanes as infrastructure projects move from planning to execution, leading to a potential misalignment between project outputs and intended benefits.

The research design unfolds in three methodical parts: Part 1 lays the theoretical foundation through a literature review on Benefit Management, Governance Structures, and Opportunity Management. Part 2 transitions to practical exploration, featuring expert interviews within Rijkswaterstaat and the Ministry of Infrastructure and Water Management to gauge Benefit Management's real-world application. Thematic analysis of interview data unveils prevailing themes surrounding Benefit Management practice in Dutch capital infrastructure projects. Part 3 proposes solutions based on synthesized findings, validated through an expert workshop, aimed at fostering a conducive environment for adopting Benefit Management practices.

Section 4 takes a deep dive into Benefit Management practice within Rijkswaterstaat's Large Projects and Maintenance department (GPO) highlighted the necessity for a holistic approach spanning the entire project life cycle. Thematic analysis revealed four significant barriers: Limited forecasting capability, Limited flexibility in output, Limited flexibility in process, and Underemphasis on social-cultural benefits.

One of the primary solutions proposed is the adoption of ex-post evaluations. These evaluations are crucial for understanding the long-term impacts of infrastructure projects and ensuring that they continue to deliver value post-completion. Experts consulted during the research underscore the importance of ongoing monitoring and assessment to maximize benefits and minimize disbenefits.

Another significant area of focus is the potential of modular infrastructure. This approach is recognized for its ability to enhance adaptability and sustainability within the infrastructure sector. The study suggests that further research is needed to explore technological innovations

that could facilitate modularity, alongside an economic impact assessment to evaluate the cost-benefit aspects of such approaches.

The research also delves into the re-evaluation of contract types, advocating for more flexible arrangements that allow for adaptability and accommodate changes without significant financial implications. This is complemented by the exploration of adjustments in high-level decision-making, particularly in the Tracéwet, to enable more dynamic and responsive decision-making processes.

Furthermore, the study proposes the establishment of an Independent Mobility Authority to streamline decision-making and management within the infrastructure sector. This centralized body would assume responsibility for the comprehensive role of modern infrastructure management, thereby reducing complexities in decision-making and stakeholder negotiations.

In summary, this thesis underscores the need for a holistic approach to benefit management in infrastructure projects. It highlights the necessity of continuous evaluation, adaptable infrastructure designs, flexible contract types, legislative adjustments, and a centralized authority structure. These solutions collectively address the unique challenges of benefit management in infrastructure projects, paving the way for more efficient, sustainable, and beneficial outcomes in the sector.

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1. Introduction

1.1 Topic introduction

Infrastructure projects, big and complex, are essential for modern society. They build our roads, bridges, and public buildings. However, they can take a long time to complete and are filled with risks and uncertainties (Flyvbjerg & Gardner, 2023). Benefit Management is a way to make sure that these projects deliver what they promise. It's a systematic approach that started in the late 1980s to identify, plan, and achieve the benefits of projects and programs (Farbey et al., 1999).

But there's a problem. When these projects move on from the planning stage, the focus on benefits seems to get lost. This master's thesis will explore how to keep the focus on benefits throughout the whole project, making sure that all the promised gains—whether they're improved accessibility, better community well-being, or environmental protection—are achieved. Additionally, it will provide enable project managers to capture the newly emerging benefits due to a changing context.

1.2 Background

The concept of 'Benefit management' originates from the late 1980's (Farbey et al., 1999), and entails the systematic approach to identifying, planning, and realizing the benefits of projects and programs (White & Casey, 2017). In the construction industry, benefit management is particularly important due to the size, complexity, and long-term nature of construction projects. Construction projects are characterized by a high level of uncertainty, complexity, and risk, which can make it challenging to realize the originally defined benefits. This has led to benefit management becoming an increasingly important area of project management (Bradley, 2016).

The concept of benefit management is part of the field of project management. Project management involves the planning, organizing, and controlling of resources to achieve specific goals and objectives (Kerzner, 2017). Benefit management focuses on the benefits that can be realized by the project or program over the long term. In the construction industry, benefit identification is particularly important, as it can help to ensure that projects are aligned with the strategic goals of the project owner, and that the expected benefits are clearly defined and quantified. Especially in the infrastructure sector, this client is normally a public party.

Benefits can take various forms in the infrastructure sector. Next to economic benefits (Conrad & Seitz, 1994), modern day public infrastructure also brings climate and social benefits (Choi

et al., 2021) as well as social cultural benefits (Kim & Song, 2019). However, within the Netherlands, they main benefit of public infrastructure is to increase the accessibility (Ministry of Infrastructure and Water Management, 2020a).

1.3 Problem statement

The Dutch national government has the aim to spend public resources efficient and effectively (*Comptabiliteitswet 2016*, 2023; Ministry of Finance, 2020). One way to do this is by working with and realising a business case. A business case explains and presents the expected benefits of a project (Murray-Webster & Dalcher, 2019). In the Netherlands, a (Social) Cost-Benefit Analysis (CBA) or Trade of Matrices (TOM) are well known tools to determine the (monetary) value of the benefits and costs, as well as to come to government policy choices (Eijgenraam et al., 2000). As will become clear in Section 3.1, there is limited literature available for benefit management during the realisation phase of infrastructure projects. Typically, practitioners of benefit management often focus on the front-end stages of projects, but tend to neglect the later stages (Ashurst et al., 2008). Similarly, Section 3.3 shows that Rijkswaterstaat, the executive organization of the Ministry of Infrastructure and Water Management, only seem to focus on benefits during the first phases of a project, and do not focus on benefits during and after the realisation of infrastructure projects. Adopting the principles of benefit management throughout the full project life cycle might present an opportunity to improve the efficient and effective spending of public resources.

Infrastructure projects often take a long time to complete, which makes them susceptible to changes of societal needs and requirements or economic effects. Examples of this are attention for the decrease of biodiversity, circular economy and resource scarcity (Maatschappelijke trends, 2022). This not only means that the originally defined benefits can be compromised due to scope changes, budget cuts or changes in the context of a project, but also that new benefits can appear during the different stages of projects, hence the need for active benefit management throughout the projects life cycle. Exploiting these newly emerged benefits can add great value to the project for the project owner and, therefore, increase project owner success as defined by Meredith and Zwikael (2019). However, the governance structure of projects must facilitate this. The MIRT-Process has recently been updated in order to better cope with the rapidly changing context. By adopting more flexibility, the process should now be better able to respond to these changes.

Another identified difficulty is the correct formulation of a project benefit. Several academic papers have led to this conclusion (Chang et al., 2013; Chih & Zwikael, 2015; Lin & Pervan, 2003). This makes it both hard to realise the benefit, but also to verify whether the benefit has been achieved.

To summarise, three problems have been identified within the scope of this research. Firstly, the infrastructure sector does not seem to apply benefit management during the realisation phase of projects, as the focus moves away from the originally defined benefits when the project enters the tender phase. Therefore, possibilities to give better substance to the originally defined benefits might be missed. Secondly, newly emerging opportunities are not (fully) exploited. Because of the long duration of projects, there might appear new opportunities because of a changing context. Lastly, benefits are not always formulated in a correct way, which can make it hard to achieve and verify them. Therefore, this research aims to develop a governance structure which enables the projects to achieve existing benefits and adapt to newly emerging benefits.

1.4 Research objective

The objective of this research is to provide means to create the boundary conditions which enable Dutch infrastructure projects to achieve their intended benefits, while allowing them to adjust to the changing context over time. To achieve this objective, the first step is to identify the critical barriers currently hindering benefit management from being implemented successfully. Next, this research aims to provide solutions to these barriers.

1.5 Research question

The main research question for this thesis is:

'How can benefit management practices be improved in the Dutch infrastructure sector for enhanced value realization?'

To answer this question, the following sub-research questions should be answered. These questions represent the consecutive steps to find an answer for the main research question.

SQ1: What is the current academic state of benefit management, opportunity management and governance structures in construction projects, and what are their respective strengths and weaknesses?

SQ2: How is Benefit Management currently being practiced in Dutch infrastructure projects, and what are its barriers and enablers?

SQ3: Which changes are needed to improve benefit management in infrastructure projects?

1.6 Research relevance

This section explores the practical and theoretical relevance of the proposed research. The research helps to enhance project owner success (as explained in subsection 3.1.2),

organizational performance, and decision-making. It serves both a theoretical and a practical relevance, which will both be explained in the following sections.

Benefit management focuses on ensuring that projects deliver their intended benefits. Although the focus of this research is on public projects, there is also a theoretical relevance for private organisations. This research helps identify effective strategies and practices for managing project benefits, which can enhance project success rates and improve overall project management processes. It helps organizations to understand, identify and enhance factors that contribute to value creation. Next to this, the outcome contributes to the decision-making process in infrastructure projects when it comes to benefit realization and project success. This enables organizations to make informed choices regarding resource allocation and benefit optimization.

Overall, the research helps to improve the efficient and effective use of (financial) resources. This is especially relevant for governments since this entails public money, and is a focus area of the Dutch government (*Comptabiliteitswet 2016*, 2023; Ministry of Finance, 2020). There is also a close correlation between this research and Q8 ‘How can policy effectiveness be increased?’ of the Toolbox Policy evaluations by the Dutch government (National Government, 2020). Similarly, it’s a key task of the Netherlands Court of Audit to check the ‘effectiveness and efficiency of government policy’ (Algemene Rekenkamer, 2021b). They have concluded multiple times that the national government needs to improve in this area (Algemene Rekenkamer, 2021a, 2022, 2023), which shows the relevance of this research.

Beyond its practical implications, this research contributes to theoretical advancements in project management and organizational studies. The governance structure improves our understanding of the underlying principles and mechanisms that drive successful benefit realization and organizational performance. By exploring the complexities and dynamics of benefit realization, our knowledge of how organizations create, and capture value is expanded.

1.7 Reading guide

For enhanced clarity and readability of this research, a structured outline is provided detailing the contents of each chapter:

Chapter 1: introduces the research topic, highlighting both its practical and theoretical relevance. This chapter also sets the context for the entire research journey.

Chapter 2: delves into the research scope and design. The research's specific focus is on the implementation of benefit management during the realization phase of Dutch infrastructure

projects. This chapter also elucidates the tripartite division of the research, with the first segment being a literature review.

Chapter 3: presents this literature review, exploring key areas of benefit management, opportunity management, and governance structure. The chapter culminates in the identification of three central themes, which are further expanded upon in Chapter 4.

Chapter 4: embarks on the second phase of this research: an empirical exploration aiming to decipher the present role of benefit management in infrastructure endeavors. Initiating with a concise elucidation of the employed methodology, the chapter then pinpoints four critical barriers impeding the successful incorporation of benefit management in real-world scenarios. Significantly, the chapter underscores that for the triumphant execution of benefit management during the realization phase, solutions must be integrated throughout the project's entire lifecycle.

Chapter 5: introduces in the third and final segment of the research by proposing solutions to the previously identified barriers. Five distinct solutions are presented, together with their link to the identified barriers.

Chapter 6: evaluates the solutions presented in chapter 5. The evaluations, based on expert interviews, delve into the viability and potential impact of these proposed solutions.

Chapter 7: the discussion section, delves deep into the results' validity and interpretations. It also sheds light on the research's limitations and potential implications.

Chapter 8: wraps up the research, providing comprehensive answers to the primary and secondary research questions.

2. Research design

This chapter will explain the research design. Firstly, the scope of the research will be defined. To answer this main research question, this thesis has been split into three parts. Each part has a corresponding sub research question, and functions as a steppingstone towards the intended result. These steps will be explained into more detail in the second part of this chapter.

2.1 Research scope

As will be described in Section 3.1, benefits are typically defined on a programme or portfolio level and should be defined prior to a specific project. This way, they can serve as a reference framework on which decisions are made throughout the lifecycle of a project. This research is limited to projects within the construction sector. The scope can be further narrowed down to only the execution phase, as depicted Figure 1. Section 3.3.3 shows that, unlike during the earlier phases of a project, benefits are not actively considered during the execution phase of a project. This makes the execution phase is especially interesting to focus on.

Figure 1 Graphical representation of a project lifecycle, and the scope of this research within this lifecycle.

2.2 Research approach

The research has been split into three parts. The parts are conducted sequentially, and the outcomes and results of each part form the base for the subsequent part.

2.2.1 Part 1 – Literature research

The first part consists of literature research into the main topics around which this thesis revolves. These topics are Benefit Management and Governance Structures. Next to this, literature research into Opportunity Management will be performed.

Benefit Management is the central topic of this research. Therefore, it is essential to have a clear understanding of its theoretical aspects. The literature research helps to gain a complete overview of the current (academic) knowledge. This research is carried out by not only reading academic papers, but also other publicly available documents. Examples of these documents are CBA's, Planning Procedures Decree (Dutch: Tracébesluit), project evaluations, and laws and legislation.

Benefit Management seems to have commonalities with Opportunity Management, which can help to understand Benefit Management. Therefore, it seems important to have knowledge about Opportunity Management. Especially the process behind it, and its current barriers are important to understand. This research will be based on academic research and documents written by professional organizations.

Since the aim of this research is enable Benefit Management, a literature review into the topic of Governance structures is carried out. The aim of this research is to gain knowledge of different governance theories and processes. This is done by reading and analysing academic research into this topic.

Question 1:	What is the current academic state of benefit management, opportunity management and governance structures in construction projects, and what are their respective strengths and weaknesses?
Aim:	Create a clear overview of the current academic and theoretical state with regards to Benefit Management, Opportunity Management and Governance structures
Method:	Literature research
Output:	An analysis of current academic literature

2.2.2 Part 2 – Practice

This second part has the aim to gain an understanding of how Benefit Management is performed in practice. This is done interviewing eight experts working on different projects within Rijkswaterstaat, as well as two people working at the Ministry of Infrastructure and Water management. These experts have been selected on their roles and responsibilities, which typically manifest on a strategic level.

After transcribing the interviews, the data is analysed by means of thematic analysis. Thematic Analysis was deemed an appropriate method for this study as it facilitates the identification and analysis of themes within data, offering a nuanced understanding of individuals' experiences, opinions, and challenges pertinent to benefit management. Moreover, it's adaptable to a constructivist approach, aligning with the exploratory nature of the study, while providing a systematic framework for analysing qualitative data (Guest et al., 2011).

Question 2:	How is Benefit Management currently being practiced in Dutch infrastructure projects, and what are its barriers and enablers?
Aim:	Create a clear overview of how Benefit Management is currently implemented in the cases, what the challenges are, and what are the differences between these cases
Method:	Interviews analysed by means of thematic analysis
Output:	A comprehensive analysis of the cases and interviews, presenting the current barriers and enablers of adopting Benefit Management

2.2.3 Part 3 – Proposing solutions

In the last step of this research, advice is given about what is needed to enable Benefit Management in infrastructure projects. This advice is based on the conclusions and outcomes of the previous two steps. By analysing, comparing, and combining the findings from parts 1 and 2, a conclusion can be drawn about the requirements. The advice aims to both provide a solution for the identified shortcomings and opportunities in the current benefit management process. The proposed solutions are evaluated by means of an expert workshop.

Question 3:	Which changes are needed to improve benefit management in Dutch infrastructure projects?
Aim:	To create a governance structure which helps with the adoption of Benefit Management in practice, deals with the presented barriers and is improved by including Opportunity Management strategies
Method:	Analysing and comparing the results of Step 1 and Step 2, and evaluation by interviewing experts
Output:	Solutions to the identified barriers

3. Literature Review

This chapter provides background information about the three main concepts of this research. These are Benefit Management (Section 3.1), Opportunity Management (Section 3.2) and Governance Structures (Section 3.3) . This is based on academic literature, news articles and governmental documents.

As will become clear in the following sections, despite key differences, the concepts of benefit management and opportunity management show several similarities.

3.1 Benefit management

This section explains the concept of Benefit Management.

3.1.1 Position of Benefits

Project management is the process of planning, organizing, and controlling resources to achieve specific project objectives within a specified time frame (Kerzner, 2017). Although the exact formulation may change, the literature typically defines four levels of project objectives. These are project input, project output, project outcomes, and project benefits (Baccarini, 1999; Youker, 1993). These terms play an important role in measuring success, evaluating progress, and determining the overall impact of a project (Meredith & Zwikael, 2019).

The relationship between output, outcome, and benefits is both sequential and interconnected. Table 1 provides an overview of how various authors and organizations define these terms. While there's a general agreement on what constitutes project outputs, the lines between benefits and outcomes often blur, leading to occasional conflicts in definitions. This ambiguity might explain why Mossalam & Arafa (2016) chose not to differentiate between the two. Subsequent sections will delve deeper into the distinct definitions and nuances of outputs, outcomes, and benefits.

Project Output: Defined by the PMBOK® Guide (2021) as the tangible and quantifiable products, services, or results delivered upon a project's conclusion. These directly stem from the project activities and might include a fully constructed building or a software application. Typically, these outputs have a short-term horizon, encompassing the project's duration.

Project Outcome: This term signifies the broader impact achieved by leveraging the project outputs (Baccarini, 1999). These medium-term effects, which might manifest a few years post-project, extend beyond immediate outputs. While outcomes might not always be quantifiable,

they're discernible and can be evaluated using qualitative or quantitative metrics (PMBOK® Guide, 2021). For instance, a construction project might lead to enhanced community safety and accessibility, while a software initiative might boost a business's productivity.

Benefits: Often synonymous with goals or objectives, benefits denote the positive impacts resulting from outcomes. They capture the value additions or enhancements experienced by individuals, organizations, or the broader society and can span social, economic, or environmental spheres. Generally materializing in the long run, these benefits underscore the essence of Benefit Management – the systematic process of recognizing, defining, planning, monitoring, and actualizing benefits, as articulated by Murray-Webster & Dalcher (2019). An intriguing observation from Table 1 is the demarcation between academic definitions (rows 1 and 2) that adopt a theoretical approach and practical interpretations (rows 3 and 4) that emphasize measurability.

Chih and Zwikael (2015) delineate between benefits and target benefits. Target benefits are the anticipated advantages set for a project before its onset, expected to materialize upon completion. In contrast, benefits are those identified or anticipated even before the project commences. Contrasting with benefits are disbenefits, which, as Fox (2008) argues, demand careful management to avoid hindering the realization of the potential benefits. Typically, strategies to manage and counteract these disbenefits come into play after project delivery (Guide for Effective Benefits Management in Major Projects, 2017)

Table 1 Overview definitions Benefits, Outcomes and Output

Source	Benefit	Outcome	Output
(Zwikael & Smyrk, 2012)	*"A "flow of value" that is triggered by the realization of a target outcome"*	*"A desired, measurable end-effect that arises when the outputs from a project are utilized by certain stakeholders"*	*"The artifacts that are produced from the work of the project"*
(Baccarini, 1999)	*"The project goal is the overall strategic orientation to which the project will contribute and should be consistent with the strategic plans of the organization. The project goal provides the rationale behind the project and describes its long-term objective"*	*"This is the intended near-term effects on the users of the project as a result of utilizing the project's outputs. The project purpose provides the means toward the project goal and determines the required project outputs"*	*"These are the immediate, specific, and tangible results or deliverables produced by project activities. The outputs explain what the project will produce"*
(PMI, 2017)	*"Quantifiable criteria that must be met for a project to be considered successful. Each quantifiable criterion includes an attribute (e.g., cost), metric (unit of measure), and is expressed either as a single value or range of values"*	*"Either tangible or intangible. The examples cited by the PMBOK are tangible outcomes such as buildings and roads and intangible outcomes such as people who can effectively apply their training"*	*"Any measurable, tangible, verifiable outcome, result or item that must be produced to complete a project or part of a project"*

(Office of Government Commerce, 2007)	*"The measurable improvement resulting from an outcome perceived as an advantage by one or more stakeholders"*	*"The result of change, normally affecting real-world behaviour and/or circumstances"*	*"The tangible or intangible product resulting from planned activity"*

Table 2 examples of project output, outcomes and benefits

Author	Project	Output	Outcome	benefit
(Baccarini, 1999)	Nutrition project in developing country	New farming practices	Increased rice production	Increased farmer income
(Nogeste, 2011)	IT project	New system	Better efficiency and thus more spare time	Spare time can be used for new projects
(*Output VS Outcome VS Benefit*, 2019)	Infrastructure	Flyover bridge	Less congestion; better traffic flow	Journey time reduced by 30 min; congestion related accidents dropped by 60%
(*Objectives, Outcomes, Outputs & Benefits*, 2020)	Implement e-commerce	New tool for customer self-service	Organisation moves to a digital service model	Increase revenue
(Naybour, 2020)	House	A house	Suitable place to live	Better health, family relations and working environment
	Betuweroute	A railway track	Hazardous chemicals are no longer transported through villages	Increase in safety in the villages

Table 2 attempts to give several examples of project output, outcomes and benefits. A typical outcome of infrastructure could be a decrease in travel time. This can result in more indirect effects, such as cheaper transportation, less environmental harm, or increased accessibility. An important remark with regards to infrastructure projects is that research shows that these projects are hardly ever the direct cause of special-economic growth (Euser, 2015). Rather than causing it, it can only facilitate an already existing ongoing trend. Therefore, it is doubtful whether special-economic growth can be considered a direct benefit of an infrastructure project. The table also clearly shows the different kinds of benefits. Not only can they be financial, but also social or environmental.

