Building adaptive capacity in project management strategies in a MIRT institutional context

A case study research into project management principles

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II. PREFACE

As every closure is the start of a new beginning, so is this thesis. It is, on the one hand, marking the end of my time as a student within the Environmental and Infrastructure Planning programme, and, more particular, as a student in Groningen. Both the interesting and enriching programme as the city with all its beauty has shaped me to the person I am today, as they gave me the opportunities to accelerate within and outside of my study programme. On the other hand, this thesis marks the beginning of a career and I am looking forward to creating a better world with the help of spatial planning.

It must be said that this thesis could not be written without the help of several persons. I would like to make use of this paper to thank them all.

First, I would like to thank the participants for making time in their tight schedules for conducting and planning the interviews. Their contributions, remarks and suggestions about adaptive management and the MIRT programme form the basis of this research.

Secondly, I would like to thank my supervisors, both from the University of Groningen as from my internship at Witteveen+Bos. Wim Leendertse, Abel Knipping and Berto Meeuwissen have helped me find the right direction, advised me in tough decisions and clarified terms used in practice. For that, I am really thankful.

Lastly, I would like to thank all my friends and colleagues for offering moral support, while I was writing this thesis and during my time as a student. Without them, the journey would have been less fun.

So, the start of a new beginning is ahead of me. I am looking forward to the opportunities the future will bring, and I am motivated to utilize them all. Nevertheless, I will always melancholically look back at my delightful time as a student in Groningen and at the Faculty of Spatial Sciences.

Enjoy reading this thesis,
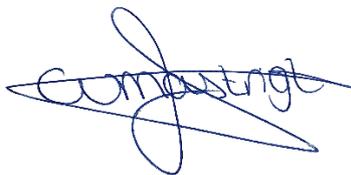
Casper van Mastrigt

Groningen, 24th of July 2019

III. EXECUTIVE SUMMARY

The MIRT programme, a Dutch funding programme for infrastructure projects, and the ideas of complexity and aligning uncertain and unpredictable behaviour of components of a complex adaptive system are contrasting. Therefore, project managers try to find management strategies in order to deal with the duality of control and flexibility. Seven challenges are derived from practice, regarding a tight planning, dealing with a fixed budget, an unclear project description, the continuity of the project management team, the lengthy decision-making process, how organizations deal with the formal institutions and dealing with wicked problems. The theory is suggesting three categories of adaptive measures, that increase the flexibility in the planning process, hence, helping project managers to deal with uncertainty. First, creative capacity ensures a variety of pathways by giving multiple actors and levels access to the planning process. Secondly, learning capacity helps organizations recognizing a changing context faster, hence, accelerate the adaptation process. Thirdly, cooperative capacity initiates a shared vision. Research, however, is lacking empirical data on how and under what circumstances these strategies can be implemented. This research is generating seven guidelines on how the adaptive capacity of a project management strategy can be expanded. By doing a multiple-case study approach, reasoning behind strategies and contextual circumstances are investigated. The seven guidelines include implementing conditions for the mentioned categories. The guidelines can be summarized as: implementing an extensive participation trajectory (creative capacity and cooperative capacity), implementing a scenario strategy (creative capacity), generate trust within the project management team (creative capacity and learning capacity), implement monitoring and evaluation (learning capacity), critically discuss assumptions and decisions (learning capacity), involve market parties more early in the process (creative capacity), and upscale the project life-cycle.

Keywords: project management, adaptive capacity, flexibility, complexity, MIRT programme

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VII. LIST OF ABBREVIATIONS

Abbreviation:	In Dutch (if applicable):	Meaning:
CAS	-	Complex adaptive systems
CCTA	-	Central Computer and Telecommunications Agency
HSL-south	Hogesnelheidslijn zuid	High-speed railway connecting between Schiphol and Antwerp, via Rotterdam
HWBP	Hoogwaterbeschermingsprogramma	Protection programme for high water safety
IPM	Integraal projectmanagement	Integrated project management
I&W	Ministerie van Infrastructuur en Waterstaat	The Dutch Ministry of Infrastructure and Water Management.
MER	Milieu-effectrapportage	Environmental impact assessment
MIRT:	Meerjarenprogramma Infrastructuur, Ruimte en Transport	The Dutch programming and budgeting system for infrastructure and spatial development.
MKBA	Maatschappelijke kosten-baten analyse	Communal costs and benefits analysis
NGO	-	Non-governmental organizations
PMBOK	-	Project Management Body of Knowledge
PMI	-	Project Management Institute
PRINCE2	-	PRojects IN Controlled Environments 2
PWM	Projectmatig werken	Project-based working
TCI	Tijdelijke commissie infrastructuurprojecten	Parliamentary Commission for Infrastructure Projects

VIII. GLOSSARY

Term:	Meaning:
Adaptive capacity:	The ability of a system to manage an altering context, by which the core of the system (for example the goal) is protected (Gupta et al., 2010).
Co-evolution:	The ability of a system to learn and approve (Hertogh & Westerveld, 2010).
Flexibility:	"The ability to act proactively in a beneficial way to changing circumstances or to the outcomes of management decisions" (Hertogh & Westerveld, 2010, p. 290).
HWBP:	The protection programme for high water safety is a national programme similar to the MIRT programme. It is following the MIRT project phasing. Although it does not have a formal decision on the preferred alternative, it does have an informal one, as the delegated government still must decide if the project is sufficient for subsidy of the HWBP (Hoogwaterbeschermingsprogramma, 2019).
Project management:	The coordination of a project: using several techniques and methods in order to solve a specific problem (Söderlund, 2004; Pellegrinelli, 2011).
Project:	A unique organizational unit with a mutually agreed predefined goal, with the required work included, which needs to be realized within limited resources (Ballard & Howell, 2003; Söderlund, 2004; Kor & Wijnen, 2005; Wijnen & Storms, 2007).
Self-organization:	"A process in which the components of a system in effect spontaneously communicate with each other and abruptly co-operate in co-ordinated and concerted common behaviour." (Boelens & De Roo, 2016, p. 46)
Stage gate approval mechanisms:	Informal decision points, where the current trajectory of a project is locked and evaluated (Olsson, 2006)
Wicked problems:	Problems with a high degree of uncertainty, due to the dynamics of the system (Hurlbert & Gupta, 2015).