In this research, the relationship between outputs, outcomes and benefits is explained as follows: outputs are the starting point, representing the direct and tangible results of a project. Outcomes build upon these outputs and result on the medium long term from users utilizing the project outputs. Finally, benefits emerge from the outcomes in the long term, capturing the positive consequences or strategic advantages gained, in line with the strategic goals of the organization.

Generally, benefits appear after the project has been completed, and they form a vital part of the business case (Chih & Zwikael, 2015; Keeys & Huemann, 2017; Turner, 2009; T. Williams & Samset, 2010; Zwikael, 2016). Prior to a project, a business case defines and formulates

the benefits which should result from the project. Consequently, benefits should be formulated prior to the design of the project output. There are plenty of well-known strategies and processes who incorporate this approach. Examples of such strategies are “theory of change” used by governments and NGO, but also “work backwards” as is often applied in Silicon Valley (Flyvbjerg & Gardner, 2023). The latter is illustrated by Steve Jobs (1997) when he said *“You have got to start with the customer experience and work backwords to the technology. You can’t start with the technology and try to figure out how to sell it… The strategy of Apple started with ‘what incredible benefits can we give to the customer?’”*. Similarly, Sinek (2009) argues in his Golden Circle theory to always start with ‘why’ you do a project, and only then start working towards the ‘what’.

3.1.2 Project success

Historically, the focus of project managers used to be on the time and costs. Together with scope, these elements form the iron triangle (Nogeste & Walker, 2005). However, there has been a shift to other concerns such as customer satisfaction and the extent to which the strategic objectives of the project are realised (Badewi, 2016). This means that the iron triangle alone is not enough to evaluate whether a project has been successful (Atkinson, 1999; Samset, 2009). A more holistic evaluation model has been developed by Meredith and Zwikael (2019). They distinguish three dimensions when it comes to assessing project success. Firstly, project management success, which rates the performance of the project manager. Secondly, Project owner success, which is about the performance of the owner in realizing the business case. Lastly, the project investment success, which assesses the investment performance of the project for its funder. An even further step is taken by Radujković et al. (2021). They have identified six categories for project success criteria which not only considers projects owners and managers, but for example also stakeholders, the environment and the users of the project.

A clear example of the difference between project management success and project owner success, is the Sydney Opera House. The project costs were about sixteen times as much as originally calculated and it took 10 years longer to build. Therefore, based on the iron triangle, one could argue that it was a complete failure from a project management perspective. However, from the perspective of the project owner, the Opera House could be seen as a success. It has become one of the most recognizable landmarks on earth, and one could say it represent Australia (Camilleri, 2016).

Combining project management and benefit management significantly enhances the probability of project success (Badewi, 2016). Next to this, organisations who align their processes and practices with their benefits management processes are performing better

(Ward & Daniel, 2012). Several organisations have written guides on how to practice benefit management. Examples are the Association for Project Management (White & Casey, 2017) and the United Kingdom's Infrastructure and Projects Authority (Guide for Effective Benefits Management in Major Projects, 2017). This shows the importance of having a good benefit management process in place to achieve project success.

3.1.3 Unsuccessful projects

After discussing project success, it is also interesting to analyse unsuccessful projects. For mega projects, unsuccessful projects are so common that Flyvbjerg (2017) formulated the "Iron Law of Megaprojects", which argues these projects go over budget, over time and/or under benefits. In his study, he analysed over 16.000 projects in a variety of sectors. Figure 2 presents the outcome of this analysis, which shows only 0.5% of all projects meet all requirements. Research by PMI (2016) shows that 17% of the organizations claim to have a mature benefits realization process. Next to this, it shows that 63% of all projects meet their original goals, and the percentage for projects finished on time or within budget is both around 50%. It's hard to compare the numbers of these papers because of the way they are presented. However, they both indicate that a significant amount of projects can be deemed unsuccessful.

This research will only focus on projects where the benefits have not been met, which means they are unsuccessful in terms of project owner success. Worldwide, one out of ten projects do not meet their intended benefits. Examples of these projects are the Sydney's Lane Cove tunnel, Channel tunnel, the Copenhagen metro, the Great Belt tunnel and the high-speed connection between Oslo and Stockholm (Flyvbjerg, 2017). However, as will become clear in the following sections, the lack of post projects evaluations in The Netherlands makes it hard to find out whether project benefits have been realised.

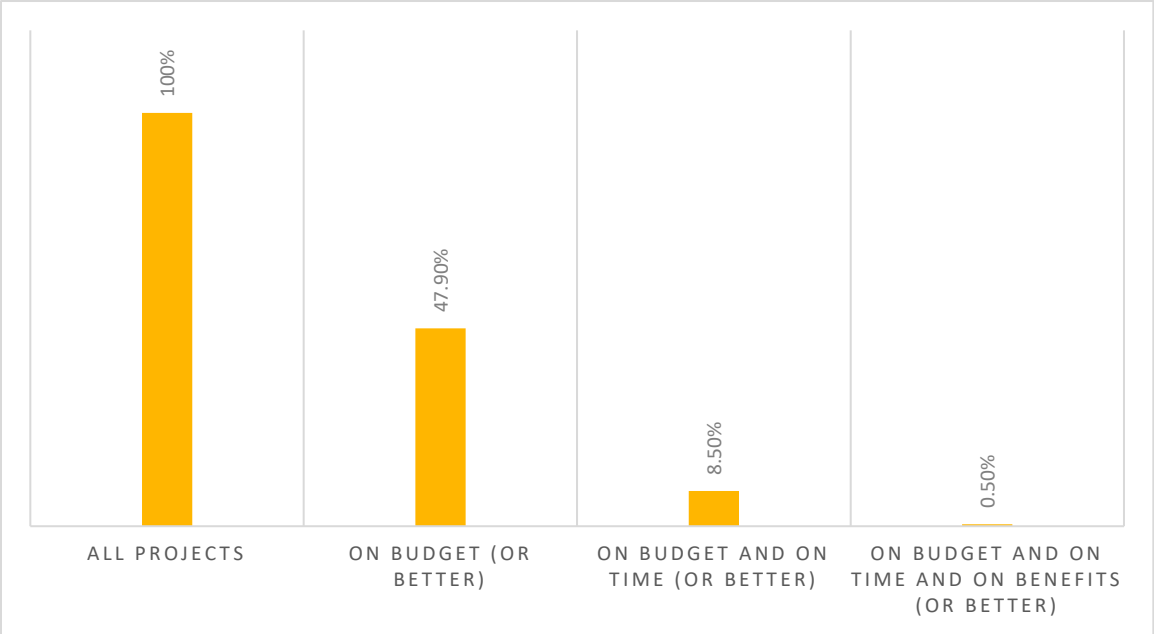

Figure 2 The Iron Law of Project Management (Flyvbjerg, 2017)

One way to evaluate projects is by means of its environmental impact. If a project is expected to have a (positive) effect on the environment, it is obliged to assess this prior to the project in an Environmental Impact Assessment (Dutch: Milieu effecten rapportage). After project completion the Environmental Protection Act (Article 7.39(1)) obligates the government to investigate all actual environmental consequences for these projects which require an Environmental Impact Assessment. However, such an evaluation of the Environmental Impact Assessment has not been found for any project during this research.

In general, it has been difficult to find ex post evaluations of infrastructure projects because they are not carried out by default. Only if a project is classified as a major project, and therefore part of the 'Regeling Grote Projecten', the government is obliged to perform a final evaluation. Examples of these kind of projects are the 'Betuweroute', 'HSL-Zuid' and the 'Vijfde Schipholbaan'. Article 16(a) of this law states that the final evaluation should also include an analysis to what extend the original goals of the project have been achieved. However, to be able to do so, these goals must have been properly defined in advance. Since they are typically left vague, the evaluation does typically not yield many results.

This subchapter will explore two projects where it is doubtful whether the intended benefits have been met. This would mean, that the project has not been successful from the owner's perspective. Both projects have been investigated by the Dutch Court of Audit because of the major social impact they had.

Betuweroute

A first example is a railway project. Railway projects are notorious for costs overruns. On

average, railway projects exceed the original budget by 45%. Besides, the originally estimated passengers also tend to be overestimated (Flyvbjerg, 2007). Although this underestimation of costs and overestimation of benefits can have a devastating effect on the outcome of a CBA, it is still common for infrastructure projects, and especially rail projects (Flyvbjerg & Bester, 2021).

The Betuweroute is a dedicated rail freight line in the Netherlands that was constructed to improve the transportation of goods between the Port of Rotterdam and the German border. The project was initiated in the 1990s as a response to the increasing congestion on the roads and waterways in the Netherlands. The construction of the Betuweroute was completed in 2007, and the line is now fully operational (*Exploitatie van de Betuweroute*, 2016).

The main objective of the Betuweroute was to shift the transportation of goods from road and waterways to rail, with the aim of reducing congestion, improving the environment, and increasing the efficiency of freight transportation. The railway was also intended to increase the competitiveness of the Port of Rotterdam by providing a direct and efficient connection to the European hinterland (*Exploitatie van de Betuweroute*, 2016). As can be seen, the objective of the railway is kept remarkably general. Similarly, in its final evaluation report (Ministry of Transport, Public Works and Water Management, 2010), two goals have been listed. Firstly, related to the project output: '*The realisation of a freight railway from the Maasvlakte to the German border near Zevenaar'*, and secondly, a goal related to the iron triangle: '*The construction of the Betuweroute should be complete at the latest in 2005'*. Other goals, related to costs and efficiency have been left out consideration since they only become apparent on the long term. The report concludes that the first goal has been achieved, and the second goal has not been achieved, since it was only completed in 2007. Thus, although the report analyses the project goals, it does not analyse the project benefits.

The Dutch Court of Audit has also done research into the Betuweroute (Exploitatie van de Betuweroute, 2016), in which they conclude it has not achieved its intended goals. The report suggests that the route has not resulted in a significant shift from road to rail freight transportation, and the economic impact of the Betuweroute has been limited. Furthermore, the report argues that the financial performance of the Betuweroute has been poor, with high operating costs and low revenues, resulting in significant subsidies from the Dutch government and a negative cost-benefit ratio. Lastly, the report states that the environmental benefits have remained unclear. Although the responsible minister did promise research into the *modal shift,* there has never been such research. Therefore, the environmental gain has remained unclear. It has to be noted that the environmental gain was a key objective when the project was introduced in 1995.

The Knowledge Institute for Mobility Policy (Dutch: Kennisinstituut voor Mobiliteitsbeleid) performed a follow-up research (Jonkeren et al., 2017). The conclusions were largely the same, but the report did not include an environmental assessment due to a lack of resources. Therefore, the environmental benefits have remained unclear. There are arguments that the reduction of lorries indeed has a positive impact on the environment. However, Dr. Wijnand Veeneman argues in an news article this effect will be limited because of the type of trains used ('Betuwelijn 10 jaar', 2017).

HSL-Zuid

The High-Speed Line South (HSL-Zuid) is a dedicated high-speed railway line in the Netherlands that connects Amsterdam with Antwerp. The project was initiated in the 1990s as a joint venture between the Dutch and Belgian governments, with the aim of providing a fast and efficient connection between the two countries. The construction of the HSL-Zuid involved the building of a new dedicated railway line, as well as the upgrading of existing tracks and infrastructure. However, the construction of the HSL-Zuid was challenged with delays. The project exceeded the initial budget by a considerable margin, with the total costs estimated to be around 11 billion euros, almost twice the initial budget. The construction of the HSL-Zuid also took much longer than anticipated, with delays caused by factors such as technical difficulties, legal disputes, and funding issues.

The HSL-Zuid was intended to provide several benefits, such as reducing travel times between Amsterdam and Brussels, increasing the capacity and reliability of the railway network, and promoting economic development and growth in the region. The project was also expected to have positive environmental impacts, by reducing the number of cars and planes used for travel between the two cities (*Hogesnelheidslijn-Zuid*, 2014). Although there were some intended benefits, they have never been formulated precisely. The aim of the project has never been formulated in more detail than: *"improving the economical position of the Netherlands and stimulating trains as an alternative for car- and air traffic"* (Ministry of Transport, Public Works and Water Management, 2020). Although this does seem to concern a benefit, the formulation does not meet the requirements set by the UK Government, as described before. Therefore, it's hard to evaluate the results. The report also does not mention whether these benefits have been achieved.

The exploitation of the HSL-Zuid has also known difficulties, due to which the intended benefits have not been achieved during the first few years (Ministry of Transport, Public Works and Water Management, 2020; NOS, 2014; van Silfhout & van den Berg, 2014). The reason for this is a lower number of travellers than expected because of conflicting interest. The government chose for a public tender with the aim to earn as much money as possible.

However, this forced the NS (the winner of the tender) to come with a very high bid, as a result of which there was not enough money to invest in high quality trains. Consequently, there were many failures and a lower number of travellers.

The HSL-Zuid has had some positive impacts. For example, railway line has reduced travel times between Amsterdam and Brussels from over three hours to just under two hours. However, the Dutch Court of Audit has published a report about the HSL-Zuid, which makes clear the project has not achieved all of its intended benefits (*Hogesnelheidslijn-Zuid*, 2014). Passenger numbers have been lower than anticipated, which has affected the financial performance of the project. The operating costs of the HSL-Zuid have been much higher than expected, and the revenues generated by the project have been significantly lower than anticipated. As a result, the HSL-Zuid has been heavily subsidized by the Dutch government. This means that both the social and financial benefits have not been fulfilled.

3.1.4 Conclusion

This subsection discussed the concept of benefit management. A definition is given, and it's relation with project output and outcome has been described. It became clear that benefit management is a well-defined concept, as it is about capturing the flow of value triggered by realizing a target outcome (Zwikael & Smyrk, 2012) by means of recognizing, defining, planning, monitoring, and actualizing benefits (Murray-Webster & Dalcher, 2019). However, it has not been widely implemented on large scale by (public) clients in the construction industry. This chapter showed that benefits are poorly described prior to a project, and there is a lack of ex-post evaluations to determine whether the intended benefits have been met. The two analysed cases show that intended benefits of construction projects are not always achieved. However, they also reveal the complexity of determining whether benefits have been achieved.

3.2 Opportunity Management

This subsection explains the concept of opportunity management. This will be done by describing opportunity management in theory and in practice, both based on academic literature.

3.2.1 Opportunity management in theory

By now, risk management is a well-known part of project management. According to Dionne (2013), scholars began studying risk management to around 1955. From there on it has evolved and its use has been extended. For example, risk management is now used in finance, engineering and insurance (Dionne, 2013).

Risks exists in a project due to the presents of uncertainty (*PMBOK® Guide*, 2021). It's important to notice here that risk and uncertainty are seen as different concepts. Speaking of a risk, one is aware of all possibilities and probabilities, while this is unknown in an uncertain

event (Park & Shapira, 2017). Following this line of reasoning, threats are the negative interpretation of risk, opportunities are the positive interpretation (Hillson, 2017). As can be derived from this definition, risk management is not only about negative risks (threats) but also about positive risks (opportunities). Although Hillson (2017) makes the distinction between threats and opportunities this way, Chapman and Ward (2011) make it at a different level. They split uncertainty into risks and opportunities, where risks only refer to negative events. Despite the difference in phrasing, the frame of mind seems to be similar.

It's now clear that scholars agree that both upside and downside risks must be included in risk management (Hillson, 2002; Johansen et al., 2018; Perminova et al., 2008; Waddell, 2004). This also becomes apparent by the following definition for the risk analysis and management process by the Project Management Institute: '*A process that allows individual risk events and overall risk to be understood and managed proactively, optimising success by minimising threats and maximising opportunities and outcomes*' (Murray-Webster & Dalcher, 2019). Hillson (2002) gives several arguments why opportunity management should be part of risk management. Firstly, he argues that a separate opportunity management process might be seen as an additional burden by project managers. By including it in an already existing process, the additional overhead can be minimalised. Secondly, he claims that the risk management mindset promotes the recognition of potential uncertainties that could impact goals and prompts project managers to actively seek solutions for addressing them.

Although there are similarities between threats and opportunities, there are also some significant differences. Hence, there is a difference in strategies when it comes to dealing with both. The Project Management Institute (2017) gives five strategies for both threats and opportunities, with three differences between them. Firstly, where to 'Avoid' a threat, an opportunity should be 'Exploited'. When trying to avoid a threat, a project team will try to avoid exposure to the uncertainty. Contrary, by exploiting an opportunity, the project team will actively try to make the uncertain event happen. The second difference is between 'Transfer' and 'Share'. A threat should be transferred to a party best capable to manage it, while an opportunity must be shared with the party best able to capture it. Lastly, there is a difference between 'Mitigating' and 'Enhance'. With mitigating, the project team's tries to minimise the probability of occurrence and/or the impact of the threat. Conversely, the aim of Enhancing is to try to maximise this probability for an opportunity.

3.2.2 Opportunity management in practice

Authors seem to agree on the importance of opportunity management, and its role in risk management. However, more recent studies indicate that organisations are struggling with opportunity management and that it's still not implemented successfully in practice (Dingelstad,

2021; Hillson, 2019; Massaad, 2021; Sharma, 2022). The aforementioned papers argue that risk management practitioners still tend to focus mainly on negative risks. Hillson (2002) mentions in his paper on how to implement opportunity management: “risk practitioners find it easier to identify potential pitfalls and problems than to look for hidden advantages or upsides”. After almost 20 years this problem still seems to exist. Also, during the APM Risk SIG Conference, the Association for Project Management presented research into opportunity management as part of the overall project risk management process. The research has been carried out together with the TU Delft. The findings of the research revealed that opportunity management practice and theory do not match. Only a few companies actually perform opportunity management, while others don’t believe in it or have not been able to gain anything from it (*APM Risk SIG Conference*, 2023).

Understanding why opportunity management is not integrated in practice might offer insights into potential challenges emerging when implementing benefit management. Hillson (2019) finds five factors contributing to the reluctance to adopt opportunities in risk management. Based on this research, each factor will be shortly explained in the following section.

Ignorance: Many individuals are not aware of the concept of including opportunities in risk management. Despite the existence of international standards and guidelines emphasizing the inclusion of opportunities, there is a lack of awareness among leaders and managers. While it may be unreasonable to expect everyone to be fully informed about the latest developments, the idea that risk encompasses both upside and downside has been around for a considerable time, making it reasonable to expect greater awareness. Equally, Massaad (2021) found that a lack of awareness restricted team members from exploiting opportunities.