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1. INTRODUCTION

1.1 Background

1.1.1 Projects

Spatial planning is typically concerned with organizations that compose strategies regarding the realization of normative futures (Rauws et al., 2014). Most organizations, the field of spatial planning included (Glasbergen & Driessen, 2005), are using functional structures as projects as the main tool to accomplish their tasks (Engwall, 2002; Pellegrinelli, 2011; Perminova et al., 2008). Considering the extensive use of projects, Maylor et al. (2006) are even speaking of the projectification of society. Although, the term project has many definitions (Maylor et al., 2006; Söderlund, 2004; Turner & Müller, 2002), in this research the definition is: *a unique organizational unit with a mutually agreed predefined goal, with the required work included, which needs to be realized within limited resources* (Ballard & Howell, 2003; Kor & Wijnen, 2005; Söderlund, 2004; Wijnen & Storms, 2007) is used. Reasons to use projects are twofold. First, projects exist because there is a complex problem to solve. Second, a project organization is the most common form to solve this problem, for the reason that deliberate cooperation of people and coordination of the team is necessary (Söderlund, 2004). The problem that needs to be dealt with is occurring in specific circumstances, hence a project is not an autonomous phenomenon. They need to be seen in their specific historical, societal and organizational context (Engwall, 2003). Projects are intended to deliver change in these particular circumstances, and therefore have the following characteristics: all projects are unique, are using different approaches, and are temporary (Koppenjan et al., 2009; Turner & Müller, 2001; Wijnen & Storm, 2007). These features are generating unique pressures and therefore need specific project management. Project management can be defined as "the complete set of decisions regarding the setup, organization and management of a project, taken during the various phases of the project, aimed at coordinating the efforts of the various actors involved in order to successfully realize the project" (Koppenjan et al., 2011, p.741). Despite the effort of project management to successfully achieve the projects goals, large infrastructure projects specifically are often characterized by cost overruns, technical complications and late delivery (Engwall, 2002; Eriksson et al., 2017; Flyvbjerg, 2003; Koppenjan et al., 2009; Locatelli, 2017; Love et al. 2015; Rijke et al. 2014).

1.1.2 The MIRT programme

Because public finances regarding infrastructure projects are often limited, countries are trying to make the most out of their limited funds. (Klakegg et al., 2016). As investments in infrastructure projects often are expensive, time consuming and of strategic importance, public decision-makers are pressured to set severe objectives on these projects and constantly control these. (Eriksson et al., 2017). This monitoring function often is fulfilled by public programmes. Public programmes are essential for creating value out of these resources, as they act as problem-solving frameworks, hence creating more efficiency. In the Netherlands particularly, each ministry has its own distinctive planning preparation, decision-making, and prioritizing processes, which had several problems regarding planning structure and additional complications in the past (Klakegg et al., 2016). The national programming and budgeting system for infrastructure and spatial development (in Dutch: Meerjarenprogramma Infrastructuur,

Ruimte en Transport, in short MIRT), which is a governmental supervising instrument overseeing projects on behalf of society, entailing processes and systems (Klakegg et al., 2016), was introduced to improve these problems. The additional Faster and Better programme (see also section **2.1.2**) was brought in in order to help expedite the projects within the MIRT, by shortening the realization time and improving the decision-making process (Arts, 2010; Klakegg et al., 2016). The MIRT regulation is designating specific, mandatory, steps a project is required to run through, in order to qualify for state funding (Klakegg et al., 2016). In this way, the ministries of the interior and infrastructure and water management are hoping to achieve a higher degree of (programmed) control over the projects.

1.1.3 Complexity theory

At the same time, the development of complexity theory has led to a more holistic approach, concentrating on a dynamic, erratic and constantly changing world (De Roo, 2010; Duit & Galaz, 2008; Hertogh & Westerveld, 2010). This idea is based on a relativistic view, where objectivity is replaced with inter-subjectivity, for example, because of a symbiotic relationship between two objects (Allmendinger, 2017). This perspective is imposing planners to leave the idea of the expert with objective knowledge about reality and as an alternative encourage them to embrace an adaptive management approach, facing a world of incremental change (Byrne, 2003; Duit and Galaz, 2008). From a complexity perspective, a considerable number of public projects have become increasingly more complex and therefore more difficult to manage (Eriksson et al., 2017; Locatelli, 2017; Love et al., 2014; Klakegg et al., 2016). This is due to the highly interconnected network society and aligning unpredictability and uncertainty (see also section **3.3)** (Boelens & De Roo, 2016). Hence, managers need to embrace the idea of establishing flexibility by creating adaptive project management strategies (Koppenjan et al., 2011; Olsson, 2006). In this research, flexibility is defined as "the ability to act proactively in a beneficial way to changing circumstances or to the outcomes of management decisions (Hertogh & Westerveld, 2010, p. 290). By applying adaptive management strategies, this flexibility can be achieved as adaptive capacity is added to project management. Hence, the ability to manage the altering context, by which the core (for example the project goal) is protected, is amplified (Gupta et al., 2010).

1.2 Problem definition

The MIRT regulation and the concept of an adaptive management approach is pointing out a conflict between control and flexibility. A project within the MIRT regulation needs to follow mandatory, predefined steps in order to achieve state funding while, at the same time, project managers must deal with an increased dynamic world, and increasingly complex infrastructure projects. This develops uncertainty and aligning wicked problems (see section **3.3.3**) and therefore project managers see adaptive project management strategies as a necessity. A transition as examined in planning practice can also be noticed in project management (Engwall, 2003). Modern project management strategies are embracing the ideas of flexibility, the network society and environmental negotiation in order to be successful (Kor & Wijnen, 2005; Lycett et al., 2002; Maylor et al., 2006). These, therefore, can be described as process management strategies. Control and flexibility are both important for successful project management. However, as Hertogh & Westerveld (2010) emphasize, approaches that are focused on control and managing risks (for example as shown in Turner & Müller, 2003) are often hard

to combine with adaptive management strategies that are focused on flexibility (for example those that are presented in Duijn et al. (2016), and in Koppenjan et al., (2003). In that sense, it is a challenge within infrastructure projects in the Netherlands to embrace the idea of complexity, by making use of adaptive project management strategies, while at the same time meet the standards of the MIRT programme.

Today's project management has developed into a comprehensive body of knowledge, which is underlining the importance of on the one hand planning and control, guided by thorough risk-management, and on the other hand the need for adaptability, with an eye on increasing complexity and uncertainty (Cooke-Davies, 2002; Eriksson et al., 2017; Koppenjan et al., 2011; Olsson, 2006). However, strategies of control and flexibility often do not mix well. A knowledge gap is existing regarding the question of how to balance control and flexibility in order to be complementary to each other, in the light of project management in practice. Various researchers, for example, Morris (1994), Packendorff (1995), and Söderlund (2004) argue that theories in project management are considered too theoretical and not sufficiently empirical. This research elaborates on situations in planning practice, more specific on MIRT projects, where a balance between control and flexibility is important. The aim of this study is to gain insight into project management strategies in infrastructure planning practice. What instruments are used and how do they work out in practice?

Hence, the aim of this research is to develop a set of general rules of project management in order to deal with the duality of flexibility, that is preferred by managers in the project's exploration phase, and control, which is typical for the project's planning phases as elaboration of a chosen alternative in the exploration phase (for example during a MIRT exploration). The exploration phase specifically is the phase where it is of importance to gather knowledge in order to make a proper decision, while at the same time flexibility is not costly in comparison to later phases (Olsson, 2006). To come to insights in the duality between flexibility and control, necessary for the tools in project management, the primary research question of the thesis is stated as followed:

How can the project's management strategy during MIRT explorations be aligned to flexibility in a project's planning phase to be adaptable to uncertainties?

In order to understand the relation between the project management approach and the project's outcome on the one hand and the relation between approaches based on control and on adaptability on the other hand, the following secondary research questions are presented:

1. *What flexibility measures or adaptive strategies does the theory on project management describe, related to the exploration and planning phase of projects?*
2. *What are the current project management strategies used in the MIRT exploration phase and the planning phase?*

Moreover, because this thesis is elaborating more on the relationship between project management strategies and the MIRT procedures, the following secondary research questions are formulated:

3. *Which problems are encountered by managers, dealing with risks and uncertainties, in practice in MIRT explorations and planning, using the current project management strategies?*

4. *What adaptive solutions does practice develop in order to meet the given problems above?*
5. *What are institutional barriers for the implementation of these flexibility measures or adaptive solutions?*
6. *What adaptive project management strategies seem appropriate for the Dutch practice and on what conditions can they be implemented?*

1.3 Outline of the thesis

Chapter **1** has already introduced a small background in the field of project management research and presented the existing knowledge gap of empirical data on how to balance control and flexibility in project management practice. Hence, the main question and secondary research questions are presented here. Furthermore, in chapter **2** background in the MIRT programme and the institutional landscape is provided. The **third** chapter entails the conceptual framework of the research, which is encompassing the challenges and solutions derived from theory and data. Chapter **4** provides a research framework, including methods and research ethics. The **fifth** chapter specifies the six cases used in this case study research. The findings on how adaptive management in the MIRT exploration phase can be contributing to desired flexibility and what kind of solutions are developed in practice are presented in chapter **6**. Moreover, chapter **7** consists of a discussion based on an analysis of the cases. A conclusion of this research is presented in chapter **8**, based on answers to the research questions. Additionally, recommendations on how to improve contemporary project management in order to be more flexible are presented in this chapter. Lastly, chapter **9** presents ideas for further research and reflects on the research process, and in chapter **10**, the references used in this research are listed.

2 CONTEXTUAL INSTITUTIONAL
LANDSCAPE

2.1 Development of public infrastructure projects and programmes in the Netherlands

The Netherlands has a long history of urban planning and is well-known for its quality of innovative urban development (Janssen-Jansen, 2016). Infrastructure development on behalf of the society is mostly supervised by the Dutch Ministry of Infrastructure and Water Management (in Dutch: Ministerie van Infrastructuur en Waterstaat, in short, I&W) (Ministry of I&W, 2018). Within these public projects, the project preparation and decision-making process were facing multiple problems during the project's early phases (Shiferaw, 2013). These problems are causing the in section **1.1** mentioned financial difficulties, technical complications and delays in a significant number of projects (Klakegg et al., 2016).

2.1.1 The TCI and Elverding Committee

To analyse these problems and to come up with suggestions to avoid these complications, the Parliament and the Cabinet selected two distinctive committees (Klakegg et al., 2016). First, the in 2004 appointed Parliamentary Commission for Infrastructure Projects (TCI) examined two major infrastructure projects, the Betuweroute and HSL-south, which experienced huge cost overruns. The committee found decision-making pitfalls at both projects and recommended a new project management approach focused on a four-stage gate approval process, which emphasized the importance of the front-end decision-making process (Klakegg et al., 2016; Shiferaw, 2013).

Moreover, in order to analyse the earlier mentioned problems concerning the Dutch infrastructure projects, and to identify the possibilities to significantly improve the speed of decision-making processes, the Advice Committee Speeding up Decision-making in Infrastructure Projects, in short, Elverding Committee, was introduced in 2007 (Arts, 2010; Elverding Committee, 2008). The commission identified a variety of problems, regarding misinformation, shortage of participation in early phases of the project, lack of clarity, shortcomings in problem analyses, and external causes outside of the project (Elverding Committee, 2008; Shiferaw, 2013). With an eye on these problems, the Committee proposed a more balanced strategy, focused on intensifying attention to the exploration phase of projects, in their advice report 'Faster and Better' (Shiferaw, 2013). "For speeding up the decision-making process, front-end investments are crucial" (Elverding Committee, 2008, p.13). The situation in 2008 and the desired conditions are presented in Figure 1.
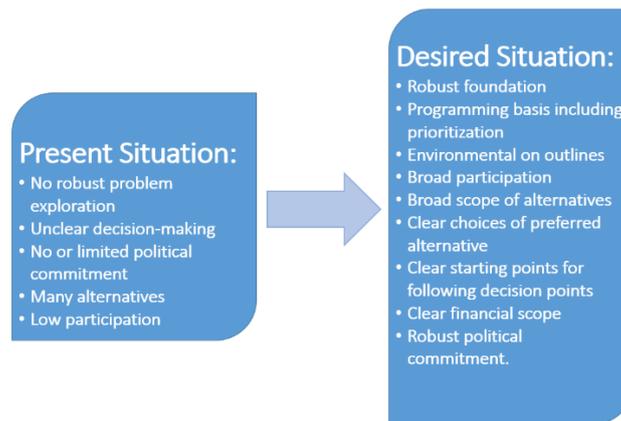
Figure 1. The situation in 2008 and desired situation by the Elverding Committee (Shiferaw, 2013).

2.1.2 The Faster and Better action programme

The Ministry of I&W took these recommendations from both commissions very seriously and proposed a new institutional system. This system contains frameworks to enhance public participation, a focus on front-end development, and stage gate approval mechanisms. This system, based on the suggestions of the TCI and the Elverding Committee combined with new regulations and laws, organizational reform, and improved procedures for evaluation and prioritization was presented as the Faster and Better Programme (Arts, 2010; Shiferaw, 2013). This action programme is using a governance framework where extensive participation is integrated into the project exploration phase (and therefore was considered better), and a thorough front-end problem analysis as an essential feature in shortening planning periods (and therefore was considered faster) (Klakegg et al., 2016; Shiferaw, 2013).