Language: Common-use language often associates risk with negative connotations. The word "risk" itself is generally perceived as something to be avoided or minimized. This perception exists across various languages, making it challenging to convey the broader meaning of risk that includes opportunities. The discrepancy between professional usage and common understanding of risk creates a barrier to accepting the inclusion of opportunities in the risk management process.

Culture: Culture plays a significant role in shaping attitudes towards risk. Different cultures have varying degrees of uncertainty avoidance, which influences how individuals perceive and handle risks. High uncertainty avoidance cultures tend to be more risk-averse, whereas low uncertainty avoidance cultures are more open to embracing risks. National, organizational, and project team cultures all contribute to people's attitudes towards upside risk and opportunity. Cultural norms, values, and

beliefs influence behaviour and decision-making, making it difficult to implement opportunity management in cultures that predominantly view risk as exclusively negative.

Psychology: Human psychology, as described by Abraham Maslow's hierarchy of needs, reveals a tendency to prioritize addressing threats over pursuing opportunities. Threats are associated with deficiency needs, which are necessary for survival and therefore take precedence. Opportunities, on the other hand, are viewed as growth needs, which are perceived as nonessential and optional. This psychological bias leads individuals and organizations to focus on mitigating threats rather than actively pursuing opportunities, hindering the implementation of opportunity management. This finding was also supported by Massaad (2021).

Inertia: Finally, there is a general inertia or resistance to change within organizations. Established risk management practices often focus solely on mitigating threats, and introducing a broader approach that includes opportunities requires a shift in mindset and processes. The inertia to maintain the status quo and resistance to change can impede the adoption of opportunity management in practice.

Although some of the identified factors are also of influence in a benefit management related context, some other barriers might be less relevant. For example, the culture in this context is expected to have a more entrepreneurial focus, which means a natural focus on opportunities. Also, the conflicting language is not present here since there is a clear separation between threats and opportunities.

3.2.3 Opportunity management process

Dingelstad (2021) has developed a framework in which gives an overview of the opportunity management process. The framework has been developed by analysing and combing the work of Chapman & Ward (2011), Hillson (2019) and the Project Management Institute (2017). The general process he distinguished consists of six steps. Each of these steps will be explained in this section. In this process, the general term ‘Risk’ is being used for both opportunities and threats.

Risk Planning: The first step is risk planning. The aim is to alter the risk management process to the specific context of the project, and to develop a common understanding of the aim.

Risk Identification: This is the second step of the process. It revolves around the identification and documentation of individual and overall project risks. All these risks are collected in the Risk Register.

Qualitative Risk Assessment: During this third step, the risks get prioritized and categorized. This can be done with different techniques such as Fault-Event Tree analysis, Source-Response diagrams and Influence diagrams.

Quantitative Risk Assessment: Next, the combined impact of individual risks on the overall project risks is getting analysed. This should be done by developing a risk model.

Risk Response: The aim of this step is to plan and implement responses to the identified risks. Common strategies for this are to Escalate, Avoid, Transfer, Reduce and Accept. As discussed before, in the case of a positive risk, one speaks of Escalate, Exploit, Enhance, Share and Accept.

Risk Monitor & Control: The last step of the risk management process is to monitor and control the risks. This means that the risk register is a dynamic document which needs constant updating and altering to the changing project context.

3.2.4 Conclusion

In recent years, a lot of academic research has been carried out with regards to opportunity management. Within this research, there is a clear shift from exploring and developing theory to implement and perform opportunity management, to researching why it's not working in practice. The research suggests that the cause for failure in practice is not necessarily a flaw in the process of opportunity management, but seems more related to the context it is used in now.

3.3 Governance Structures

This chapter will first explore different project life cycle approaches. After this, the concept of project governance is examined. Next, three governance structures from different countries will be analysed to explore how different countries have implemented a benefit-orientated governance structure. Each of them offer the means to decision makers to take better-informed decisions (Odeck et al., 2015). Although there is a focus on the front-end stages of infrastructure projects, some governance structures are also used in later stages or different industries.

3.3.1 Project life cycle approaches

In the realm of project management, understanding the lifecycle through which a project progresses is critical. At the heart of this progression lie three methodologies: the linear lifecycle, the iterative lifecycle and a hybrid life cycle (Murray-Webster & Dalcher, 2019). Their selection can profoundly influence the trajectory from project initiation to closure.

The linear or waterfall lifecycle is characterized by its sequential progression. Projects following this model have a set of distinct phases, each leading to the next, starting from the initial concept until the final outcome or benefit is achieved. Its primary strength lies in its structure. With clear deliverables and milestones at each phase, this approach offers predictability and stability (Adenowo & Adenowo, 2020). It's best suited for projects where requirements are well-defined from the outset and are unlikely to change. However, its predictability also entails a downside. Due to its rigid structure, making changes or revisions once a phase is complete can be challenging, affecting the project's flexibility.

As opposed to the linear approach, the iterative or agile lifecycle is characterized by its cyclical nature. This approach originates from the software development industry (Beck et al., 2001), but its relevance is also recognised in the infrastructure sector (Flyvbjerg & Gardner, 2023). Projects under this model undergo multiple iterations, often revisiting phases based on user or stakeholder feedback. The key aspect of this model is its adaptability. By integrating feedback after each iteration, it allows for continuous refinement and improvement. This model is especially relevant for projects with high levels of uncertainty or where requirements might evolve. Urban planning projects or innovative infrastructure developments, which require regular stakeholder engagements, often benefit from this approach. While it offers increased flexibility, it demands effective feedback management to ensure the project doesn't veer off its primary objectives.

The hybrid model, as the name suggests, combines elements from both the linear and the iterative model (Murray-Webster & Dalcher, 2019). It might begin with an iterative approach, especially during phases with high uncertainty like requirements gathering, and then switch to a more structured, linear approach for deployment. This amalgamation offers a balance of structure and flexibility. In the infrastructure sector, many projects might not strictly fall into the linear or the iterative category. For such projects, a hybrid approach offers the adaptability of iterative models during initial stages and the predictability of linear models during execution. It provides a tailored approach depending on the project's unique demands.

3.3.2 Project Governance

Although different definitions of project governance are given (*PMBOK® Guide*, 2021; Muller, 2011; Turner, 2009), they all agree that the main concern of project governance is to align project objectives with the corporate strategy, and to realize the intended benefits. In this context, a project is a tool used to create an output, which results in a beneficial outcome when operated (Turner, 2006). Project Governance can be described as ‘the system of decision-making, accountability, and control that ensures that projects are operated effectively and efficiently’ (Biesenthal & Wilden, 2014).

Ahola et al. (2014) distinguish between two types of project governance: governance external to any specific project, and governance internal to a specific project. The first type, governance external to any specific project, involves the overarching governance structures and processes that are put in place to manage a portfolio of projects across an organization. This type of governance is external to any specific project and aims to ensure that individual projects are aligned with the strategic goals of the organization. It includes standardized reporting practices, roles, and monitoring structures to align the interests of the organization and its projects and prioritize resource usage over a portfolio of several projects. The second type identified by Ahola et al. (2014), governance internal to a specific project, is concerned with the specific governance structures and processes that are put in place to manage a particular project. This type of governance is internal to a specific project and is designed to ensure that the project is managed effectively, efficiently, and successfully. It includes project-specific roles, decision-making processes, and monitoring structures to ensure that the project is aligned with the strategic goals of the organization and that the project manager is accountable for the project's success.

The main difference between the two types of project governance is that the first type is external to any specific project and focuses on the governance of a portfolio of projects across an organization, whereas the second type is internal to a specific project and focuses on the governance of that particular project. It's found to be important to consider both streams. When governance is viewed external to a specific project, the focus is intra-organisational. However, when it involves a project consisting of multiple organisations, governance structure is dealing with inter-organisational challenges (Ahola et al., 2014).

In the literature, six dominant governance theories are distinguished (Biesenthal & Wilden, 2014; Derakhshan et al., 2019). They all aim to explain project governance, but the complexity of project governance might require a combination of theories to fully understand how it contributes to project success (Musawir et al., 2017). In table 2, an overview has been presented of the dominant governance theories. This has been done based on the work of Biesenthal & Wilden (2014) and Derakhshan et al. (2019).

Table 3 Summary of central governance theories (Biesenthal & Wilden, 2014; Derakhshan et al., 2019)

Theory	Description	Key authors
Agency theory	Agency theory describes the possible conflict of interest between owners and managers in a company. The theory assumes that managers may act in their own self-interest rather than in the interest of owners, and suggests that appropriate governance mechanisms, such as monitoring and incentives, can align their interests and mitigate potential agency problems.	(Mitnick, 1973), (Ross, 1973), (Eisenhardt, 1989)

Transaction cost economics	Transaction cost economics (TCE) is a theory that examines the cost of completing transactions, and how these costs influence the governance structure of an organization. The aim is to create a governance structure which leads to the lowest possible transaction costs. A key aspect of this process is the selection of contractors and suppliers (Turner & Keegan, 2001).	(Williamson, 1975), (Coase, 1937)
Stakeholder Theory	Stakeholder theory suggests that organizations have a moral responsibility to consider the interests of all stakeholders (R. E. Freeman, 1984). According to the theory, the interests of different stakeholders can conflict with each other. Therefore, organizations should practice stakeholder management to balance these interests and create a sustainable and responsible business.	(T. Donaldson & Preston, 1995), (R. Freeman & Mcvea, 2001)
Shareholder theory	Shareholder theory argues that the primary goal of a corporation should be to maximize shareholder value. Accordingly, the interests of shareholders are prioritized above the interest of other stakeholders. Therefore, it is the responsibility of the management to use resources in a way that maximizes returns for shareholders. The theory has been criticized for its narrow focus on financial returns and its failure to consider the interests of other stakeholders, such as employees, customers, and the broader community.	(Jensen & Meckling, 1976), (Friedman, 1962)
Stewardship theory	According to the Stewardship theory, managers have an intrinsic motivation to act in the best interests of an organization, rather than self-interest or the interests of shareholders. Consequently, managers should act as stewards, taking a long-term view and ensure the sustainability of the organization. Stewardship theory is based on trust, collaboration, and empowerment between a principal and agent (Turner & Keegan, 2001).	(L. Donaldson & Davis, 1991), (Davis et al., 1997)
Resource dependence theory	Resource dependence describes how organizations manage their resources, with the aim to achieve the predefined objectives (Pfeffer & Salancik, 1978). It theory suggests that organizations can use strategies like collaboration and diversification to manage dependencies, and it offers tools to execute these strategies (Thompson, 2011).	(Pfeffer & Salancik, 1978)

The Agency theory is one of the most popular view on project governance (Biesenthal & Wilden, 2014). This theory also entails the separation of ownership and control. This means, a conflict may arise between the principal (business manager) and the agent (project manager) when their interests do not align (Jensen & Meckling, 1976; Ross, 1973). In this context, the interests of the project manager are about the direct output of a project. The interest of a business manager however, are about the longer term outcomes and benefits of a project. When the agent prioritizes his own interests, this may jeopardize the interests of the business manager, and therefore the outcomes and benefits of a project. To mitigate this potential

conflict, ‘agency costs’ can be introduced to align the interests of the principal and the agent (Jensen & Meckling, 1976). An example of this are performance-based contracts (Biesenthal & Wilden, 2014). On the contrary, the Stakeholder and Stewardship theories disregard the potential problem coming with the Agency theory. The stakeholder theory revolves around the idea that a company should serve the interests of all its stakeholders, as well as the society (Blair, 1995; T. Donaldson & Preston, 1995). According to the stewardship theory, the agent will act in the best interest of the principal (Davis et al., 1997).

3.3.3 MIRT Rules of the Game

MIRT is a governance structure for special projects and programs of the Dutch government, and is an abbreviation for Multi-year program Infrastructure, Spatial Planning and Transport (Dutch: Meerjarenprogramma Infrastructuur, Ruimte en Transport) (Ministry of Infrastructure and Water Management, 2010). The exact process, tasks and responsibilities are described in the so-called *playing rules*. This has been done for the preparation phase, exploration phase, planning and study phase as well as the realisation phase. An administrative decision is made after each of these phases, which means there is an explicit ‘*go/no go’* decision gate (Ministry of Infrastructure and Water Management, 2022). The following sections will first describe the principles of MIRT, followed by a short description of the four phases. The information in these sections is based on the ‘Spelregels van het Meerjarenprogramma Infrastructuur, Ruimte en Transport (MIRT)’ (Ministry of Infrastructure and Water Management, 2022)

MIRT is based on three key principles. The first of which is about how special challenges are approached with a broad perspective, so that new and creative possibilities for realizing them come into view. For example, this means that the type one modality (such as rail, bicycle, road or waterway) is not chosen in advance. The aim of the solution is to contribute to an array of benefits, such as livability, environmental quality, sustainability and improving the international competitive position.

The second principle revolves around a customizable approach. This is important because of the wide variety of project for which MIRT is used. For example, it’s used for large and small projects, as well as new construction and renovation of existing infrastructure. A second reason is that sometimes a simple intervention is enough, while in other cases a programmatic approach provides a better solution. Next to physical solutions, the result of MIRT could also be to adjust legislation, financial measures or try in influence human behaviour.

The third and last principle of MIRT focusses on collaboration. The aim is to create an equal and fair collaboration between all parties involved. Not only the national government, but also local governments and parties are included in the process. By doing so, a shared solution and vision can be created.

The three principles align with the principles of Benefit Management. Especially the first two principles do so. They dictate the intended benefits should first be determined, and only then the solutions which offers the best fit. Also, the second principle prescribed the flexibility necessary create the maximum value.

As mentioned before, MIRT has four sequential phases. Figure 3 shows these phases, and the steps which they consist of. The last phase is the realisation phase, which also entails the scope of this research. The MIRT playing rules focus in this phase on reaching the delivery decision, which marks the formal ending of the project. After this milestone, the (former) project enters the operational phase and is transferred back to from Rijkswaterstaat to the Ministry of Infrastructure and Water management. The delivery decision is made based on the final report. This final report explains and justifies to total project expenses, the timespan, and the realised scope. If the contractual agreements and the information profile have been fulfilled, the project gets a positive delivery decision (Ministry of Infrastructure and Water Management, 2022). It's important to mark that although this makes it mandatory to reflect on the realised scope, there is no mandatory reflection on whether the intended benefits have been met.

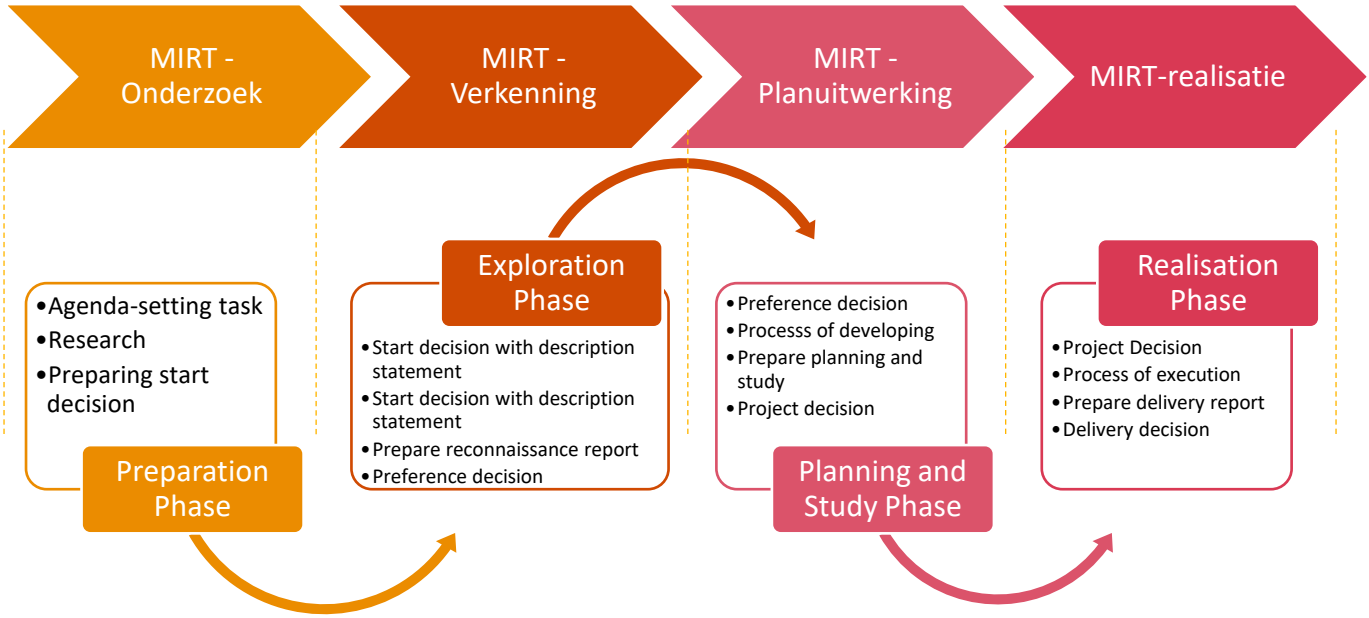

Figure 3 MIRT - Rules and procedure

The MIRT Process has recently been updated in order to be better able to deal with the rapidly changing context. This is done by building in more flexibility into the process. Next to this, sustainability has become an integral part of the MIRT method. This means that factors such as circular economy, climate adaptation and a healthy living environment can now be easier integrated in MIRT projects. However, although the 'MIRT Rules of the Game' now allow for a more integral and sustainable approach, it also indicates that this possibility is limited to the scope of the financial funds (Ministry of Infrastructure and Water Management, 2022). This

used to be the ‘Infrastructuurfonds’ but is as of 2016 changed into the broader ‘Mobilitietsfonds’.

To conclude, it’s interesting to see how the MIRT phases are structured. The early stages of the process seem to align with benefit management, since there is a clear focus on outcome and benefit rather than output. However, once we move further into the process, a more typical project control method is applied, with a focus on project manager success instead of project owner success.

3.3.4 Norwegian Quality Assurance Scheme

In the 1980s and 1990s, Norway experienced numerous scandals related to major public projects (MPP’s). In response, the government commissioned a study to examine the planning, implementation, and follow-up of such projects. The study revealed that 8 out of 11 projects had cost overruns, indicating the need to standardize planning procedures and cost estimation methodologies (Berg et al., 1999). As a result, a Quality Assurance (QA) regime was introduced in 2000 for MPP’s to ensure successful investment and decision-making processes.

This governance structure aimed to improve analysis and decision-making in the front-end phase, and especially the relation between the two. Although there were already binding rules for this decision-making in place, there was a lack of rules to ensure the quality and consistency of analysis and decisions in these stages of a project. Also, the governance structure aims to deal with political priorities, stakeholder alliances, and the changing context over time. All these factors make the process unpredictable. Therefore, there was a need for rules and mechanisms to ensure effective decision-making and mitigate potential issues (Samset et al., 2006).

The governance structure consists of two phases: the feasibility phase QA1 and the basic design/engineering phase QA2. In the year 2000, the Norwegian Ministry of Finance introduced a mandatory QA system known as "mandatory quality-at-entry" (now known as QA2) to reduce implementation costs in MPPs. This system was later extended in 2005 to include quality assurance (QA1) in the early concept/project selection phase. The aim was to ensure that projects chosen were appropriate and viable, considering broader cost-benefit and societal factors. The main principles and features of the QA system will be described in the following sections, based on the work of Christensen (2011).

QA1, the feasibility phase, focuses on the choice of concept/solution and includes the preparation of need analysis and outlining of overall strategy. QA2, the basic design/engineering phase, reviews the budget, management structure, and contract strategy.

It looks ahead to identify managerial challenges and ensure a realistic budget. QA1 qualifies projects for QA2, and QA2 qualifies projects for participation in the budget process. However, passing QA1 does not guarantee a subsequent QA2, and passing QA2 does not guarantee project prioritization. The Norwegian cabinet plays a key role in taking the final decisions on project continuation and prioritization (Christensen, 2011).