2.2 The MIRT programme

The Faster and Better action programme is eventually integrated within the MIRT programme. This is an integrated infrastructure and spatial development investment programme initiated by the ministry of I&W and the ministry of interior. The main goal of this programme is to establish coherence and collaborations between different actors and various policy fields and to improve the integration of infrastructure and space. The MIRT is covering the complete development process of a project (Ministry of I&W, 2016a; Klakegg et al., 2016). The programme is based on a funnel process (Van Geet et al., 2019) consisting of regional administrative consultations, an overview of current infrastructure projects, an area development agenda, MIRT research, and the mandatory MIRT guidelines. The process starts with the area development agenda, where the Dutch government in collaboration with local stakeholders is composing spatial-physical challenges of a particular area. The MIRT research is used to find synergies and interdependencies between local challenges in order to adapt to the various dynamic contexts in society (Van Geet et al., 2016). Formally, the MIRT exploration is starting with the intake decision, based on the starting documents, which contain a case description, a fitting approach, and proper risk management narration. The exploration is concluded with an administrative and area supported decision on a preferential alternative, which is among others containing a motivated preferred solution, a short- and long-term vision, and a budget concerning spatial measures. The planning phase is formally starting with the project realization decision, which concerns optimization and procedural

formalities. Finally, an approval decision is marking the MIRT realization phase (Ministry of I&W, 2016a). Figure 2 is illustrating a simplified representation of the MIRT procedure.
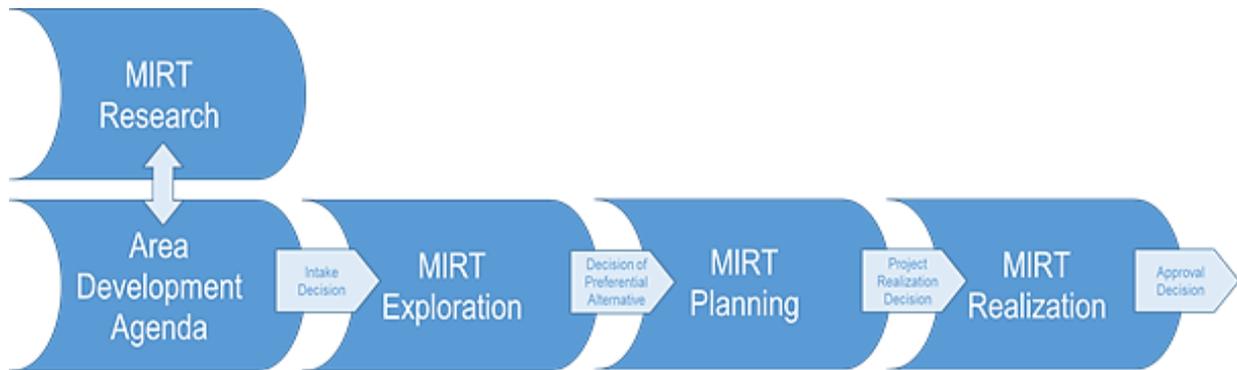
Figure 2. Simplified MIRT procedure. (Author, 2019).

2.2.1 MIRT exploration phase and the decision of the preferential alternative

The main goal of the MIRT exploration phase is to provide smart, sustainable and climate-proof solutions through thorough, comprehensive, and integrated research. Win-win situations, sustainability considerations, area information above and beneath ground level, and cultural heritage are included in this exploration. Various actors, including governmental organizations, executive parties, private actors and regional stakeholders, are trying to find common ground in how to execute the forthcoming project. Funding can be adjusted from National Infrastructure fund and/or the Delta Fund if legal requirements are met (see also section **2.2.3**). The different MIRT explorations are annually considered and prioritized within the existing budgets. Integral area developments or complex projects are preferably elaborated in an overarching framework vision (in Dutch: structuurvisie). Formally, the MIRT exploration phase is starting with a starting decision (which is usually made by the Minister of Infrastructure Water Management together with the Minister of the Interior during the regional administrative consultations), based on the starting document, which contains a case description and the main goal of the exploration, the process of the exploration, and description of uncertainties and how to respond to this ambiguity (Ministry of I&W, 2016a).

The essence of the MIRT exploration is the funnel and filtering process and to develop alternative solutions. This encompasses the development from a broad assessment towards one preferential alternative, in order to meet binding financial agreements. To facilitate this process, insight into collective costs and benefits are needed. This will be investigated in a communal costs and benefits analysis (in Dutch: Maatschappelijke kosten-baten analyse, in short: MKBA). Moreover, results from the environmental impact assessment (in Dutch: Milieu-effectrapportage, in short: MER) and results from participation processes are provided to gain more insights into the case (Ministry of I&W, 2016a)

The preferential alternative consists of:

a. A clear consideration of the preferential alternative, including the funnel process, and MKBA;
b. The comprehensive description of a preferential alternative, including the area integration, programme of measures, and sustainability potential;
c. If applicable: a short and long-term solution;
d. The funding of measures.

It is noteworthy to examine the determination of this preferential alternative as a formal decision, made by relevant involved governmental officials. It implies a clear and hard division between the MIRT exploration phase and the MIRT planning phase.

2.2.2 MIRT planning phase

Subsequently to the MIRT exploration phase follows the MIRT planning phase. The main goal of this phase is to specify the preferential alternative into a decision, in national infrastructure project called a route decision (in Dutch: Tracébesluit), which enables the project to meet the financial and legal requirements of the realization. The MIRT planning phase can be seen as the continuation of the funnel process, started in the MIRT exploration phase, where the project realisation is prepared in a way that after the project decision is made the realisation can start immediately (Ministry of I&W, 2016a).

2.2.3 Legal framework of the MIRT

The intake decision can only be made by Authorized Supervision in consultation with other involved authorities. The margins of the preferential alternative are based on the Route Law (in Dutch: Tracéwet). This law is dictating the specifications an intake decision must comply with and is formulating which laws and regulations must be incorporated into this decision. Moreover, investments from the central government into MIRT projects are mostly financed by the National Infrastructure Fund and the Delta Fund (Ministry of I&W, 2016a). The law on the infrastructure Fund is dictating the investments made for sustainability and integration purposes are only possible when fitting into the scope of the Delta Fund. Both laws are underlying the MIRT procedure and are dictating the formal framework.

2.2.4 Relationship between the Faster and Better Action Programme and the MIRT programme

The MIRT programme is a mandatory investment programme, while the Faster and Better action programme is focusing on process optimization. They are not directly institutionally linked. However, they are both implemented in the front-end phase of projects (see figure 3), as the TCI and Elverding Committee were advising (Klakegg et al., 2016; Shiferaw, 2013). Therefore, both
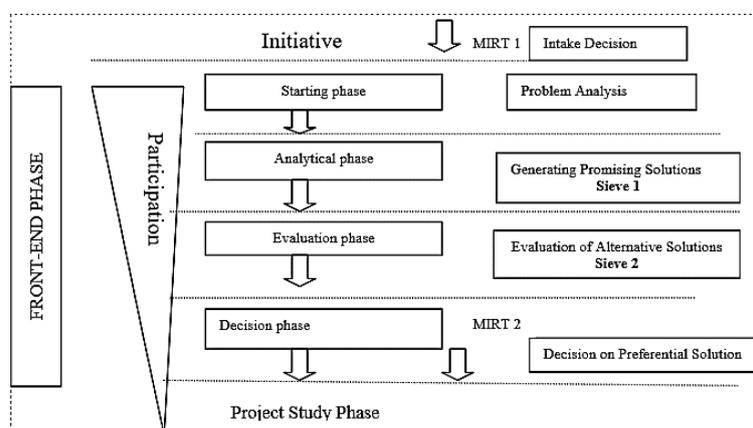
Figure 3. Project governance framework at the front-end according the Faster and Better Programme and the MIRT programme. (Shiferaw, 2013).

could influence the project exploration phase context and are therefore important for project managers to consider.

2.2.5 MIRT renewal
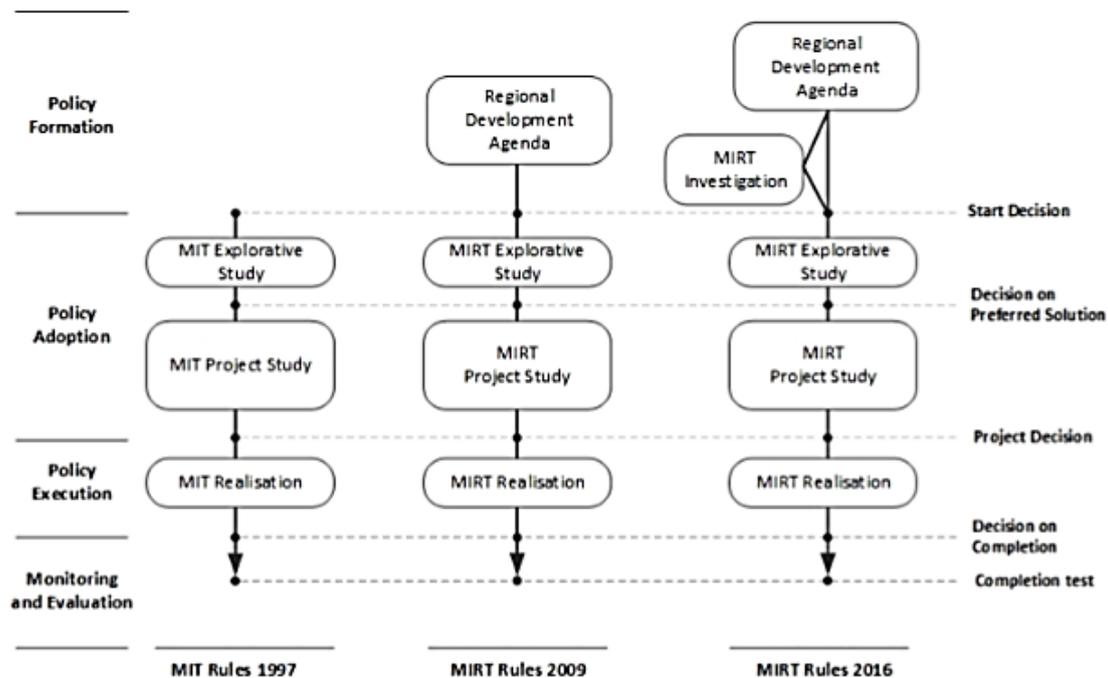
Figure 4. MIRT programme development (Van Geet et al., 2018).

As shown in Figure 4, the MIRT process is in time constantly revised, moving to a more integrated land use planning (Van Geet et al., 2019). To improve synergy in actors and utilization, the MIRT programme is currently being revised, based along on the fundaments: broadening the scope, custom fit, and collaboration (in Dutch: brede blik, maatwerk en samenwerking) (Van Geet et al., 2016). The scope extension is aimed for a more integrated spatial approach. The principle of custom fit is targeting smart solutions in order to create adaptive capacity. Moreover, collaboration is focusing on equal participation. With the MIRT renewal, I&W hopes to achieve more comprehensive, synergetic, supported, and adaptive infrastructure projects (I&W, 2016b).

2.2.6 Future: Adaptive capacity in MIRT

A small interview with a policy advisor at Rijkswaterstaat (the executive agency of I&W) gives insights on what the future will bring for the MIRT programme. The agency is aware of the lengthy period it takes to fulfil the preparation (exploration and planning) for the execution of infrastructure development, and the aligning increased uncertainty that this enhance. Therefore, three future additions to the programme are examined. First, the integral approach (as described in section **2.2.5**) is promising and therefore it is proposed to further extend this. Second, monitoring mechanisms are increasingly important to adapt to uncertainties. Therefore, the MIRT programme must facilitate this even more. Lastly, a closer collaboration between the national government and regional governments is proposed, as this will improve the decision-making process and the integral approach.

3. THEORETICAL FRAMEWORK

3.1 Defining projects and project management

"Nowadays, it is hard to imagine an organization that is not engaged in some kind of project activity. Over the past decade, organizations have been turning from operations to project management as part of their competitive advantage strategy" (Maylor et al., 2006, p. 663).

This citation represents the current state of the projectification of society. A state of the extensive use of projects by individuals and organizations in contemporary society, which significantly expands the definition of the project unit is examined by Maylor et al. (2006). A considerable amount of utilitarian structures has been altered to projectified organizational forms, where working in projects takes the biggest share in their efforts to accomplish work (Engwall, 2002; Perminova et al., 2008; Koppenjan et al., 2010). Nevertheless, in order to understand this phenomenon and to figure out how to manage project organizations, a deliberate analysis of the definition and use of projects is needed. Even though the definition of projects is heavily debated, in this thesis the following definition, as it includes the general characteristics of most definitions, is used: *an unique organizational unit with a mutually agreed predefined goal, with the required work included, which needs to be realized within limited resources* (Ballard & Howell, 2003; Söderlund, 2004; Kor & Wijnen, 2005; Wijnen & Storms, 2007). The basic conceptual model of a project is straightforward, as it is a time-limited task given by one actor – the client – to another – the contractor. According to Figure 5, the project is consisting of three subsequent phases: selection – were the client determines the project -, the execution – were the executor is realizing the pre-determined project -, and the goal assessment – where the project is evaluated and results are compared with the initiated goals (Engwall, 2002). The project goal often is subdivided into three traditional project objectives: scope/performance, costs/budget and time/schedule (iron triangle), which influence and constrain each other (Raydugin, 2013). Risks (the probability of disruption times the consequence) can disturb the project objectives (Versteegen & Rijkens, 2007). Following Eriksson et al. (2017) and Love et al. (2015) scope changes due to external and internal developments are particularly causing costs overruns and time delays. Financial resources and the planning are therefore often rigid composed (see for example the MIRT programme in chapter **2**), generating challenges in completing the project within a set timeframe and fixed budget. Moreover, Olsson (2006) is arguing that an unclear project description is also affecting the project goals.

The earlier discussed MIRT exploration phase and MIRT planning phase can be positioned in the process towards the project execution. The client can originate from the market, from hierarchy (when a parent company is delegating projects towards companies lower in the organizational structure), or the government can serve as initiator (which is common in infrastructural projects) (Wijnen & Storms, 2007).
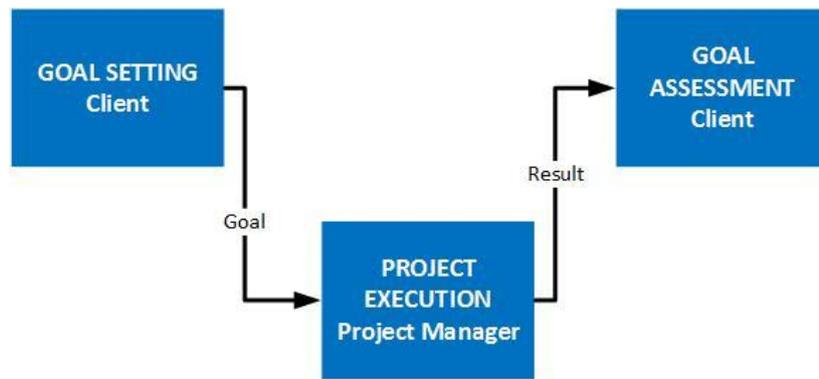
Figure 5. The basic conceptual model of project management (Engwall, 2002).