As depicted in Figure 4, The QA system has several standard milestones and decision-making gates, which are all applicable to MPPs across all sectors. It aims to ensure political control over fundamental decisions and increase the professional quality of decision-making premises and documents (QA1). The focus is on important decisions rather than excessive detail.

The QA system was developed to address several issues. Firstly, it aimed to prevent MPPs from having unrealistic budgets and cost overruns, which hindered other projects' implementation. Secondly, it aimed to overcome decision-making processes heavily influenced by local political initiatives and campaigns, allowing central political authorities more leeway for project selection. Lastly, the QA system aimed to establish higher professional standards by incorporating independent expertise through external consultants (Odeck et al., 2015).

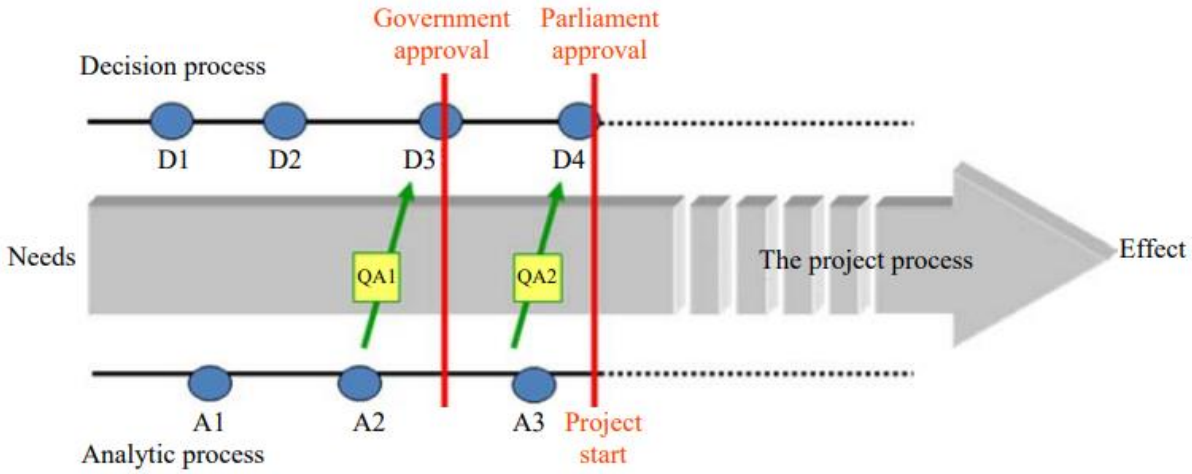

Figure 4 The Norwegian quality assurance system for MPP's (Samset, 2009)

3.3.5 Gateway Review Process

The Gateway Review process is a structured review framework used for assessing major projects at key stages of their lifecycle, and is used by the UK by the Government, Defence and health sector (UK Government, 2010). The process aims to improve the delivery and success rate of projects by providing independent and objective assessments. To be able to do so, the process is designed to assess the viability, progress, and readiness of government

projects. It ensures that projects are on track to achieve their objectives and identifies any issues or risks that need to be addressed. (Fawcett & Marsh, 2012).

The process consists of a several of reviews, which are conducted at specific stages in a project's lifecycle. Typically, six review stages can be identified, with each stage representing a distinct phase of the project. The following stages can be distinguished (UK Government, 2010):

Gateway 1: Strategic Assessment / start-up
Gateway 2: Business Justification
Gateway 3: Delivery/procurement Strategy
Gateway 4: Investment Decision
Gateway 5: Readiness for Service
Gateway 6: Benefits Evaluation

Each Gateway Review involves an independent review team, typically comprising experienced professionals from both within and outside the government. The team assesses the project against a set of predefined criteria and produces a report with recommendations. These criteria vary depending on the specific stage of the process, but they generally include aspects such as project objectives, benefits realization, risks and issues, project governance, project management capability, and stakeholder engagement. The Gateway Review process results in a report that provides an assessment of the project's status and identifies any areas of concern or improvement. The report also includes recommendations for action to address the identified issues, and it helps inform decision-making regarding the project's future. This governance structure has a clear focus on benefits. They are tested and evaluated during multiple stages of the project (UK Government, 2010).

3.3.6 Conclusion

First an analysis of project governance has been given. Next, 3 governance structures used by national governments have been analysed. The analysis presents 2 ways of categorizing project governance: internal and external project governance. The latter seems to be closest to the scope of this research due to its broader scope and clear focus on the strategic aim of a project. However, an important conclusion is that the two types can’t be seen apart from each other. A key feature identified by the research is the existence of gateways in all three governance structures. These are ‘go/no go’ decision stages during which get decided whether to continue with a project or not. This means that project teams move away from the idea that all projects must be completed once they have started. Also, there seems to be a degree of benefits management in all three governance structures. A clear indication of this is taking the

benefits as a starting point when initiating a project, and only then start to think in solutions to fulfil these benefits.

3.4 Conclusion

An exploration into Benefit Management, Opportunity Management, and Governance Structures was undertaken to provide a deep understanding of their current state of the art, intertwined theories, and mutual connections.

Firstly, the research delved into the nuances between outcomes and benefits. Notably, there exists a disparity in their definitions, especially between scholarly and practical perspectives. A pivotal discovery was the necessity to clearly predefine benefits before a project's commencement, emphasizing the longitudinal nature of benefit management that spans the entire project lifecycle. It's imperative to constantly reassess benefits by addressing three key questions at various project stages: (1) Their relevance in evolving contexts, (2) emergence of new benefits, and (3) whether the project's output aligns with the predestined benefits. This iterative feedback and evaluation process resonates with the cyclical nature of projects.

Subsequently, the study shed light on Opportunity Management, revealing a growing scepticism regarding its efficacy despite its resemblance to risk management. The nexus between benefit management and opportunity management revolves around navigating uncertainties, which might either jeopardize existing benefits or pave the way for novel ones. It's observed that such management processes might already be organically integrated into the realisation phase, even if not explicitly recognized. Furthermore, due to the similarities between these concepts, the barriers hindering the implementation of opportunity management provide a compelling perspective on the implementation of benefit management. This raises the question of whether these barriers are also applicable to benefit management, which will be further explored in the empirical research of step 2.

Furthermore, a bifurcation of project governance was discerned: one external and the other intrinsic to specific projects. Six predominant governance theories were analysed, spanning agency theory to resource dependence theory. These governance frameworks are instrumental in harmonizing project goals with organizational strategies, enhancing decision-making, and streamlining project management. A comparative analysis of governance structures from the Netherlands, Norway, and the UK unveiled varying emphases on benefit management at different project stages. Interestingly, most adopted a linear trajectory, overlooking the potential advantages of a more iterative approach. It's evident that a well-structured governance framework can propel organizations towards astute decision-making, optimal resource allocation, and ultimately, realizing the envisioned project benefits.

To summarise, this literature research has resulted into several aspects warrant exploration in the next phase of this research. Foremost, it is pertinent to ascertain whether project managers from Rijkswaterstaat hold any vested interest in benefits. Given that benefits primarily concern the project owner, the investigation will determine if Rijkswaterstaat operates solely as an implementing body or if they adopt the wider perspective of a project owner in evaluating project success. Should they align with the latter, it would be insightful to understand their criteria for gauging project success.

Additionally, gauging the extent to which project managers contemplate benefits will be illuminating. Delving into their familiarity with benefit management and discerning which benefits materialize from their projects will clarify if the projects possess objectives beyond mere accessibility enhancement. Concurrently, it's vital to observe if these benefits undergo transformation over time and whether there's a cognizance of their potential evolution. This is particularly significant in light of literature insights suggesting a diminishing focus on benefits during and post the realization phase. Concluding this exploration, understanding how benefit management intertwines with the governance structure during a project's realization phase will be of prime importance.

Thus, the literature research has culminated in the identification of three core themes to guide the subsequent phase of this research: (1) Awareness, (2) Responsibilities, and (3) Strategies to leverage benefits.

4. Empirical Research

This chapter presents the results of the interviews. The aim of the interviews was to get an insight of the current state of benefit management within Rijkswaterstaat, with a focus on the department Large Projects and Maintenance (Dutch: Grote Projecten & Onderhoud, GPO). The interviews have been carried out with employees of Rijkswaterstaat and the Ministry of Infrastructure and Water Management.

4.1 Interviewee selection and background

To gain insights into the real-world application, challenges, and opportunities of benefit management within governmental settings, primary data was collected through interviews. A qualitative approach was deemed most suitable, as it allows for the capture of nuanced opinions and facilitates a deeper understanding of the complexities involved.

The participants for the interviews were selected based on the following criteria:

Position: All participants hold strategic positions within Rijkswaterstaat or the Ministry of Infrastructure and Water Management. This is important since benefit management typically manifests at this level.

Expertise: Participants were selected based on their involvement in projects or policy where benefit management strategies could or should be implemented or considered.

Willingness to Participate: Only individuals who were willing to share their experiences and insights were considered for the interviews.

For this research, 15 invitations for an interview have been sent, of which 10 interviewees accepted. From the interviewees: 8 people work at Rijkswaterstaat, and 2 work at the Ministry of Infrastructure and Water Management. Out of the 8 people working at Rijkswaterstaat, 6 work as a project director/manager at a current major project in the Netherlands. Each participant was ensured confidentiality to promote open and honest discussion. Prior to the interviews, an interview guide was developed, which is added in Appendix A – Interview guide. The questions were directed at understanding the interviewees' knowledge and experience in benefit management, as well as assessing the current extent of its implementation in practice. Additionally, the interviewees were asked to identify potential barriers and enablers associated with practicing benefit management.

The choice to focus on Rijkswaterstaat and the Ministry of Infrastructure and Water Management was driven by the organizations' pivotal roles in large-scale infrastructure

projects in the Netherlands. Given their influence and the complexity of the projects they manage, these organizations offer a rich context for exploring the intricacies of benefit management.

4.2 Setup

This section elucidates the thematic analysis process employed to interpret the qualitative data amassed from the semi-structured interviews. The analysis aimed to unravel insights into how benefit management is and can be potentially implemented within the Rijkswaterstaat. Therefore, based on the work of Guest et al. (2011), the following process is followed:

The initial step of the process was coding the transcripts. Each of the ten interviews was examined and coded separately to maintain an in-depth understanding of the responses within their contextual settings. The coding was carried out in several iterative cycles, starting with an open coding approach to generate initial codes from the interview data. During this phase, relevant phrases, sentences, or paragraphs were highlighted and tagged with codes that encapsulated their essence. This step has resulted into 429 quotations, divided over 183 codes.

Following the coding, the next step was to scrutinize the amassed codes to discern sub-themes. This phase entailed grouping codes that shared a common narrative or concept, which resulted into 16 sub-themes. These sub-themes are presented in Figure 5, together with the number of codes of which the sub-theme is compiled, and number of quotations used for each sub-theme.

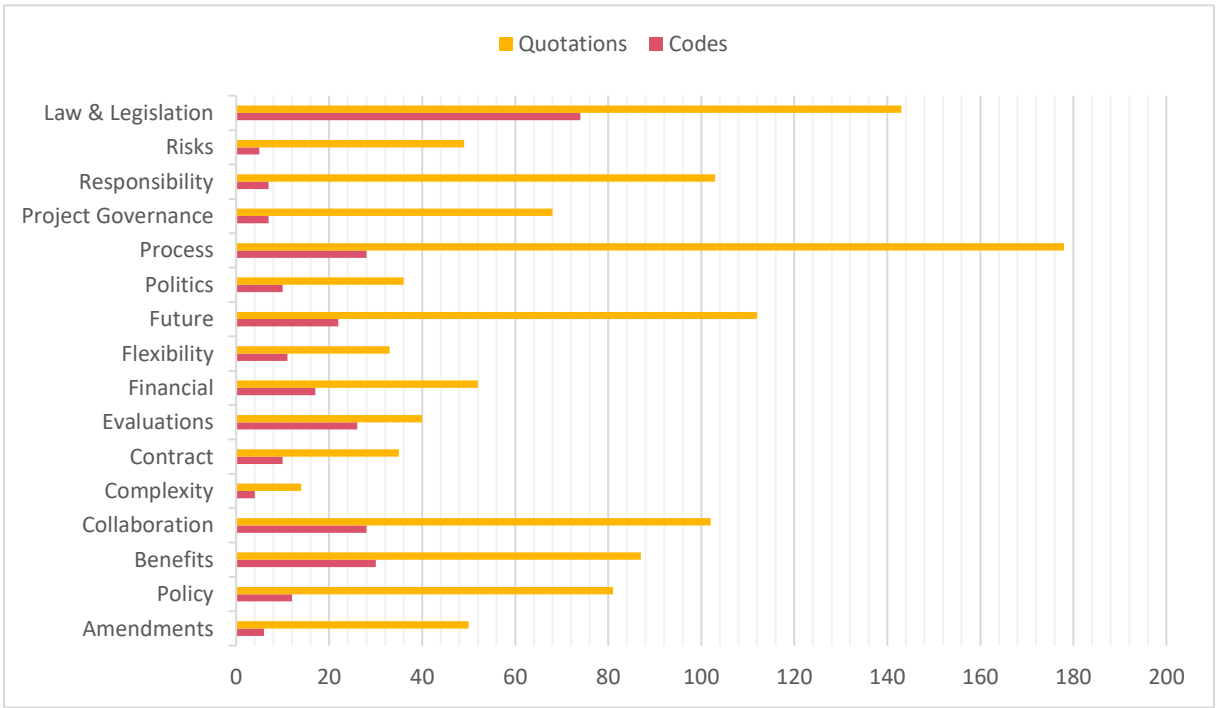

Figure 5 Sub-themes, quotations and codes resulting from the analysis.

In the last step, the sub-themes were further categorized into main themes. The theoretical themes mentioned identified in Section 3.4, which were (1) Awareness, (2) Responsibilities, and (3) Strategies to leverage benefits, were first used to cluster the sub-themes. However, not all sub-themes fitted in one of these themes. Therefore, they were renamed, and a fourth theme was added. The identification of these four themes was guided by the research objectives, and further refined by revisiting the original data as well as assessing several documents suggested by the participants. The four themes are shown in Figure 6, together with the related sub-themes from Figure 5. The figure shows that some sub-themes only relate to one theme, and others have links with multiple themes, which adds to the complexity. The themes will be explained in more detail in section 4.3. Each theme embodies a boundary condition in the existing process, hindering the optimal integration of benefit management within the Dutch infrastructure sector.

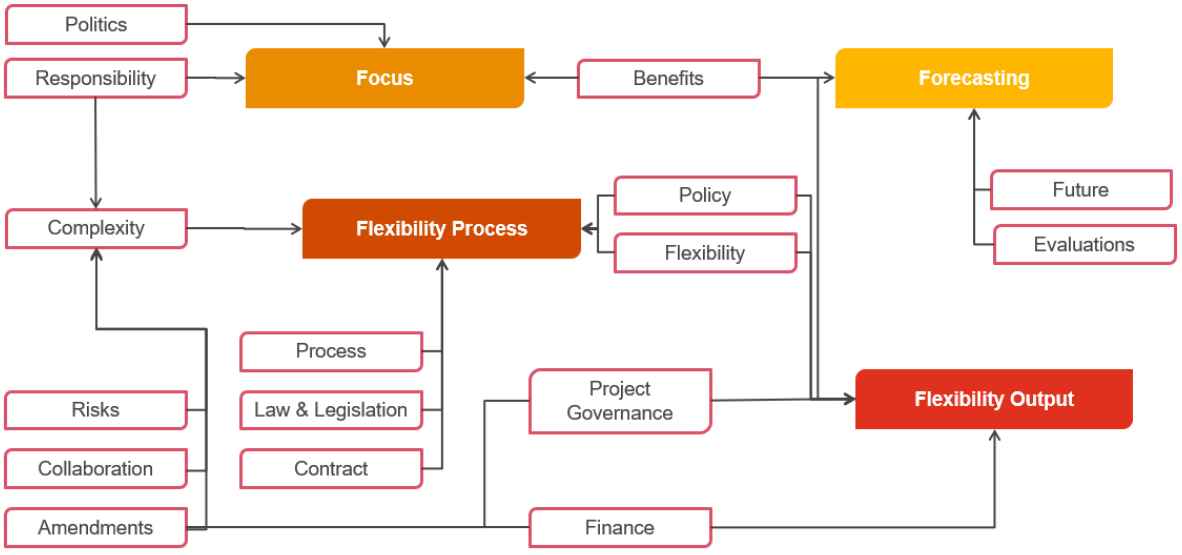

Figure 6 Identified themes and related sub-themes.

4.3 Barriers and related causes

The analysis has resulted into a deeper understanding of the context in which this research aims to implement benefit management. Each of the four identified themes represents a barrier which must be overcome in order to successfully implement benefit management. The following barriers have been identified:

Forecasting: Limited understanding of the impact of infrastructure on its surroundings, together with a limited understanding of our future needs and requirements.

Flexibility Process: As soon as the final ‘tracebesluit’ has been made, the process offers little room for amendments.

Flexibility Output: The output is not designed to be able to easily adjust to changes in societal needs and requirements.

Focus: When building infrastructure, the main requirement for the national government is accessibility. Other benefits are the responsibility of local governments or other stakeholders.

This section dives deeper into each barrier and will explain the underlying causes for each of them. This is done based on the analysis of the collected data, as well as the literature research and reports recommended by interviewees. Figure 1 gives a schematic overview of the four themes, and their underlying causes. The numbers indicate the (sub)sections in which each barrier and cause is explained in more detail.

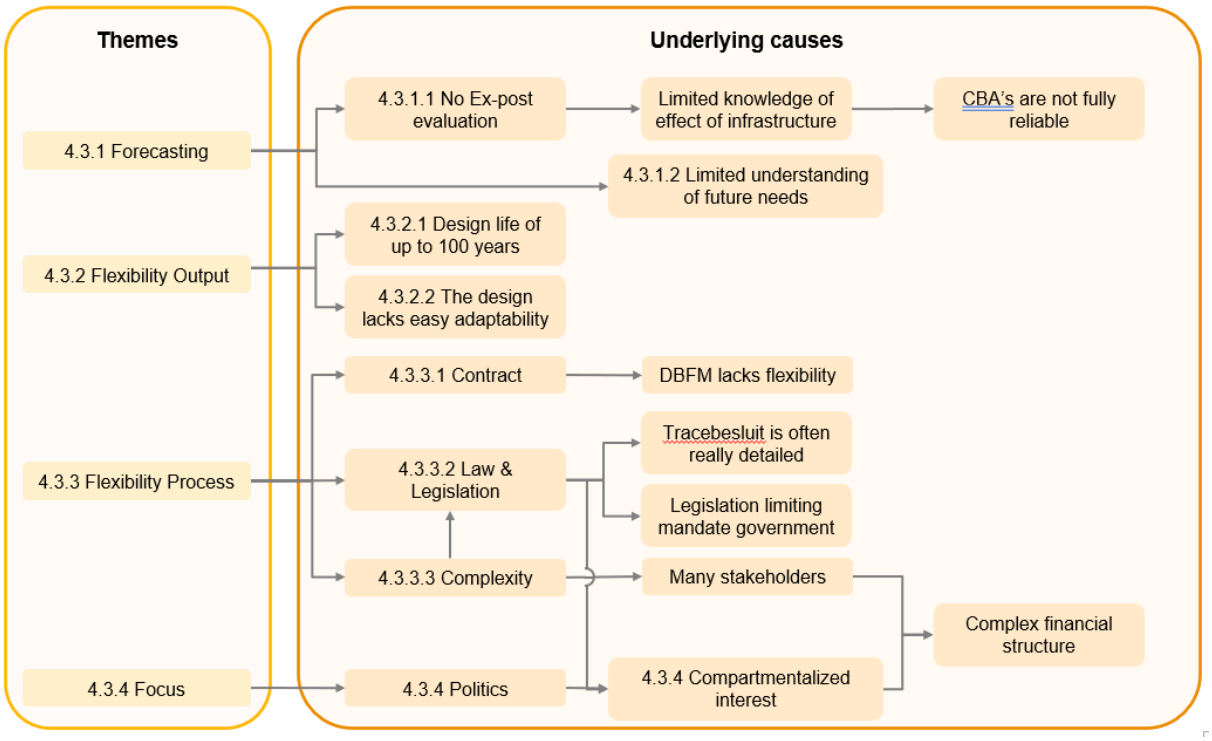

Figure 7 Themes, their underlying causes

4.3.1 Forecasting

The research made clear that, due to the inherent uncertainty of the society, future needs and requirements are often hard to predict. This problem is also recognised by academics. Linear processes based on predict-and-control, such as the MIRT-Process, are not fully able to deal with this uncertainty (Bourne et al., 2023).