It implies that production is a fundamental argument for the use of projects. In other words: projects are there to deliver beneficial change (Turner & Müller, 2002). This implies that change needs a certain form of coordination in order to balance available resources and priorities effectively, where the project organization comes in handy (Pellegrinelli, 2011). This coordination can be defined as project management: using several techniques and methods in order to solve a specific problem (Söderlund, 2004). These techniques and methods can be seen in the light of designing, operating, and improving the current situation (Ballard & Howell, 2003). Or, more deliberate: "the complete set of decisions regarding the setup, organization, and management of a project, taken during the various phases of the project, aimed at coordinating the efforts of the various actors involved in order to successfully realize the project" (Koppenjan et al., 2011, p.741). Moreover, this project management team is identified as a temporary organization, as the project has a predefined target (Turner & Müller, 2002). Lastly, as the project is subject to context-specific circumstances such as a unique historical and organizational background, it can be interpreted as a unique venture. Therefore, the project management strategy needs to be fitting to the project circumstances. Various forms of projects need different forms of organization (Engwall, 2003). Project-based approaches usually work within phasing principles, in order to ensure a comprehensive process (Kor & Wijnen, 2005). This phasing also needs to be tailor-made to the project and project organization, as both are suited to context-specific circumstances (Engwall, 2003). According to Kor & Wijnen (2005), and Wijnen & Storms (2007), phasing is based on four key principles: reasoning before action, working from broad towards a small manner, working from present towards future and vice versa, and clustering similar tasks. Regular phasing is consisting of 6 phases: initiative, definition, design, preparation, realisation, and evaluation.

This project phasing is comparable to the framework used in the MIRT programme, presented in Figure 2 (chapter **2.2**). Concentrating on the MIRT exploration phase (section **2.2.1**), the principles of reasoning before action and working from broad towards a small manner can be observed. What is contrasting however, is the severe division in phases.

3.2 Traditional project management

The roots of traditional project management can be found in rational mechanistic thinking. Here, project management tries to balance an assumed predictable world, resulting in tools and instruments based on hierarchy, direct causal relationships, and work-break-down structures (such as Ghant chards) (Geraldi, 2008). This mechanistic thinking implies a focus on measurable and quantitative input data in order to curtail project complexities to technical engineering problems (Busscher et al., 2015). Traditional project management approaches are emphasizing the importance of routine planning (Kor & Wijnen, 2005; Perminova et al., 2008), in a way that planning targets are clear, detailed, and definite, a prior of further planning developments. Working routinely shows advantages with respect to other approaches in terms of efficiency: established methods and decision procedures are known by actors involved and therefore ensure sufficient knowledge about the processes, and facilitation, smoothening replacement of people on functions (Wijnen & Storm, 2007). Planning targets should be specified thoroughly in three dimensions: performance (concerning the scope of the project), time (relating to the temporal length of a project), and costs (referring to the type and amount of resources that is allowed to be spend) (Engwall, 2002; Söderlund, 2004). In project management practice, this dimensional division leads to narrowly defined projects, problematically lacking functional integration with other infrastructure elements (Busscher et al., 2015). Planning is established throughout additional activities such as risk management, including identification, analysis, supervising, and controlling (Perminova et al., 2008; Wijnen & Storm, 2007). These elements of risk management need to be sequentially followed in order to allow the project team to assess the most likely risks (Pinto, 2002). In order to get in control of the project, uncertainty and risks need to be diminished as much and as early on as possible in the process (Engwall, 2002). However, trying to calculate risks can give some difficulties: some risks could be predicted, whereas others are more severe to envision. Likewise, some risks are internal to the organization, where other risks are caused by factors outside of the project. Finally, a division can be made between technically oriented risks, and risks that arise from problems with human resources (Pinto, 2002). Furthermore, through proper risk management, risks that cannot be avoided, could be predicted and controlled (Busscher et al., 2015; Koppenjan et al., 2011; Wijnen & Storm, 2007). Overall, this form of project management can be described as predict and control management, as it focuses on front-end analysis, with a clear-cut switch from development towards execution to control risks (Koppenjan et al., 2011). Considering the above-mentioned description of traditional project management, Glasbergen and Driessen (2004) came up with six key principles of the traditional approach:

a) First, a planning agency, In the Netherlands for example the Ministry of I&W, initiates the project and keeps being formally responsible the whole lifecycle of the project formally responsible;

b) Projects are narrowly and priory defined, resulting in sectoral interests;

c) The agency's project manager who is responsible for the project is in charge of the complete assignment. Therefore, he or she is the centre point of attention (also addressed by Turner & Müller, 2003);

d) The project manager is appointed of the bases on his or her competences. Hence, he or she needs technical expertise, knowledge of organizations, legal abilities, and financial proficiency;

e) The planning of the project is essential and should be executed in detail within the agency itself. Key to this planning is the internal communication within the agency: the plan should be elaborated with all the relevant agency actors, before being made public. On the other hand, generating stakeholder support, most notably other public actors, is a key task for the project manager;

f) The main reason for involving or informing citizens, industry, civil organizations, and other local actors is to gain expertise and information. Communication is considered crucial to gain stakeholder support for the project.

3.3 Managing in complexity

3.3.1 Recognition of complexity

Most strategies in planning practice were based on the idea of deterministic closed systems, with clear-cut elements linked throughout a direct causal relationship (De Roo, 2010), and the believe that through a proper management strategy, risks could be predicted and controlled (Koppenjan et al., 2011). However, during the 1990s, due to developments in chaos theory, complexity theory, and system theory, this planning ideal shifted into a new paradigm (Allmendinger, 2017). Complexity theory developed from chaos theory and recognizes a world where different actors are interacting in open systems. Additionally, it acknowledges that particular situations in these open systems cannot be explained or predicted, resulting in some form of randomness (Curlee & Gordon, 2010). Hertogh & Westerveld (2010) are recognizing two perspectives on complexity: detail complexity and dynamic complexity. Detail complexity is encompassing the notion of the number of components in the system and the interrelatedness of those components. This perspective can also be described as a deterministic approach. Although an increase in detail complexity will make the project more complicated, it will not necessarily make it more complex, in the sense of increasing uncertainty and unpredictability. On the other hand, dynamic complexity is far more corresponding to the earlier mentioned complexity theory perspective. This perspective acknowledges the characteristics of certain systems to evolve over time, due to self-organization and co-evolution of its actors (Hertogh & Westerveld, 2010). These insights imply in certain situations a shift from a linear, predictive reality, towards a dynamic and uncertain environment. This paradigm shift is forcing practitioners to abandon the idea of certainty through extensive risk management, based on systematic knowledge about reality, and convert it into a more realistic world perspective of complexity and incremental change (Byrne, 2003; Duit & Galaz, 2008).

3.3.2 Management in complex adaptive systems (CAS)

Systems that express the core characteristics of complexity theory are called complex adaptive systems (CAS) (Aritua et al., 2009; Moroni, 2015). In these systems, changes occur in an unpredictable and random, spontaneous way. These modifications are generated by different agents' behaviour within the system. The agents are changing their behaviour, based on information and feedback from other agents, which implies self-organization (Duit & Galaz, 2008). According to Boelens & De Roo (2016, p. 46), self-organization can be described as "a process in which the components of a system in effect spontaneously communicate with each other and abruptly co-operate in co-ordinated and concerted common behaviour". This occurs in a way that the macrosystem of the CAS is connected to the

microsystem, without determined steering capacity (Teisman et al., 2009). Considering self-organization, the several elements within the CAS are composed within time and space, and constantly react to altering contextual circumstances (Rauws, et al., 2014). The system does not only show signs of constant change, it also has the ability to learn and improve (Hertogh & Westerveld, 2010). Hence, co-evolution is a key feature of CAS (Duit & Galaz, 2008). Curlee and Gordon (2010) made a thorough description of this phenomenon in their book: "Complexity theory state that critically interacting components self-organize for form potentially evolving structures exhibiting a hierarchy of emergent system properties" (p.7). Co-evolution and self-organization make systems uncertain and hard to predict (Duit & Galaz, 2008). This is making CAS futures multiple and systems open (Byrne, 2003). Based on the observations above, Aritua et al. (2009) came up with six key components of CAS:

a) Interrelationships and interrelatedness: several components in a CAS have relationships or affecting each other due to their interrelatedness;

b) Adaptability: in a CAS, information flows in and out. New information is generating feedback loops within the system, influencing the behaviour of the particles;

c) Self-organization: individual elements in a CAS behave in contiguity;

d) Emergence: although the system's behaviour is derived from the behaviour of the components, the concept of emergence can be described as "the whole is greater than the sum of the parts" (p.77);

e) Feedback: negative and positive feedback is circulating and altered by components throughout the CAS, affecting elements within the system;

f) Non-linearity: modest changes within the CAS can have a major impact on the outcome of the system. Therefore, non-linearity implies uncertainty and unpredictability.

3.3.3 Wicked problems: new management principles

In a traditional project management view, the relation between cause and effect are relatively understandable and linear (as described in section **3.2**). Problems and risks can be identified, located and controlled (Hertogh & Westerveld, 2010). However, complexity knowledge implies a management strategy based on different management principles (see Table 1), as it is not possible to know all the factors, conditions, and relationships (Teisman, 2005). Koppenjan et al. (2011) identifies in addition to the various management principles (Table 1) similar project management approaches (see Table 2). In their article, they refer to type 1 and type 2 approaches, which corresponds to traditional project management (predict-and-control) and process management (prepare-and-commit), elaborated on in section **3.4**. Managing in a CAS and handling wicked problems implies new conceptions about reality. Hertogh & Westerveld, (2010) came up with six notions about the CAS:

a) The stakeholder, product and activity system demonstrate a high level of interrelatedness;

b) The system of actors is highly dynamic, resulting in altering, diverging interests that provoke uncertainty;

c) The external environment and feedback within the CAS can trigger a transformation in behaviour;

d) This change in behaviour can eventually lead to a change to the behaviour of the system;

e) Actions within the CAS are impossible to predict, which encourage managers to make decisions in uncertainty;

f) This situation requires managers with certain capabilities, such as communication and the ability to identify uncertainties.

Dealing with CAS principles, implies that managers must handle so-called wicked problems. The problems are described as problems with a high degree of uncertainty, due to the dynamics of the system (Hurlbert & Gupta, 2015). These problems have the following three characterises (Rittel & Webber, 1974; Roberts, 2000; Head & Alford, 2015):

a. The problem statement is not clear, as actors are simultaneously creating declarations about the problem definition (see also intersubjective understanding of concepts (De Roo, 2010; Allmendinger, 2017) in section **3.3.2**);

b. As the problem statement cannot be defined, so is the solution. Hence, processes are open-ended;

c. The problem-solving process is facing the complexity derived from CAS (see section **3.3.2**), which actors and their interests and values can change during the process (social pluralism).

This wicked problems are affecting the in section **3.1** project objectives, as they are causing challenges regarding so-called unknown unknowns. Following philosopher Donald Rumsfeld, these are risks that we cannot introduce to our risk management tools, as they remain unknown (Raydugin, 2013).

3.3.4 Towards a new project management perspective

These new complexity perspectives and insights of wicked problems underline the need for flexibility and adaptability mechanisms in project management (Koppenjan et al., 2011; Haasnoot et al., 2013). There is a need to focus on *becoming*, rather than *being* in the planning process. This insists a practitioner attitude shift from reactive to proactive (Rauws et al., 2014). These new management principles are forming the basis for a shift towards process management (Busscher et al., 2015), which is a strategy focused on dynamic adaptive plans in order to deal with uncertainty (Haasnoot et al., 2013).

Table 1. Basic assumptions of the two perspectives and corresponding management strategies (Hertogh & Westerveld, 2010).

Perspective	Deterministic perspective	Complexity perspective
Basic Assumptions		
Knowable	The world is knowable, controllable, predictable and manageable.	The complex nature of the world is partly unknowable, uncontrollable, unpredictable and unmanageable.
Rationality	Objective rationality and judgement.	Bounded rationality and boundary judgements.
Coincidence	Coincidences are of minor importance.	Coincidences are more important than any single decision.
Nature	Stability.	Instability.
Viewpoint	Researchers as independent external observers of the world.	Researchers are part of the system.
Openness	Closed system, which can be described separately from the environment outside the system.	Open systems, change in reaction to their environment and vice versa; complex situations evolve over time. Emergence: The system is the source of the characteristics. The rate of change is context dependent.
Causality	A causes B rationality. Solutions are defined in terms of causal factors. The effects between cause and effect are simple, clear and linear.	Behaviour is the results of loops, where variables are interrelated.
Management strategy		
Break down	Reductionism. The whole can be divided into parts, without losing information.	Holism. Appreciation of the world as a whole, comprising many interrelationships. The whole is greater than the sum of parts.
Key to successful organisation	Command and control. The dynamic is directed by a central authority and results from formal rules and practises.	To make connections, which lead to vital networks. Management by 'sense-making'.
Problem Solving	Problems can be identified, solutions located and implemented and everything thus kept under control.	Problem solving must grapple with many interrelationships and emergent behaviour that is inherently unknowable to the human mind.
Goal setting	Focus on long range planning and fixed implementation.	The most we can do is to manage the local. Continuously revisiting what might be going on.
Self-organisation	None. The focus is on organising from an independent position.	Dynamic behaviour is capable of producing unexpected variety and novelty through spontaneous self-organisation.
Main body of theory	Systems management (project management)	Proces management (dutch) Complexity management

Table 2. Differences between predict-and-control and prepare-and-commit (Koppenjan et al., 2011).