Next to us not knowing what our future needs and requirements are, we also have a limited understanding of how infrastructure impacts the world around us. Section 3.1.3 already

showed that ex-post project evaluations are scarcely conducted. Similarly, the Advies Comissie Versnelling Besluitvorming Infrastructurele Projecten (2008) concluded in their report 'Sneller en Beter' the following: *"During construction and commissioning, the virtual reality of calculating and predicting ends and the actual traffic and environmental effects of a project become clear. It is striking that these are not measured structurally, let alone that possible recovery measures are considered in advance. Apparently, the calculated reality is considered more important than the 'real' reality years before commissioning.".* Additionally, Interviewee I admitted that the Ministry of Infrastructure and Water Management hardly ever performed ex-post evaluations.

> *"Ex-post evaluations are a requirement from the Tracéwet, but I can't say that we really deal with it actively. The question is also what you can achieve with it.."*
>
> *~ Interviewee I*

To summarize, this leads to two challenges: (1) the uncertainty surrounding future needs and (2) the ambiguous contributions of the current projects. The latter appears to be more tractable and could be addressed through systematic ex-post evaluations, for which the requisite legal frameworks are already established in the Tracéwet.

4.3.2 Limited flexibility in the output

As argued before, infrastructure projects are significant investments with long design-lifespans, typically up to 100 years (Ministry of Infrastructure and Water Management, 2020b, 2023). Benefit management aims to ensure that the intended advantages are achieved and sustained over the asset's life cycle. For benefit management to be effective, it is crucial for the output of infrastructure projects to be inherently adaptable. An adaptable output ensures that if the projected benefits are not realized, or the societal needs change, the infrastructure can be modified or repurposed to meet the evolving needs and circumstances. Currently however, there is a limited focus on a flexible and adaptable design of the output, which makes it harder to adjust the output to changing needs and requirements.

> *"You can try to go through that procedure more quickly, but then the problem remains. Then you have completed the project, but the change takes place afterwards. Because changes are continuous, and we have had to deal with them continuously in those 225 years that we (Rijkswaterstaat) have existed. And yes, that's why every now and then a road is tackled."*
>
> *~ Interviewee J*

4.3.3 Flexibility process

This section is about the limited flexibility in the different project phases. As can be seen in Figure 6 and Figure 7, this barrier is more complex compared to the others, due to the many underlaying causes. For projects to capitalize on emerging opportunities during the preparation and construction phase, a certain level of flexibility is essential. At present, however, the current rigidity in this process of major projects seems to limit the capacity to adapt to changing circumstances and requirements. The data pointed out three main causes resulting into this inflexibility, which are contractual limitations, the laws & legislation and lastly the complexity of projects. Previous research carried out by AT Osborne (2019) also showed the importance of flexibility in the MIRT process, and yielded similar results.

> *"I can make adjustments, but only to a limited extent. And this is especially the case with large projects; I find that a nice comparison. They really are like supertankers. Once they get going, they are really going. And then it's not like you turn the steering wheel and you turn them around quickly. So, you have to look far ahead continuously to check if it's still on the right course. Currently, what you see is that this course, this looking far ahead, is coming closer more and more quickly. That's actually a nice comparison. It changes very quickly as I look at it. And how do you then anticipate it?"*
>
> *~ Interviewee C*

Among the participants, a clear consensus emerges regarding the reduction in flexibility throughout the process. During the initial stages of MIRT, ample room for adjustment exists; however, post each gate, this flexibility diminishes significantly, as illustrated in Figure 8. This trend is attributable to the design of the MIRT process. The MIRT framework commences with a broad approach, maintaining as many options as possible, and gradually narrows down to a specific solution. This process, termed 'Funnelling,' aims to enhance adaptability (Ministry of Infrastructure and Water Management, 2022), represented by the orange line in Figure 8. Nonetheless, empirical data reveals a notable discrepancy between the theoretical flexibility and the flexibility actualized by practitioners, with the latter depicted by the grey line. The findings of this research resonate with the escalating emphasis on adaptability during the decision-making process, crucial for navigating the evolving context (de Roo, 2015; Rauws et al., 2019). In an advisory memo aimed at augmenting the coordination between national and regional environmental visions, Lenferink et al. (2018) propose several strategies to boost the adaptability of the process. For instance, they cite the 'Voorkeursbesluit,' enacted at the

conclusion of the research phase. Following this decision gate, an informal urgency to complete the project seemingly arises. Consequently, considerable pressure mounts to address the uncertainties of potential future alterations prematurely. They argue that this substantial decision gate thus engenders an unnecessary focus on minutiae, subsequently curbing adaptability during the planning and realization phases. Instead of substantial decision gates, they recommend employing smaller, partial decision gates, aiming to preserve as many possibilities as feasible for an extended duration.

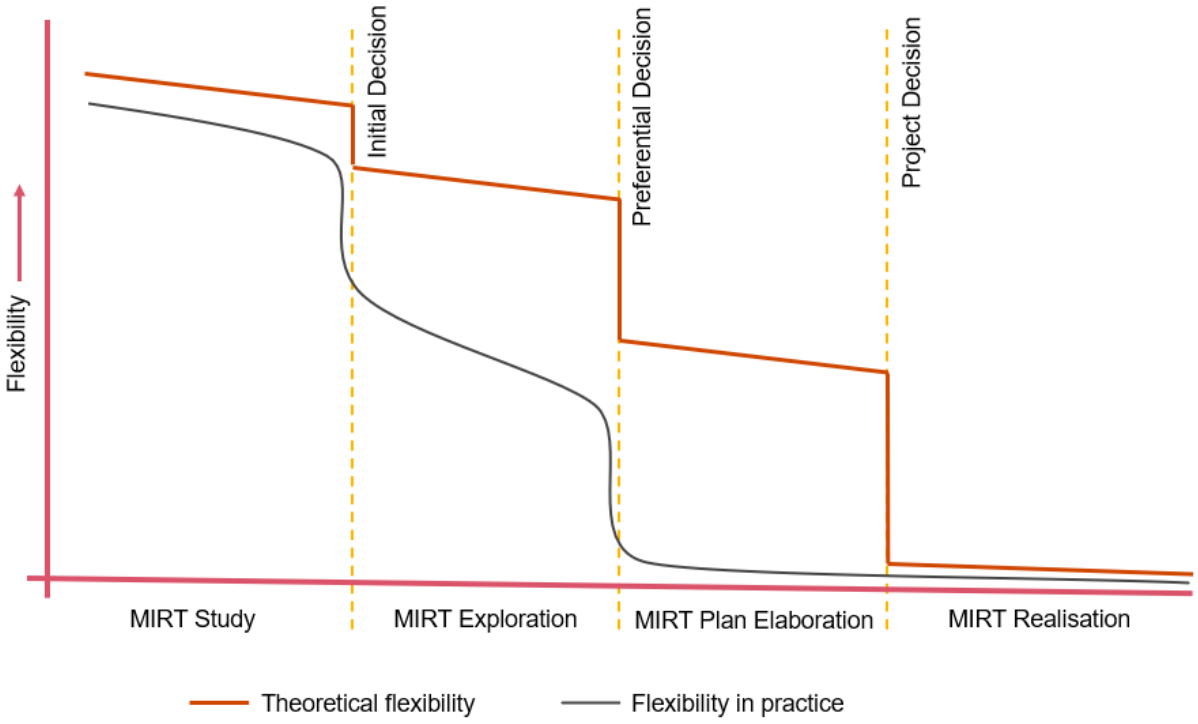

Figure 8 Graphical representation of decreasing flexibility in the MIRT-Process

Contractual limitations

For infrastructure projects exceeding a value of €60 million, the default contracting model is the Design, Build, Finance, Maintain (DBFM) agreement, as stipulated by the Ministry of Finance (2013). However, their often-rigid nature makes them undesired and is one of the causes they are no longer used for new projects. This inflexibility arises from predetermined scopes and specifications, as well as financial clauses that impose steep costs for delays (AT Osborne, 2019). Consequently, practitioners are generally reluctant to introduce scope

changes, as these are likely to cause delays due to intricate permitting processes.

> *"Look, with a DBFM-contract it is anything but convenient to implement changes. In a DBFM, implementing changes is about the same as swearing in church. It really costs you a fortune and a lot of time; millions fly around you."*
>
> *~ Interviewee A*

A newly emerging contract in the Dutch construction industry is the 2-phase contracts. This contract type provides greater adaptability, primarily because many (design) decisions are deferred until later stages of the project. This approach allows for late-stage modifications to be more easily incorporated into the project design. Evidence supporting the benefits of this flexibility can be observed in the A2 Maastricht project. In this case, initial construction focused solely on the tunnel structure for the highway, leaving decisions about the tunnel's surface development for a later stage. This deferred decision-making approach resulted in a final design that was more in line with Maastricht's contemporary needs.

> *"Well, it was actually a two-phase project there. We were wondering, what should replace the old A2? What should go on top of that tunnel? We didn't design that at all. So, we didn't design that in advance. We decided we wanted a 'green carpet', so that's what we call it for now. But what that 'green carpet' entails, we will see by the time that tunnel is ready. By then, we'll be about ten years further along, something like that. And let's look then and consult with the residents to see what should happen."*
>
> *~ Interviewee D*

Tracéwet

In the Netherlands, the Tracéwet serves as a fundamental legislative framework governing the planning, development, and implementation of large-scale infrastructure projects, particularly those managed by Rijkswaterstaat, the Dutch Ministry of Infrastructure and Water Management. The law stipulates the various phases and requirements of infrastructure planning and is typically results in a 'Tracébesluit', which legally and financially authorizes the project's realization. The following section will give a brief description of how the law works. After this, it will be explained why this is hindering flexibility.

In the first phase, the Planning Phase (Dutch: Planuitwerkingsfase), project teams work on preparing the decisions needed for the project's actualization. The planning process is subject to various procedural and legal regimes, such as environmental assessments and stakeholder consultations. Next, the Tracébesluit is made. This is the formal decision that marks the transition from the planning to the realization phase. The Tracébesluit includes specifications like the project's geographical layout, structural designs, and any conditions tied to environmental concerns. Once issued, the Tracébesluit is published for public consultation and can be subject to judicial review. After a positive Tracébesluit, the project enters the execution phase. Here, the plans laid out in the Tracébesluit are executed, and changes to these plans necessitate formal amendments (Ministry of Infrastructure and Water Management, 2021).

The Tracébesluit typically outlines the project with a high level of detail, offering little to no room for modifications post-approval. This is intended to provide legal certainty but limits adaptability. Unlike other types of spatial planning decisions (e.g. bestemmings- and inpassingplan) the Tracébesluit lacks provisions for adjustments or deviations, making the amendment process difficult and costly (AT Osborne, 2019). This is because changes to the Tracébesluit usually entail a reconsideration of associated permits, adding another layer of complexity and reducing the willingness to implement changes. Additionally, the Tracébesluit often serves as a de facto detailed design document, despite the fact that the actual design expertise and responsibility resides with implementing agencies and contractors. This adds another dimension to the inflexibility as any changes at the implementation stage would require a formal amendment to the Tracébesluit.

It now has become clear how the Tracéwet works, and how a detailed Tracebesluit hinders flexibility because of the lack of provisions to allow deviations. However, it is still unclear why a Tracébesluit is typically so detailed. Contrary to what may seem obvious, this is not because of the Tracéwet itself. An explanation for this high level of detail can be found the culture and guidelines of Rijkswaterstaat. Typically, there is a significant political pressure to complete projects on time and within budget. In order to achieve this, the culture within Rijkswaterstaat aims to avoid amendments and unforeseen events. In an attempt to prevent surprises, designs are made with a high level of detail. This can than results in a Tracébesluit with a higher level of detail than strictly needed (AT Osborne, 2019). This attempt to get certainty by locking-in is also pointed out by Herder et al. (2011). They point out that the complex legal process involved with the Environmental Impact Assessment (MER) also stimulates to lock in early with a high level of detail.

Complexity

The analogy of large infrastructure projects to oil tankers has been made by several interviewee's and accentuates the intrinsic challenge of altering course once set in motion. Much like how a tanker requires substantial time and effort to change direction due to its size and momentum, large infrastructure projects, limited by their complexity, find it exceedingly difficult to adapt to changes swiftly. The data shows that this complexity is mainly related to a broad spectrum of stakeholders and related finance structure. In the realm of Dutch infrastructure, this complexity poses substantial hurdles towards flexibility, especially in integrating amendments during the ongoing phases of a project. This section explores the how stakeholders and financing structures contribute to this complexity.

The cornerstone of complexity in large infrastructure projects is the extensive stakeholder collaboration. In the Dutch infrastructure sector, projects such as the expansion of the A16 motorway necessitate robust interaction among governmental bodies, contractors, local communities, environmental groups, and others. The data indicates that the matrix of varied interests, coupled with the bureaucratic tape often associated with public infrastructure projects, presents a significant hurdle to incorporate amendments. The effort required to achieve consensus among the diverse stakeholder groups not only prolongs decision-making but also ingrains a level of rigidity that hampers adaptive changes.

The financial architecture of large infrastructure projects further compounds the complexity. Typically, projects within the Dutch infrastructure sector are funded through by several governmental bodies. Each funding stream carries its own set of needs and requirements. The data underscores that this multifaceted financial arrangement severely restricts flexibility as any proposed amendments may trigger a domino effect of renegotiating financial agreements and reallocating resources, thereby elevating the financial and operational challenges.

The primary financial mechanism for Dutch infrastructure is the Mobiliteitsfonds. Historically, infrastructure financing in the Netherlands was channelled through the Infrastructuurfonds, established in 1994. This fund aimed to consolidate various infrastructure expenditures, fostering coherence, and promoting a more streamlined financial structure. However, evolving challenges - ranging from increasing complexities to climate change, energy transitions, and heightened mobility demands - necessitated the introduction of the Mobiliteitsfonds (Ministry of Infrastructure and Water Management, 2020a). The Infrastructuurfonds, due to its restrictive legal framework, lacked the adaptability required to address these emerging contexts (Rijksoverheid, 2016). A key difference between the Mobiliteitsfonds and its predecessor is the former's provision for expenditures aimed at increasing efficiency, including research and pilot

projects. While the Mobiliteitsfonds offers greater adaptability than the Infrastructuurfonds, its primary emphasis remains centered on mobility.

In national infrastructure projects overseen by Rijkswaterstaat, a complex, staggered decision-making process is employed. This process commences with a proposal from Rijkswaterstaat to the 'Directoraat-generaal Mobiliteit' within the Ministry of Infrastructure and Water Management, accompanied by an 'opdrachtbrief' to the Directeur-Generaal from Rijkswaterstaat. Subsequently, the Directeur-Generaal delegates the assignment to regional departments. These regional departments collaborate with the Programs, Projects and Maintenance (PPO) and/or Major Projects and Maintenance (GPO) departments to further develop and execute the project or program. This chain of command is illustrated in Figure 9. The intricacy of this structure impedes prompt responses to changes, consequently constraining the flexibility of the process.

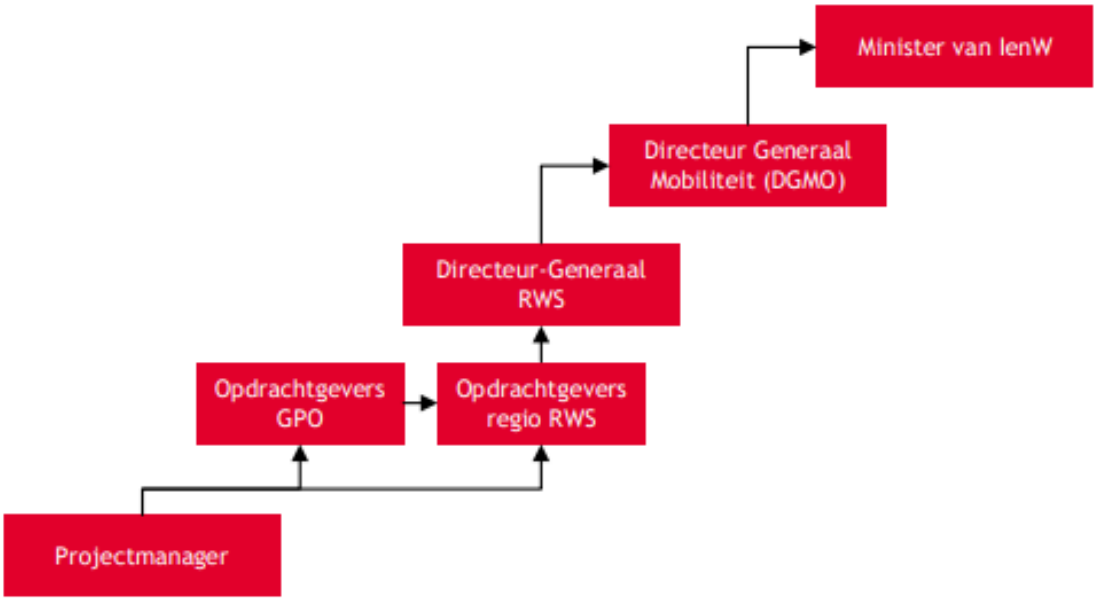

Figure 9 Graphical representation of the line of command within Rijkswaterstaat and the Ministry of Infrastructure and Water Management (AT Osborne, 2019)

Uncertainty

Upon examining the underlying causes that currently constrain flexibility in the process, it becomes evident that the central issue pertains to managing uncertainty. In the realm of Benefit Management, a certain degree of flexibility is required to accommodate adjustments in a project, particularly when it surfaces that the initially defined benefits may not be fully realized or when new and additional benefits emerge. This underscores the inherent uncertainty associated with benefit management in construction projects. The data delineates two distinct approaches within Rijkswaterstaat regarding the handling of uncertainty in major projects. The first approach, as exemplified by a quote from Interviewee D (provided below), seeks to control

and avoid uncertainty. Conversely, the second approach, illustrated by a quote from Interviewee A (also provided below), acknowledges uncertainty as an intrinsic aspect and strategizes accordingly. While both perspectives are represented among the interviewees, the inclination toward controlling uncertainty appears to be more prevalent.

This phenomenon is not solely observed in practice but is also mirrored in academic discourse. Cruz & Marques (2013) elaborate on the potential to leverage uncertainty as an opportunity when adaptive mechanisms are integrated into the contract. They advocate for the employment of real options, demonstrating how this strategy can augment the value of a project. The feasibility of utilizing real options in, among other facets, special planning is further explored by Herder et al. (2011). Their analysis illuminates the promise of real options while also acknowledging the primary hindrance of 'lock-in'. Predominantly due to legal proceedings, projects frequently become entrenched in a detailed design early on, thereby curbing flexibility in subsequent stages—a constraint corroborated by this research. Koppenjan et al. (2011) delineate the juxtaposition between the desire for flexibility to adapt to changes and the imperative to predict and manage uncertainty. They surmise that neither extreme is ideal, underscoring the necessity to strike a harmonious balance between these two approaches. This is also described in greater detail in subsection 3.3.1.

“It is a control of the overrun and the misery that exists. Instead of the revenues being forecasted in advance..”

~ Interviewee D

“We knew that we were entering a period with many changes; Socially, in terms of content, politically, administratively, in various ways. We knew that. We could already reason about what was going to happen concerning data and ICT. What was going to happen around mobility. If you then simply looked at what that meant during the time we were implementing, well, the changes were overwhelming, and that's the reality. So in my role, I told the steering group, I want to discuss future-proofing because I expect a lot of changes. And the answer was then: '[name], you've been working at Rijkswaterstaat for so long, haven't you understood it yet? Scope is scope, and with DBFM, scope is just scope.' And then I said: 'Well, then I'll just leave the project. Because I know those changes are coming, and I'll constantly be fighting with you. I think that dispute is unnecessary the way we're setting it up now. But we need to discuss future-proofing now..”

~ Interviewee A

4.3.4 Underemphasis on social-cultural benefits

Rijkswaterstaat and the Ministry of Infrastructure and Water Management play critical roles in shaping the infrastructure landscape of the Netherlands. One notable characteristic of their approach has been an intense focus on improving accessibility. While ensuring accessibility is fundamentally important, it often becomes the overriding criterion, overshadowing other equally crucial considerations. This is amplified by the influence of funding mechanisms like the Mobiliteitsfonds, which shares similar priorities.

The updated MIRT-Rules of the Game do provide the possibility to explore and realise social and sustainability benefits. However, the extend to which they can be realised is still bound by the scope of the funding mechanism. As described before, this used to be the Infrastructurefonds, and now is the Mobiliteitsfonds. Although this new fund does provide a more integral way to facilitate benefits in infrastructure projects, it’s still does not offer the formal room for social-cultural benefits.

"We adhere to the statutory requirements. At the same time, we are exploring opportunities, as I find such a project in Maastricht to be fantastic. However, I also discern that we are unlikely to replicate this success in many places due to the substantial financial expenditure from the mobility fund. The benefits derived are not encapsulated in mobility, but rather in livability and spatial quality, which causes a certain tension. Consequently, the Minister might need to revert to the cabinet and articulate a willingness to pursue similar projects. The Minister of Internal Affairs or the Minister of Health should provide the required funds for realizing those benefits, as no allocation for such expenditures was made initially."

~ Interviewee I

4.4 Conclusion

The focus of this chapter is to understand the present status of benefit management within Rijkswaterstaat, specifically within the Large Projects and Maintenance department (Dutch: Grote Projecten & Onderhoud, GPO). To gather insights, interviews were conducted with employees from both Rijkswaterstaat and the Ministry of Infrastructure and Water Management. A thematic analysis technique was employed to offer a more structured interpretation of the data.

Initially, the study's objective centred on integrating Benefit Management during the realization phase of significant infrastructure initiatives. However, insights from the collected data suggested the necessity for a more encompassing strategy. Specifically, it became evident that benefit management requires a holistic inclusion throughout the project's life cycle and cannot be restricted to a singular phase.

Before initiating a project, it's imperative to delineate its benefits meticulously. This allows for the transformation of these benefits into measurable Key Performance Indicators (KPIs), which can be tracked during and post the realization phase. Such continuous assessment provides a more profound understanding of infrastructural impacts, refining the accuracy of Cost-Benefit Analyses (CBA) for future projects. In scenarios where it becomes evident that pre-defined benefits might not be realized, it is vital that the project owner possesses the means to adjust the project's trajectory to ensure that these benefits are achieved. Consequently, the process must possess inherent flexibility. In parallel, evolving contexts might present opportunities to realize additional benefits or expose unforeseen dis-benefits. If such shifts manifest during the realization phase, the process again requires flexibility. This research shows that an effort has

been made to increase the flexibility of the MIRT-process, however, this utilization of this flexibility seems to be very limited. It's crucial to acknowledge that such contextual shifts might also emerge post the realization phase. For optimal utilization of benefit management, the project owner should retain the ability to tweak the project direction, ensuring maximized potential benefits and minimizing dis-benefits. This underscores the importance of maintaining flexibility in the deliverables.

Based on these insights, the research remit was expanded to encompass the entirety of the project life cycle. Within this broader scope, the study identified four key barriers hindering the optimal implementation of benefit management: Limited forecasting capability, Limited flexibility in the output, limited flexibility in the process and an underemphasis on social-cultural benefits. Addressing these barriers is paramount for the successful incorporation of benefit management. Chapter 5 aims to provide solutions to overcome them.

5. Solutions

The analysis revealed several factors that impede the successful implementation of benefit management. In Chapter 0, an initial examination based on the literature was conducted to discern the requirements for successfully implementing benefit management during the realization phase of projects. However, as elucidated in Chapter 4, the obstacles precluding the implementation of benefit management were found to be more extensive than anticipated in the preceding chapter. Hence, this research extends its scope beyond the realization phase to address solutions for overcoming the identified barriers comprehensively.

With the four principal barriers and their underlying causes now identified, the ensuing step is to propose solutions to surmount these hurdles. Figure 10, an evolved version of Figure 7, delineates the interrelationship among the barriers, underlying causes, and proposed solutions. These solutions have been either proffered by interviewees or extracted from a diverse array of academic and non-academic resources.

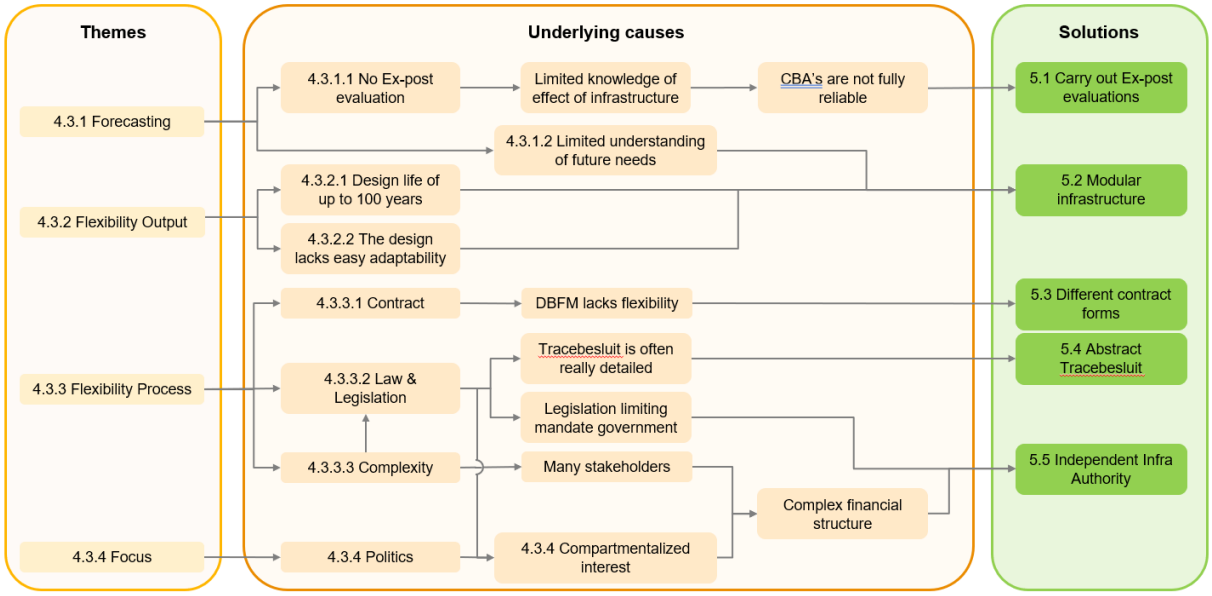

Figure 10 Themes, underlying causes and solutions to enable benefit management.

The aim of the solutions is to create the right boundary conditions to enable benefit management. If uncertainty is seen as a given, instead of a threat, it can be harnessed as an opportunity. As concluded in the previous chapters, a certain degree of flexibility is needed to do so. The proposed solutions all have their own origin, which can be found in Table 4. The table shows that they either result form the interviews, or from the literature research. In both cases, additional literature has been used to improve the argument for the solutions, which can be found in the corresponding subsections.

Table 4 Origin of the different solutions

Solution	Source
Ex-post evaluations	Interviewee C, D & I
Modular Infrastructure	Interviewee H,
Different contract forms	Interviewee A, B, C, D
Abstract Tracébesluit	Literature (de Roo, 2015; Lenferink et al., 2018; Rauws et al., 2019)
Independent Infra Authority	Interviewee A

5.1 Ex-post evaluations

Ex-post evaluations, conducted after the completion of infrastructure projects, are crucial for assessing actual impacts, benefits, and deviations from stated objectives and expectations. Data from interviews reveal that despite the legal mandate for ex-post evaluations in the Netherlands, there's a noticeable lapse in compliance. Currently, the MIRT process mandates an ex-post evaluation to officially conclude a project, although this typically occurs shortly after construction completion. Given that benefits often materialize over a longer term, as outlined in Section 3.1, such evaluations are likely to overlook these benefits. This oversight not only impedes the iterative process of learning and improvement but also limits the potential benefits for managing and refining future infrastructure initiatives.

The scarcity of ex-post evaluations in infrastructure projects is acknowledged in academic circles as well. Sukasuka et al. (2022) discuss a global, systematic shortfall of ex-post evaluations in Public Private Partnerships, particularly concerning the social benefits they offer. Jong et al. (2019) contend that unlike ex-ante assessments, ex-post evaluations are conducted infrequently yet hold the potential to enhance understanding of which projects yield specific benefits and why. They also posit that ex-post evaluations incentivize decision-makers to uphold good governance and assume accountability for their decisions. They have devised a conceptual framework to assess the impact of ten infrastructure projects supported by the European Regional Development Fund and the Cohesion Fund, employing a mix of Cost-Benefit Analysis and qualitative analysis to evaluate 18 effects across four categories, all of which are detailed in Table 5.

This research advocates the adoption of the framework proposed by Jong et al. (2019) for systematically evaluating Dutch infrastructure projects. The framework acknowledges the pivotal role of infrastructure in contemporary society and accordingly considers a broad spectrum of benefits. It evaluates projects based on five performance indicators (Relevance, Coherence, Effectiveness, Efficiency, and Added Value) and six determinants (Relation with

the Context, Selection Process, Project Design, Forecasting Capacity, Project Governance, and Managerial Capacity). This comprehensive approach aims to facilitate a holistic assessment of projects, thereby enhancing the learning capacity of, in this case, Rijkswaterstaat and the Ministry of Infrastructure and Water Management. This framework has been previously employed to assess 144 road projects (Halámek et al., 2021) and the Athens metro extension project (Benardos et al., 2021).

Table 5 Effects of a project assessed in the ex-post evaluation (Jong et al., 2019)

Category	Effect	CBA	Qualitative analysis
Economic growth	Travel time	✓	
	Vehicle operating cost	✓	
	Reliability of journey time	✓	✓
	Income for the service provider	✓	
	Wider economic impacts		✓
	Institutional learning		✓
Quality of life	Safety	✓	
	Crowding	✓	
	Service quality (other than crowding)	✓	✓
	Security		✓
	Noise	✓	
	Aesthetic value	✓	✓
	Urban renewal	✓	✓
Environmental sustainability	Local air pollution	✓	
	Climate change (GHG)	✓	
	Biodiversity		✓
Distributional effects	Allocation over social groups		✓
	Allocation over territorial areas		✓

At the core of this framework is the use of Cost-Benefit Analysis (CBA), which serves as a critical tool in assessing the long-term contributions of infrastructure projects. Unique to this approach is the hybrid typology of CBA, which amalgamates features of both ex-ante and ex-post evaluations. This is particularly useful for projects that have been operational for a minimum of five years, allowing for a more ambitious scope of effect accounting and mitigating the risk of optimism bias by relying on observed data.

Complementing the quantitative aspect of CBA is a qualitative analysis. This includes a thorough documentary analysis, desk research, and an extensive series of stakeholder interviews, supplemented by field missions. Such an approach enables a critical focus on project identification, a deep dive into the socio-economic context, a reconstruction of the decision-making process, and an assessment of potential alternative options. The qualitative analysis further extends to gathering evidence on non-quantifiable effects and factors influencing the project's performance. These qualitative aspects are then aggregated into a measurable framework, using a scoring system that ranges from -5 for highly negative effects to +5 for highly positive ones.

Furthermore, the framework categorizes effects into various types, ranging from those easily quantifiable in monetary terms to those that are difficult to measure or are highly uncertain. This classification enhances the understanding of a project's multifaceted impacts, providing a more nuanced view of its overall performance.

5.2 Modular infrastructure

A modular approach appears to furnish the necessary tools to address several identified issues. This chapter delves into the potential advantages modular infrastructure presents, and how it can facilitate the implementation of benefit management within the infrastructure sector.

At its essence, modularity entails the design of complex systems as a composition of smaller subsystems or modules, which can be developed independently yet integrated to function cohesively. This leads to the inquiry: how can modularity principles be applied to infrastructure to enhance the flexibility of project outputs? An illustrative example can be drawn from the building sector. With the burgeoning growth of urban centres, the demand for swift and efficient housing solutions escalates. Modular housing, constructed using prefabricated units or 'pods,' presents an efficacious alternative to conventional construction methodologies. Analogous to shipping containers, these pods can be standardized, stacked, and arrayed in diverse configurations (Phillips et al., 2016; Thomas, 2023). A further advancement is observed in the emerging trend of modular house factories producing standardized, ready-made houses.

The objective of this research is to foster efficient benefit management. The preceding chapter deduced that a certain degree of flexibility in output is requisite to achieve this end. Such flexibility should empower the project owner to navigate the inherent uncertainty delineated in sub-section 4.3.1, potentially through a modular approach with interchangeable modules. This modality allows for the adjustment of infrastructure's purpose, capacity, and characteristics with relative ease. Interchangeability of modules necessitates a level of standardization. While standardization catalyzes flexibility, it's pertinent to note that excessive standardization may

constrain flexibility (Hanseth et al., 1996), underscoring the importance of a balanced approach.

This research joins a lineage of studies advocating for modular infrastructure. Prior research has elucidated the potential inherent in modular infrastructure. For instance, a 2013 paper titled 'Small Modular Infrastructure' extolled the virtues of modular infrastructure. The author posited that traditional capital cost reductions are realized through project size escalation; however, the benefits derived from repetitive learning, achievable through numerical scaling, can yield similar effects (Dahlgren, 2013). In a parallel vein, Flyvbjerg and Gardner (2023) argue that the learning effects from repetitive actions mitigate risks and failure costs. In their book 'How Big Things Get Done', predicated on an extensive academic research base, they demonstrate that projects composed of smaller modules incur fewer cost overruns compared to monolithic projects. This suggests that employing smaller modules can engender an equally efficient construction process, albeit with reduced risks. Beyond the construction phase, modular infrastructure also augments road maintainability. Vaitkus et al. (2019) examine various types of concrete modular pavements, concluding that modular solutions can expedite construction and maintenance of roads by leveraging interchangeable modules to shorten repair durations.

> *"Get a small thing, a basic building block. Combine it with another and another until you have what you need. That's how a single solar cell becomes a solar panel, which becomes a solar array, which becomes a massive megawatt-churning solar farm. Modularity delivers faster, cheaper, and better, making it valuable for all project types and sizes. But for building at a truly huge scale – the scale that transforms cities, countries, even the world – modularity is not just valuable, its indispensable."*
>
> *~ Bent Flyvbjerg, 'How Big Things Get Done'*

The modular approach is poised to significantly bolster the transition towards a circular economy, a movement currently gaining momentum within the Dutch infrastructure sector (Rijksoverheid, 2019). Rijkswaterstaat aspires to achieve full circularity by 2030, thereby envisaging the reuse of existing civil structural components like bridges and viaducts (Rijkswaterstaat, 2023). Nonetheless, the unique attributes of these components, coupled with their lack of design for reuse, render this endeavor challenging. Transitioning to modular and standardized components could markedly enhance the prospects in this domain. Moreover, the modular approach synergizes with an iterative life cycle methodology. As elucidated in

section 3.3.1, this methodology affords greater flexibility when juxtaposed with a traditional linear approach.

5.3 Contract type

In the current landscape, the inflexible financial construct and long-term nature of DBFM contracts frequently present obstacles when adopting to unforeseen changes, which became clear in section 4.3.3. This underscores the necessity for more flexible contracts characterized by greater agility, capable of adapting to the shifting requirements of projects and stakeholders over the project lifespan.

The DBFM model, while offering financial and operational clarity, may inhibit project adaptability due to its fixed pricing and long-term maintenance obligations. Within literature, there is also a realisation that there is a certain degree of flexibility needed in contracts. Demirel et al. (2017) explore the flexibility of the DBFM contract. Their research underlines the importance of timely recognition of possible changes, together with having coping mechanisms to cope with these changes. These coping mechanisms are further explored in a follow-up research (Demirel et al., 2019), which shows that the standardized Dutch DBFM contract acknowledges uncertainty and includes various coping mechanisms. In line with this research, Koppenjan et al. (2020) conclude there is indeed some flexibility in DBFM contracts. However, they argue that this is limited in practice due to the long lifespan of projects, the financial component and it mainly takes ‘known unknowns’ into consideration. Besides, they conclude that: "The contract is not flexible, but the way it is handled still achieves the required flexibility".

One potential alternative could be the adoption of a traditional contract, wherein the project owner exercises comprehensive control, simplifying the incorporation of amendments. A significant concern here is the specialized knowledge imperative for Rijkswaterstaat, a proficiency which they presently lack. One expert emphasized the government's incapacity to shoulder the entirety of risks intrinsic to this contractual form.

Recently, there's an evident shift towards the two-phase contract model. This arrangement, which postpones decision-making, promises enhanced flexibility. It allows amendments to be integrated effortlessly up until the culmination of the final design (phase 1). Nevertheless, given its novelty in the Dutch context, it needs more time to prove it’s added value when it comes to flexibility.

5.4 High-level decision making

Having flexibility in project decisions is imperative as it enhances the adaptability to unforeseen changes or new information which can significantly alter the predefined course of a project. A rigid decision framework can create legal and procedural bottlenecks. Section 4.3.3 described

how the current rigidity in the Tracébesluit, often results in lengthy amendment procedures and public consultations for even minor changes. This bureaucratic entanglement can be significantly alleviated through a more flexible project decision, thereby speeding up the project lifecycle.

It has also become clear that the Tracewet itself does not require the level op detail seen in many projects. It seems like this is a result of the wish of Rijkswaterstaat to predict and control uncertainty. This is, amongst other things, caused by political pressure. Koppenjan et al. (2011) argue that an attempt to fully control uncertainty in advance endangers project objectives. Instead, they argue a balances approach between '*predict-control'* and '*prepare-and-commit'*. The former approach to project management emphasizes detailed front-end planning, fixed scopes, and hierarchical coordination, with deviations seen as undesirable. In contrast, the latter approach treats change as inevitable due to uncertainties and encourages broad task definitions, functional goals, cooperative collaboration, and a more horizontal, open communication structure among all stakeholders.

As of Januari 2024, the Tracéwet will be replaced by a the new Environmental and Planning Act (Dutch: Omgevingswet). This means that the Tracébesluit will be replaced by a 'Project decision' (Dutch: Projectbesluit). The new law seems to create a more coherent, shorter and less complicated process. Although this simplification does seem to be an improvement, it is unclear whether the new law offers more room for a more flexible approach.

5.5 Independent Infra Authority

The management and development of infrastructure in the Netherlands face multiple challenges, from the rapid pace of technological change to the imperative of sustainability. Creating an Independent Infrastructure Authority (IIA) could offer a new approach to infrastructure planning, development, and management. This entity could act as a central coordinating and overseeing body, dedicated to the long-term improvement and sustainability of the Netherlands' infrastructure systems.

Section 4.3.3 describes how the chain of command adds to the complexity. Next to the relationship between Rijkswaterstaat and the Ministry of Infrastructure & Water Management, there are many more stakeholders involved in the process, which further complicates decision making. Examples of these stakeholders of the national government such as the Ministry of Economic Affairs and the Ministry of Internal Affairs, but also local governments such as provinces or municipalities. Herder et al. (2011) writes: *"This multi-agent setting complicates the implementation of flexibility. Decision-making involves a lot more than just a board meeting; it is often a long process which could also include political trade-offs and stakeholder consultations."*. Implementing an independent authority can resolve this by centralizing the

responsibility and mandate. This way, by reducing the number of stakeholders involved in the decision-making process the complexity is reduced, which allows for more flexibility.

The previous sub-section covered the complexity of having many stakeholders involved. Next to the complex decision-making, there is also a financial aspect. Each of the previously mentioned stakeholders (this is a non-exhaustive list) also contributes financially to different aspects of the project. Since the Ministry of Infrastructure and Water Management only has the mobility fund to its disposal, its legally bound by contributing to the accessibility feature of infrastructure. However, current infrastructure has a more integral role in our society, as can interacts with e.g., safety, economic development and environmental management. This means, that other stakeholders must step in to fulfil this role, resulting in a situation where a infrastructure project can have multiple project owners. This compartmentalized structure adds further to the overall complexity of the decision-making as they will have to agree about the benefits and the financial backing, further limiting flexibility. Also here, a central authority with one fund covering for all the different benefits strongly reduces the complexity.

An independent authority could also ensure that infrastructure planning aligns with long-term national goals, such as sustainable development, climate resilience, and economic competitiveness. It would overcome a changing political coming with the different governments. This way, a centralized authority can offer policy coherence, streamlining various projects to ensure they meet set standards and long-term strategic objectives.

5.6 Conclusion

The analysis in the previous sections reveals that numerous factors hinder the successful implementation of benefit management. These factors are delineated in Section 4.2 and subjected to detailed examination in Section 4.3. The primary objective of this chapter was to establish optimal boundary conditions to facilitate benefit management. Through this analysis, it has become evident that effectively managing uncertainties is vital to optimizing the benefits derived from a project. As articulated in preceding chapters, there's an inherent need for flexibility to this end. The provided solutions aim at taking away some of the uncertainty (by conducting ex-post evaluations) but mostly provide tools to cope with the inherent uncertainties in large projects. This is done based on a ‘prepare and commit’ approach rather than the more traditional ‘predict and control’ strategy.

Conducting ex-post evaluations will help to better understand how infrastructure project impact their environment. This can give valuable insights for the decision-making process of future projects. It’s advised to keep monitoring the effects over a longer time span, because of the long-term nature of benefits.

Modular infrastructure facilitates projects to adjust to a changing context, and therefore to realise new benefits and reduce disbenefits. It enables a circular project life cycle approach which is typically more flexible compared to the traditional waterfall model, which is often seen in infrastructure projects. Next to the opportunities it provides for benefit management, is also has several other benefits such as an increase in efficiency, decrease of risks, and it allows for a more sustainable circular economy by reusing modules.

Next to a more flexible output, achieved by modular infrastructure, there is also more flexibility needed in the process. Current limitations arise from existing laws, contractual frameworks, and intricate complexities. Although recent legislative and contractual updates offer some advancements, they seemingly fall short in accommodating requisite flexibility. Therefore, further investigative studies are warranted to understand the effects of these recent developments.

To reduce the complexity of infrastructure, the proposal advocates for the establishment of an Independent Infra Authority, concentrating decision-making processes. This centralized body would supersede the current consortium of project owners - each constrained by individual budgets, requirements, and interests - assuming responsibility for the comprehensive role of modern-day infrastructure without being susceptible to the changeability of the political landscape. This approach, coupled with an integrated budget, has the potential to markedly reduce intricacies in decision-making and stakeholder negotiations.

To summarise, it’s important to acknowledge that benefit management does not start at the realisation phase, nor does it end after completion of a project. It requires an integrated place in the governance structure of infrastructure throughout the entire project lifecycle: from initiation to decommission. Project owners must build a governance structure which allows for changes during the process, always focused on optimizing benefits and reducing dis benefits.

6. Evaluation

This chapter will cover the evaluation of the results of the research. This will be done by means of interviewing experts. The main goal of the expert consultation is to evaluate the results of this research. Expert consultation was carried out as individual consultation due to limited availability, time constraints, and to avoid social influence. During the interviews, the aim and the findings of the interviews will be presented. This means that the four barriers will be explained, along with the corresponding possible solutions.

6.1 Evaluation Set-up

After the collecting the initial results by means of interviewing experts from Rijkswaterstaat and the Ministry of Infrastructure and Water Management, an evaluation step has been conducted. The aim of this step is to evaluate the results from the previous sections. Three experts from PwC have been questioned in individual sessions. These sessions started with a short presentation in which the aim, method and results were presented. Each of the main themes as described in sub-section 4.3 was explained, after which the proposed solutions in Section 5 where presented. The experts gave their feedback on the various topics.

The experts have various positions and backgrounds within PwC, but a common factor is their extensive experience working on complex project, knowledge about project management and their ability implement well-functioning project governance structures. More details of the experts can be found in **Fout! Verwijzingsbron niet gevonden.**.

6.2 Evaluation results

6.2.1 Ex-post evaluations

Expert A: Recognizes the problem of ex-post evaluations. Indicates that a lot of energy is put into obtaining a project beforehand, and the associated Cost-Benefit Analysis. Once it's delivered, they just let it do its thing. In his opinion, evaluations only take place if something has gone wrong. Acknowledges the importance of ex-post evaluations.

Expert B: Indicates that it's important to set the reference point to which the end-result of the project is compared as late as possible. So, carry out the measurement for this just before the start of a project. This way, the time between the ex-post evaluation and the reference situation is kept as short as possible, so the effect of the project is clearer.

Expert C: Indicates that it's also valuable to look at indirect contributions to benefits. In addition, it's important to consider disbenefits and the contribution to stopping negative trends.

6.2.2 Modular infrastructure

Expert A: Does not have the technical knowledge to judge whether its realistic, but does sees potential in the idea.

Expert B: Sees potential in this, but advises to consider the legal limitations. Can we do more than what is currently needed? This in relation to efficiency and oversizing without being certain if it will be needed in the future.

Expert C: Likes the idea and sees potential.

6.2.3 Contract types

Expert A: Mentions that with DBFM-contracts, all risks lie with the contractor. As a result, a high bill for changes ends up with the client. Another disadvantage of DBFM is that everything is specified in great detail. A traditional approach seems impossible because Rijkswaterstaat no longer has the necessary knowledge in-house, and all risks lie with the client. The government can no longer, and does not want to, bear all these risks. The market can work more efficiently and effectively here and is therefore better suited to bear these risks. You still see traditional contracts with smaller governments and projects.

Expert B: Indicates that there is a clear interplay between the contract and the Tracéwet when it comes to flexibility. Advises to introduce gradations in the possible changes and how contract forms can contribute to this.

Expert C: Wonders why the contracts are so watertight. What is the underlying cause of this? He observes that current contracts are still very much based on the waterfall model, while other sectors are already using more agile processes.

6.2.4 High-level decisionmaking in the Tracéwet

Expert A: Knows too little about this to reflect on the legislation but recognizes the problem. Agrees with the statement that the current 'Tracebesluit' generally leaves very little room for changes. Also points to the importance of the democratic process that underlies this.

Expert B: Sees this as the biggest limiting factor for flexibility in the process. The possibilities for changes are very limited, and the associated process takes a long time. Making changes to the 'Tracébesluit' easily takes a year, mainly due to the deadlines that apply everywhere. Doesn't have enough knowledge about the new 'omgevingswet' to judge how it affects major infrastructure projects. Has the idea that it mainly becomes easier for small projects.

Expert C: Indicates that there are two types of lawyers. The first follows the letter of the law and the second follows the spirit of the law. This latter approach can help in improving flexibility in the decision-making process.

6.2.5 Independent Infra Authority

Expert A: Indicates that it goes beyond just infrastructure, and therefore suggests broadening the scope and proposes an Independent Mobility Authority. States not knowing if it helps reduce complexity, but certainly sees potential for integration. Mentions having heard this idea before but sees challenges in organizing it. This is a different kind of solution because it's on a higher level.

Expert B: Doesn't immediately see the added value in this. Wonders if this is the right way to solve the problem and is hesitant to add an extra party. Thinks this works better at a local level than at a national level, given the strong local differences.

Expert C: Wonders if this also happens abroad. Wants to simplify the playing field with fewer stakeholders and integrated collaboration, and supports initiatives that contribute to this.

6.2.6 Further comments

Expert A: Indicates that the solutions are comprehensive, and agrees with the chosen approach. Notes: in the technical sector, everyone tends to think in risks and numbers. Benefit management is more about the soft side, about feelings rather than numbers. The difficulty with benefit management might be that it's hard to measure, and therefore difficult to realize. This is because it requires more soft-skills in a technical environment. So, you need different people for that.

Expert B: It is important to define the benefits well in advance and translate them into good and achievable KPIs. Also, thinking about effects is very important for this. Regularly zoom out during the project to see if we are still on the right track. There is still too much thought of: how are we going to reach the finish line in terms of time, money, and quality? Quality often gets sidelined in these considerations. Let benefit management be part of daily operations and occasionally zoom out.

Flexibility in the process is indeed essential for steering. Otherwise, you just hope to reach the finish line. It's valuable to anchor benefit management in project management. Such positive elements can make people prouder of their work. By thinking positively about a project's contribution instead of putting out fires and limiting troubles, it can make work much more enjoyable.

Benefit management also closely aligns with stakeholder management. Benefit Management can help keep stakeholders positively involved in a project. I believe it's also about doing small things with maximum exposure to make a significant contribution to the environment.

Expert C: We all see it as a one-time thing, while management is a repetitive activity over an extended period. How are you going to make benefit an integral part of a project or program?

It starts with the preliminary study but continues with measuring moments long after the project. This is not only true for RWS but is seen in many other organizations.

So indeed, keep measuring for a long time. Also, measure intermittently on different facets. Adjust if you then see deviations.

6.3 Improvements of the solutions

The consensus among experts was largely in favor of the proposed solutions, though the suggestion of an Independent Infra Authority sparked more debate. Expert A recommended a name that reflects its comprehensive role, suggesting 'Independent Mobility Authority.' This term, aligning more closely with the authority's broad scope, will be adopted in the ongoing research.

Expert B, however, expressed reservations about establishing a national authority, advocating instead for a regional approach. This preference stems from the varying needs inherent to different regions. While a regional authority could cater more effectively to local specifics, this approach potentially limits the ability to manage, analyze, and coordinate mobility issues at a national scale, overlooking the typically overarching nature of infrastructure.

This dichotomy highlights the need for a nuanced balance that accommodates both local specificity and national oversight. Finding this equilibrium, which effectively addresses regional diversity while maintaining a cohesive national strategy, calls for further investigation. This additional research is crucial to developing a framework that is both regionally responsive and nationally comprehensive.

6.4 Conclusion

In addressing the sub research question, *'Which changes are needed to improve benefit management in infrastructure projects?*', the analysis points towards a multifaceted approach. The proposed solutions, encompassing ex-post evaluations, modular infrastructure, flexible contract types, high-level decision-making adjustments in the Tracéwet, and the establishment of an Independent Mobility Authority, collectively offer a comprehensive strategy for enhancing benefit management in infrastructure projects.

Firstly, the implementation of ex-post evaluations is pivotal. Experts agree on the necessity of these evaluations to understand the long-term impacts of infrastructure projects. By continuously monitoring and assessing projects even after their completion, valuable insights for future projects can be gained, ensuring that benefits are maximized and disbenefits minimized.

Secondly, the concept of modular infrastructure is recognized for its potential to facilitate adaptability and responsiveness in projects. Experts note the legal and technical

considerations that need to be addressed, but there's a consensus on the potential for modular designs to enhance efficiency and support a more sustainable, circular economy.

The re-evaluation of contract types, particularly the move towards more flexible arrangements, is another crucial change. Experts highlight the limitations of the DBFM-model, and suggest the need for contracts that allow for adaptability and can accommodate changes without significant financial penalties.

Adjustments in high-level decision-making, specifically in the Tracéwet, are also necessary. Experts point to the rigidity of current legislation as a major impediment to flexibility in project management. A more dynamic legal framework that allows for quicker and more responsive decision-making could significantly enhance the ability to manage benefits throughout a project's lifecycle.

Lastly, the proposal of an Independent Mobility Authority, while lightly debated, underscores the need for centralized decision-making and an integrated approach to managing the complex interplay of various stakeholders in infrastructure projects. One expert suggested that while a national authority could provide overarching coordination, regional authorities might be more attuned to local needs, indicating the necessity for a balanced approach.

In conclusion, to improve benefit management in infrastructure projects, a holistic approach is required, one that incorporates continuous evaluation, adaptable infrastructure designs, flexible contract types, legislative adjustments for more dynamic decision-making, and a centralized yet responsive authority structure. Each of these solutions addresses specific aspects of the project management process, and when integrated, they have the potential to significantly enhance the overall management and realization of benefits in infrastructure projects.

7. Discussion

7.1 Validity

In this section, the focus shifts to discussing the validity of the research methods and data. Emphasis lies on establishing credibility and reliability in the study's findings. A combination of literature research, interviews, expert evaluation sessions, and the analysis of academic papers and reports from various sources was employed. Despite some limitations, such as the specificity of the research context, efforts were made to bolster both internal and external validity through systematic data collection and analysis. The diverse research strategies were utilized to validate the findings, incorporating insights from academic and practical sources. To further enhance validity, an assessment of both internal and external factors was conducted (Maruster & Gijsenberg, 2013).

7.1.1 Internal Validity

Literature Research: The internal validity of the literature research is considered high, as it relied on established academic sources and peer-reviewed articles. The information obtained from these sources was consistently applied to the research objectives and questions. Additionally, the inclusion of non-academic reports from government and other institutions provided practical insights that complemented the academic literature.

Interviews: To enhance internal validity, a semi-structured interview protocol was developed, and the same base set of questions was posed to each interviewee. Additionally, follow-up questions were used to clarify responses and validate information. Thematic analysis was employed to systematically analyse the interview data, ensuring that the interpretations were grounded in the participants' responses. Efforts were made to reduce biases by maintaining a neutral tone and avoiding leading questions.

Expert Evaluation Sessions: The expert evaluation sessions were conducted in a controlled environment following a set structure. After introducing the research, the experts could give there opinions and ask in-depth questions about the proposed solutions. The experts involved had relevant knowledge and experience in the field, which adds to the internal validity of the findings.

7.1.2 External Validity

Generalizability: The extent to which the findings can be generalized to a broader population may be limited, given the specificity of the research context and the small sample size. However, care was taken to select a diverse and high-quality group of experts and interview participants to increase the external validity to some degree. The inclusion of government and institutional reports also aids in understanding practical applicability in broader contexts.

Transferability: The research findings may be transferable to similar contexts or settings within the scope of the study, but it may not be directly applicable to entirely different contexts. The research limitations and scope should be considered when applying the findings elsewhere.

7.2 Interpretation of results

7.2.1 Expectations

Prior to conducting the research, it was anticipated that practitioners would exhibit reluctance toward seeking new benefits during the realisation phase due to the substantial risks associated with implementing changes at this stage. Although the literature acknowledges these risks, it also suggests tools to mitigate them. The interviews revealed two streams within Rijkswaterstaat: a traditional stream mainly adhering to the iron triangle framework, and an integral stream considering the broader impact of a project. Both stream acknowledged the fast-evolving environment in which projects operate yet displayed variance in their responsiveness. The traditional stream was indeed hesitant to implement amendments, aligning with the initial assumptions. However, surprisingly, the integral stream, despite recognizing the risks, felt a responsibility to continually seek new opportunities for societal contribution. It was thus surprising to find that a growing recognition exists amongst project managers that they have a broader responsibility towards realising benefits.

The initial scope of this research was confined to the realisation phase of construction projects, with much of the literature review reflecting this focus. However, data analysis from the interviews unveiled a necessity for a broader approach to implement benefit management effectively. It emerged that strategic provisions should be established during the front-end stages of a project, and the benefit management endeavour should extend beyond project completion. This revelation casts a new perspective on the subject matter, advocating for a shift in viewing infrastructure not as a project with a defined start and end, but as a continual process, cycling through a series of stages periodically. This perspective promotes the idea of periodically modifying, updating, and improving infrastructure to ensure the sustained realization of desired benefits. The notion of modularity emerged as a fitting approach for this paradigm, enabling Rijkswaterstaat to extract, improve, repair, or reuse modules, thereby aligning infrastructure management with evolving societal benefits. This unexpected finding not only broadens the scope of benefit management but also introduces a new dimension to the discourse, underlining the importance of adaptive and modular approaches in ensuring the enduring relevance and effectiveness of infrastructure projects.

7.2.2 The call for efficiency

During this research, it became apparent that there is an increasing focus on enhancing the efficiency (Advies Comissie Versnelling Besluitvorming Infrastructurele Projecten, 2008) and flexibility (AT Osborne, 2019) of infrastructure projects. This research fundamentally echoes these aims; however, it's important to acknowledge a potential drawback. A significant advantage of the current model, which entails a rigorous legal framework with several checks and balances, is the assurance it provides to residents for the future. Decisions are made well in advance, allowing ample time for litigation against them. Moreover, once decisions are finalized, revising them is not straightforward without opening new avenues for residents to litigate. This aspect is crucial for maintaining a democratic society.

The Ponte Morandi incident elucidates the tension between efficiency and a meticulous democratic process. The strict procedures, safety valves, and participatory nature inherent in the democratic process tend to render it slow and inefficient, yet they form the bedrock of a democracy's guarantees. Therefore, it's pivotal to strike a balance between upholding these democratic processes and the ability to respond promptly to societal needs.

7.3 Limitations

This research encountered inherent time constraints which impacted various facets of the research process, influencing the depth and breadth of both the literature review and primary data collection. The time limitations narrowed the scope of the literature review, possibly omitting some relevant academic and non-academic contributions that could have enriched the theoretical foundation of the study. Moreover, the constrained timeframe affected the interview and expert evaluation sessions, restricting the number of participants and the depth of each data collection activity. This limitation may have implications on the diversity of perspectives and experiences captured in this study.

Furthermore, the use of thematic analysis to interpret data from the 10 interviews introduced several limitations. The inherently subjective nature of thematic analysis may have allowed for the researcher's biases to subtly influence the identification and interpretation of themes, potentially affecting the objectivity and replicability of the findings. The richness and complexity of the data are crucial for the efficacy of thematic analysis. Given the limited number of interviews, some nuances may have been overlooked, thereby also limiting the generalizability of the findings to broader populations within or beyond the Dutch infrastructure sector.

The quality of the findings is closely tied to the quality of data collected. If the data were not sufficiently varied or rich, the resultant themes might not adequately represent the phenomenon under investigation. The effectiveness and accuracy of the thematic analysis are

also significantly influenced by the researcher's skill and experience in conducting qualitative analysis, with potential for oversight or misinterpretation. The process of distilling narrative data into themes may inadvertently mask or alter the nuances of individual participants' views, particularly when perspectives contrast or conflict.

Additionally, achieving a consistent coding scheme throughout the analysis process is crucial for the reliability and validity of the findings. The potential for coding discrepancies, either due to evolving interpretations or inadvertent inconsistencies, poses a limitation to the credibility of the thematic outcomes.

These limitations highlight the nuanced challenges faced by this research and warrant a cautious interpretation and application of the findings. Future research might benefit from a mixed-methods approach, larger sample size, or strategies such as peer debriefing and member checking to mitigate some of these limitations, fostering a more robust and comprehensive exploration of the research topic.

7.4 Implications

The findings from this extensive investigation into the realm of Benefit Management within Dutch infrastructure projects yield substantial academic and practical implications, poised to drive informed discourse and impactful changes within both domains.

7.4.1 Academic Implications:

This research, focusing on benefit management practices within the Dutch infrastructure sector, particularly at Rijkswaterstaat, offers profound academic implications that extend across various disciplines of project management. The main academic implication lies in the cross-disciplinary integration. By intertwining concepts from Benefit Management, Opportunity Management, and Governance theories, this research heralds a cross-disciplinary dialogue, which is instrumental in fostering a holistic understanding of Benefit Management within complex infrastructure projects. An example of this is how the complexity of project governance structures can hamper benefit management, or how a circular project governance model with an iterative life cycle approach can enable it. This research shows how Benefit Management should play an integral role in project management. This is also reflected in the academic part of this research. This research links benefit management to research topics as complexity, uncertainty, flexibility, modularity and circularity, as well as the broadening of understanding benefit management in the construction industry.

7.4.2 Practical Implications:

Benefit Realization Optimization: The emphasis on a holistic embrace of Benefit Management throughout the project lifecycle, as underscored by the findings, provides a pragmatic blueprint for optimizing benefit realization in infrastructure projects. This is

pivotal for ensuring that the resources invested in infrastructure projects are judiciously utilized to maximize societal benefits.

Operational Flexibility and Adaptability: The advocacy for modular infrastructure and agile contractual frameworks signifies a paradigm shift towards operational flexibility and adaptability, essential for navigating the inherent uncertainties and evolving contexts of infrastructure projects. This is especially pertinent in light of the barriers identified, such as limited flexibility in output and process.

Policy and Governance Reform: The proposal for an Independent Mobility Authority and the anticipated advent of the Environmental and Planning Act (Omgevingswet) in January 2024, spotlight a pathway towards streamlined decision-making and reduced complexity in project governance. This is instrumental for aligning infrastructure planning with long-term national goals and fostering a conducive environment for effective Benefit Management.

Enhanced Monitoring and Evaluation Frameworks: The emphasis on structured and ongoing monitoring and evaluation, alongside the implementation of robust ex-post evaluation mechanisms, is critical for ensuring accountability, continuous learning, and refinement of future infrastructure initiatives. This resonates with the need for a more iterative, cyclical model of governance and project management to ensure fruitful realization of intended benefits.

Financial Integration: Addressing the financial compartmentalization by transitioning towards a centralized authority with one fund covering all different benefits could significantly reduce complexity, enabling a more integrated approach to benefit management. This is crucial for ensuring the holistic realization of benefits across the lifecycle of infrastructure projects.

In essence, the implications of this research are poised to catalyse a ripple effect of informed discussions, policy reforms, and practical transformations within the domain of Dutch infrastructure projects. Through a meticulous exploration of the existing landscape, identification of barriers, and proposition of pragmatic solutions, this thesis not only contributes to the academic enrichment but also charts a course towards a more efficient, sustainable, and benefit-driven infrastructure development paradigm in the Netherlands.

8. Conclusion

8.1 Answering sub-research questions

'What is the current academic state of benefit management, opportunity management and governance structures in construction projects, and what are their respective strengths and weaknesses?'

The exploration of Benefit Management within Dutch infrastructure projects unveils a significant ambiguity between outcomes and benefits, reflecting a broader disconnect between academic theorizations and practical applications of these terms. While traditionally, project success metrics have been anchored to time and cost, the research illuminates a burgeoning emphasis on evaluating the extent of realized intended benefits as a more holistic success metric. It underscores the necessity for a meticulous articulation of benefits at the project outset, highlighting their long-term materialization which outlives the project's completion phase. Literature also indicates possibilities for iterative life cycle models when it comes to realising benefits and coping with uncertainty, this is contrast to a more standard waterfall-model. By endorsing an iterative governance system, fuelled by user feedback, projects can be steered towards their intended benefits and newly emerging benefits amidst evolving circumstances. An example is the implementation of modular infrastructure, better allowing for an iterative governance model by allowing for continuous refinement, improvement or adjustment to new unforeseen circumstances of infrastructure since it's easily changeable characteristics.

Transitioning to Opportunity Management, despite its shared tenets with Benefit Management, the domain faces scepticism, especially when compared to Risk Management. The scepticism is largely embedded in contextual variances rather than intrinsic process flaws. The engagement with uncertainty, a cornerstone in both Benefit and Opportunity Management, is notably orchestrated under Risk Management during the realisation phase, hinting at a latent application of Opportunity Management which may remain underexplored or unnoticed.

Lastly, the delve into Governance Structures bifurcates them into external and internal facets with regards to a specific project, unveiling a variety of governance theories. These structures play a pivotal role in aligning project objectives with organizational strategies, and in navigating the complex environment of decision-making and resource management. The exploration of various governance models, as adopted by different national governments, reveals a spectrum of approaches towards benefit management across project phases. While Dutch governance emphasizes benefits during early stages with a potential decline in focus during execution, the

UK's governance model sustains its emphasis on benefit management. The prevalent linear approach in governance, as observed, hints at an unexplored potential for a more iterative, cyclical governance model to ensure a fruitful realization of intended benefits.

In conclusion, the current academic landscape of Benefit Management, Opportunity Management, and Governance Structures in construction projects demonstrates a rich tapestry of theories, each with its strengths and limitations. However, a discernible gap between academic propositions and practical implementations suggests a compelling avenue for further research and practice to bridge these realms, particularly focusing on embracing iterative models, engaging with uncertainties, and aligning governance frameworks to foster a conducive environment for the successful realization of project benefits.

'How is Benefit Management currently being practiced in Dutch capital infrastructure projects, and what are its barriers and enablers?'

The exploration into the practice of Benefit Management within Dutch capital infrastructure projects, particularly within Rijkswaterstaat's Large Projects and Maintenance department (GPO), embarks upon a comprehensive understanding through the lens of thematic analysis, grounded in insights gathered from interviews conducted with employees from both Rijkswaterstaat and the Ministry of Infrastructure and Water Management.

Initially, the scope of inquiry was fixated on entwining Benefit Management during the realization phase of major infrastructure initiatives. However, the data narrated a different tale, articulating the indispensability of a broader strategy. It unveiled that Benefit Management demands a holistic embrace throughout the project's life cycle, transcending the bounds of a singular phase. However, there are several barriers hindering the optimal fruition of benefit management, each barrier representing a formidable challenge yet also a gateway to potential solutions:

> **Forecasting:** The narrative of forecasting unveils dual challenges; the intricacies of predicting future necessities amidst societal uncertainty, and the nebulous impact of current infrastructure endeavours. Linear predict-and-control frameworks like the MIRT-Process find themselves in a quagmire managing this ambiguity. The research also shows a lack of ex-post evaluations, preventing the project owners to learn from the impact made by the project, and to adjust accordingly.
>
> **Limited Flexibility in Output:** The long-term nature of infrastructure projects inherently fosters inflexibility, demanding adaptable outputs that permit modifications or repurposing to align with the evolving societal needs or to address unrealized projected benefits.

Limited Flexibility in Process: A third crucial factor theme is process flexibility, unearthing the challenges sowed by contractual limitations, laws & legislation, and project complexity. While the early phases of the MIRT process attempt to allow for flexibility, focus get lost later in the process, encapsulated in the term 'Funnelling'. The rigid contours of contractual frameworks, especially the DBFM agreement, are critiqued for their lack of adaptability.

Underemphasis on Social-cultural Benefits: Lastly, there is the overshadowed realm of social-cultural benefits. Despite the strategic roles of Rijkswaterstaat and the Ministry of Infrastructure and Water Management in moulding the Netherlands' infrastructure, the overriding emphasis on enhancing accessibility often eclipses other vital considerations. The transition from Infrastructuurfonds to Mobiliteitsfonds, although fostering a more integrated approach to benefit infrastructure projects yet remains devoid of formal avenues for social-cultural benefits.

Each barrier, thus, unfurls not only a challenge but a conundrum awaiting resolution.

'Which changes are needed to enable benefit management in the Dutch infrastructure projects?'

The examination of facilitating benefit management within Dutch infrastructure projects unveiled a rich journey across diverse terrains of policy, practice, and structural frameworks. Insights drawn from this thorough analysis spotlight several pivotal alterations as catalysts to nurture a favourable environment for benefit management. The following encapsulates the key findings and recommendations derived:

Ex-Post Evaluations: Emphasized as crucial, ex-post evaluations serve as a robust mechanism to assess actual impacts, benefits, and deviations from initial objectives post-project completion. The observed gap between existing legal mandates and practice underscores the need for enforcing compliance with ex-post evaluations. Extending the timelines for such evaluations to capture long-term benefits and adopting robust frameworks like the one proposed by Jong et al. (2019) are vital strides towards fostering an iterative learning culture and refining future infrastructure initiatives.

Modular Infrastructure: The promise of a modular approach advocates for infrastructure design as a composition of smaller, independently developed yet cohesively integrated modules. This paradigm grants project owners the agility to adapt infrastructure's purpose, capacity, and characteristics, aligning with Rijkswaterstaat's

aspirations for full circularity by 2030. Transitioning towards modular and standardized components could significantly bolster prospects in the domain of a circular economy.

Transformation of Contractual Frameworks: The critique of rigid financial constructs and the long-term nature of DBFM contracts pivots towards advocating for more agile contractual frameworks. The potential of the two-phase contract model, offering enhanced flexibility by deferring decision-making, emerges as a possibility. The need for timely recognition of possible changes, along with the incorporation of coping mechanisms to navigate these changes, as explored by Demirel et al. (2019), form part of the discourse.

High-level Decision Making: The bureaucratic hurdles stemming from the rigidity in the Tracébesluit are recognized as barriers to flexible project decisions. The forthcoming Environmental and Planning Act (Omgevingswet) in January 2024 is anticipated to create a more coherent, shorter, and less complicated process. Advocating for a balanced approach between 'predict-control' and 'prepare-and-commit' could foster a conducive environment for flexibility in project decisions.

Independent Mobility Authority: The proposition of an Independent Mobility Authority surfaces as a potential remedy to the complex challenges faced in the management and development of infrastructure in the Netherlands. This centralized entity could streamline decision-making, reduce complexity, and foster flexibility. By centralizing responsibility and mandate, it could ensure alignment of infrastructure planning with long-term national goals, thereby fostering efficient benefit management.

Addressing the financial compartmentalization where different stakeholders contribute to various project aspects is vital. Transitioning towards a centralized authority with one fund covering all benefits could significantly abate complexity, thereby enabling a more integrated approach to benefit management.

These outlined pivotal changes, envisaged within a framework of policy enforcement, structural transformations, and a paradigm shift in contractual and decision-making frameworks, carve a pathway towards a more conducive environment for benefit management within Dutch infrastructure projects. The anticipated harmonization of these elements is projected to simplify the existing infrastructure management landscape significantly and foster a culture that prioritizes the realization of benefits across the lifecycle of infrastructure projects.

8.2 Answering main research question

'How can benefit management practices be improved in the Dutch infrastructure sector for enhanced value realization?'

In conclusion, the enhancement of benefit management practices within the Dutch infrastructure sector hinges on its comprehensive integration across the entire project lifecycle. The journey begins at the front-end stages, with the articulation of clear and achievable benefits, which should then be translated into specific outputs. Concurrently, it is paramount to establish a governance structure imbued with the requisite flexibility to adeptly navigate future (unforeseen) changes. This flexibility ought to be woven into the decision-making processes, contractual agreements with other entities, and fundamentally, into the design framework. The latter can be adeptly achieved through the adoption of modular infrastructure, a paradigm that not only fosters flexibility but also paves the way towards a more efficient and sustainable industry.

To achieve greater fluidity in the process, a reduction in complexity is indispensable. This research advocates for the inception of an Independent Mobility Authority, a proposition aimed at diminishing the number of stakeholders and simplifying the financial architecture, thereby ushering in a more streamlined and manageable operational landscape.

After project delivery, a structured and ongoing monitoring and evaluation regime is essential to ascertain the extent to which the infrastructure is delivering on its promised benefits, be they intended or emergent. The modular infrastructure ethos facilitates prompt responses should the infrastructure fall short of delivering its benefits, while the robust evaluation and monitoring framework provides a rich learning ground. The insights gleaned from such evaluations are invaluable, serving as a repository of knowledge for informed decision-making and refined CBAs in subsequent projects. Through this holistic and iterative approach, the nexus between project design, execution, and evaluation becomes a fertile ground for continuous improvement, ultimately propelling the Dutch infrastructure sector towards achieving its objectives in a more efficient, sustainable, and benefit-driven manner.

Several popular academic topics in project management come together in this research. The main problems lay in the well-studied topics of uncertainty and complexity, and the solutions mainly lay in the governance structure of the projects. The proposed solutions lead to a decrease in the complexity, and an increase in flexibility of the governance structure, which is therefore better able to deal with uncertainty. The latter is due a shift of focus; rather than predicting the future, its aims to provide the means to easily adjust to changes.

8.3 Recommendations for future research

8.3.1 Modular infrastructure

The potential of modular infrastructure in enhancing flexibility, efficiency, and sustainability within the Dutch infrastructure sector is highlighted in this study, yet a gap in modularity and standardization compared to other sectors is apparent. Further research is warranted to bridge this gap, specifically focusing on a comparative analysis with sectors where modularity has been successfully implemented, investigating barriers to modularity within the infrastructure sector, and developing a tailored standardization framework. Additionally, exploring technological innovations that could facilitate modularity, conducting economic impact assessments to evaluate cost-benefit aspects, and undertaking case studies or pilot projects to gauge practical implications are crucial. Engaging stakeholders through collaborative platforms, proposing policy recommendations to create a conducive environment for modular infrastructure, developing educational programs to equip the workforce with necessary skills, and designing a long-term monitoring framework to track progress over time are also recommended. Through these avenues, a clearer pathway towards the robust implementation of modular infrastructure in the Dutch infrastructure sector can be established, aligning with contemporary needs and global sustainability goals.

8.3.2 Independent Mobility Authority

The notion of establishing an Independent Mobility Authority surfaced as a significant avenue to streamline decision-making and management within the Dutch infrastructure sector, as discussed in this research. Despite being a concept that has persisted over time, its real-world implementation necessitates a deeper exploration. Subsequent research should delve into the structural, legal, and operational frameworks required to establish and operate such a authority. Understanding the potential opportunities such as enhanced project flexibility, centralized decision-making, and financial consolidation is essential, alongside a critical evaluation of possible drawbacks like bureaucratic hurdles, stakeholder resistance, or loss of localized control. Examining the technological and human resource capabilities needed, along with a thorough risk assessment and stakeholder analysis, could provide a holistic view. Moreover, investigating public acceptance and political willingness would add value.

8.3.3 Flexibility in client-contractor relationship

The exploration of flexibility within the client-contractor relationship emerged as a critical need in fostering successful infrastructure project outcomes. It's apparent that evolving project dynamics necessitate a fluid interaction between the client and contractor, which may be facilitated through both formal and informal agreements. Future research should meticulously investigate how different types of contractual arrangements influence the flexibility of the client-contractor relationship, and how they compare to each other. Additionally, the role of informal

agreements, trust-building, and communication channels in promoting adaptability and collaborative problem-solving should be scrutinized. The investigation could also extend to examining how legal frameworks and industry norms either support or hinder the cultivation of flexibility within these relationships.

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Appendix A – Interview guide

8.4 Introduction

Geachte deelnemer,

Dank u voor deelname aan mijn onderzoek naar benefit management tijdens de uitvoeringsfase van projecten. Ik doe dit onderzoek in het kader van mijn master thesis van de opleiding 'Construction Management & Engineering' aan de TU Delft. Ik doe dit onderzoek in samenwerking met de afdeling Kapitaalprojecten & Infrastructuur van PricewaterhouseCoopers. Uw inzichten, als iemand die direct betrokken is bij de projecten, zijn van onschatbare waarde voor dit onderzoek.

Het doel van mijn onderzoek te onderzoeken hoe benefit management verbeterd/geïmplementeerd kan worden in de uitvoeringsfase van infrastructuurprojecten. Op deze manier kan mijn onderzoek bijdragen aan het doelmatig besteden van publieke middelen. Benefit management heeft doorgaans een focus op de voorbereidende fases van projecten. Echter, het is om verschillende redenen interessant om ook naar de uitvoeringsfase van infrastructuurprojecten te kijken. Allereerst zorgt de lange doorlooptijd van deze projecten ervoor dat veranderingen in de maatschappelijke context kunnen zorgen voor nieuwe behoeften.

In dit onderzoek worden benefits gedefinieerd als de lange termijn baten van een infrastructuurproject. Voorbeelden hiervan zijn de sociaaleconomische ontwikkeling ten gevolge van een verbeterde bereikbaarheid, of een verbeterde veiligheid van een bepaalde regio. Een typisch kenmerk van benefits zijn de lange tijdspanne waarop deze zichtbaar worden. Hier onderscheiden ze zich van 'kansen' of 'positieve risico's', welke onderdeel zijn van risicomanagement. Deze zijn doorgaans gericht op bijvoorbeeld kostenbesparingen of het verkorten van de uitvoeringstijd, en daarmee op de directe totstandkoming van de output van een project. De positieve, lange termijn, impact die deze output heeft zijn de benefits waar dit onderzoek op focust.

8.5 Interview questions:

1. Algemene Achtergrond & Ervaring

- Kunt u kort uw huidige rol en verantwoordelijkheden bij Rijkswaterstaat beschrijven?
- Hoe lang bent u al betrokken bij bouwprojecten van Rijkswaterstaat?

2. Inzicht in Benefit Management

- Bent u bekent met benefit management? En zo ja, hoe zou u benefit management definiëren in de context van de projecten die u begeleidt?
- Zijn er voorafgaand aan dit project specifieke benefits gedefinieerd? En zo ja, hoe zijn deze in outcome's en outputs vertaald?
- Hoe ziet de governance structuur van dit project eruit? En zijn er specifieke tools, methoden of richtlijnen die om ervoor te zorgen dat de geïdentificeerde benefits daadwerkelijk worden gerealiseerd tijdens de uitvoering van het project?
    - Hoe zou dit verbeterd kunnen worden?
- Hoe wordt er omgegaan met onvoorziene omstandigheden of veranderingen in de projectomstandigheden die van invloed kunnen zijn op de verwachte voordelen? Bijvoorbeeld scope en ontwerpwijzigingen?
- Wordt er tijdens de uitvoering van projecten nog gezocht naar kansen om extra invulling te geven aan huidige benefits, of juist nieuwe benefits te creëren?
    - Ziet u hier ook een risico in scope creep?
- Zijn er specifieke meet- en rapportagemechanismen die worden gebruikt om de mate van benefit realisatie te meten en evalueren?

3. Uitdagingen & Voordelen

- Welke uitdagingen voorziet u bij het implementeren van benefit management in de realisatiefase?
- Kent u voorbeelden uit het verleden waarbij het ontbreken van benefit management leidde tot gemiste kansen of uitdagingen?
- Omgekeerd, kunt u zich een situatie herinneren waarin actief benefit management leidde tot duidelijke positieve resultaten?

4. Praktische Implementatie

- Wat is naar uw mening nodig om benefit management effectief te integreren?

5. Culturele & Organisatorische inpassing

- Denkt u dat de huidige organisatiecultuur van Rijkswaterstaat zo'n integratie ondersteunt? Waarom wel of niet?
- Zijn er specifieke afdelingen of teams binnen Rijkswaterstaat of I&W die bijzonder cruciaal kunnen zijn voor deze implementatie?

- Welke partij is naar uw mening het meest geschikt hier verantwoordelijk voor te dragen? Zou dit bijvoorbeeld vanuit RWS kunnen of past dit beter bij de taak van I&W?