	Type I	Type II
	Predict-and-control	Prepare-and-commit
Terms of Reference	Blueprint	Functional
Task definition	Narrow for best control	Broad for best cooperation
Contract	Task execution	Functional realisation
Incentives	Work-task based	System-output based
Change	Limit as much as possible	Facilitate as much as needed
Steer	Hierarchical	Network
Information exchange	Limited, standardised	Open, unstructured
Interface management	Project management task	Shared task

The recognition of complexity and aligning wicked problems thus enforce new assumptions (bounded rationality, open systems, see Table 1) and aligning management strategies, based on holistic approaches, network management, and cooperation (see Table 1 and Table 2) in order to deal with uncertainty. Section **3.4** is elaborating more on what this change connotates for management.

3.4 Process Management

Alternatively to project management, which is focusing on a deterministic predict-and-control perspective (deterministic perspective in Table 1 and type 1-perspective in Table 2), is process management (complexity perspective in Table 1 and type 2-perspective in Table 2). This management approach is focusing on irrationality, non-transparency, and competition over resources (Duijn et al., 2016). In order to reduce costs and time overruns, which are common in project management, complexity theory is embraced (Koppenjan et al., 2011). Dealing with uncertainty and aligning wicked problems can be seen as the most important characteristic of process management (Glasbergen & Driessen, 2004; De Bruijn et al., 2008). Van Meerkerk et al. (2013) for example is arguing for a complexity sensitive management strategy in order to deal with planning contexts characterized by a high variety of interdependent stakeholders and additional dynamics. Such a strategy implies that attempts of steering or managing a CAS, are always going hand in hand with local dynamics of self-organization, and co-evolving developments (Teisman et al., 2009) In order to deal with complexity, management strategies should have an external focus (a focus on actors) and a sufficient amount of flexibility in order to deal with the ever-changing environment (Duijn et al., 2016). Flexibility can be described as "the ability to act proactively in a beneficial way to changing circumstances or to the outcomes of management decisions (Hertogh & Westerveld, 2010, p. 290). Reaching flexibility is fundamental to create adaptability in the management approach (Koppenjan et al., 2011). This entails a focus on the social context, where local actors (individual citizen interest, NGO's, and other organizations) should have a role in the development of a project (Glasbergen & Driessen, 2004). In this way, managers can become an integrated part of the actor-network, hence co-evolve with it (Boelens & De Roo, 2016). De Bruijn et al., (2008) specified four fundamental components of interactive management, together with fourteen derived management principles (see Table 3).

Table 3. Fundamental management components and aligning principles (De Bruijn et al., 1998) in Hertogh and Westerveld (2010).

Design principles of Interaction (De Bruijn et. al., 1998)		
Openness	1	All relevant players are involved.
	2	Choices are agreed upon in process agreements.
	3	Transparency of processes and interaction.
Safety	4	Core values of players are protected.
	5	Commitment to the process, not to the result.
	6	Players can postpone commitments.
	7	Exit rules.
Progress	8	Incentives for co-operation, especially at the completion of processes.
	9	Top level players.
	10	The context is used to accelerate the process.
	11	Try to remove conflict from the centre of the interaction.
	12	Command and control as an accelerator for interaction.
Content	13	Content facilitates process. Experts and stakeholders have different roles.
	14	The process develops from variety of content to selection.

The process within a CAS is far more interactive than within a traditional closed systems. The management approach, therefore, must focus on stakeholder interaction and flexibility in order to deal

with a changing context and new insights. The approach needs to base on the project's development (Hertogh & Westerveld, 2010; Rijke et al. 2014). Or as De Roo (2010) is framing it: a focus on *becoming* instead of *being*.

Interactive strategies are aiming for influencing the self-organization processes in a way beneficial to the project (Edelenbos et al., 2013). This is according to Hertogh and Westerveld (2010) leading to four extensive management strategies: alignment with stakeholders, flexible project scope, usage of short-term predictability, and variation. These strategies are based on the assumptions made in Table 1 and Table 2 and the principles made in Table 3.

a) Stakeholder alignment: The main challenge for process managers is to align and coordinate relevant stakeholders in such a way that a shared vision about the project outcome and the realization of these objectives is conceived. This strategy is attached to various actor interests in the project environment (De Bruijn et al., 2008; Hertogh & Westerveld, 2010). Agendas and issues should be corresponding in order to align (Edelenbos et al., 2013). Managers should invest project resources in stakeholder participation in order to reach consensus. Hence, adapting to developments in the project context (Duijn et al., 2016). A general agreement can be accomplished by establishing an understanding of intersubjectivity (De Roo, 2010; Allmendinger, 2017) and ambiguity. Moreover, interaction based on exchanging arguments between different actors and collective action is crucial (Hertogh & Westerveld, 2010). Glasbergen and Driessen (2016) argue that in order to ensure a variety of societal interests, the planning procedures should be open in early stages. Here, the focus should be on process agreements, rather than project goal agreement (De Bruijn et al., 2008);

b) Flexible project scope: The result of the stakeholder alignment needs to be incorporated into the project. This could mean that in order to adapt to this, the scope of the project needs to be adjusted to a formed consensus (Hertogh & Westerveld, 2010);

c) Usage of short-term predictability: Complexity embracing management implies managing in uncertainty as co-evolution and self-organization make systems hard to predict (Duit & Galaz, 2008). Even though developments are often non-linear, the short-term patterns can be predicted. Through constant monitoring complexity over time, management strategies can be adjusted and tailored to the project's development (Hertogh & Westerveld, 2010). Hence, in order to be proactive (Rauws et al., 2014) adaptability mechanisms need to be implemented into the management approach (Koppenjan et al., 2011);

d) Variation: In order to overcome complexity, a variety of management strategies can help increase the probability of a fitting approach. The actor-network often is varying, hence the variation in strategies can help to adapt to this mixture (Hertogh & Westerveld, 2010). Variation can be achieved by creativity generation (Axelrod & Cohen 2000).

3.5 Conventional project management strategies

3.5.1 PMBOK

The Project Management Body of Knowledge (in short PMBOK) is a project management framework designed by the Project Management Institute (in short PMI). It is observing project management as multiple interlinked and interdependent processes, which is guiding projects towards a desired outcome (Chin et al., 2010). Three key elements can be observed within PMBOK: processes, points of attention, and techniques (Kor & Wijnen, 2005). The framework is consisting of five general process phases: initiation, planning, execution, monitoring and closing (Chin et al., 2010). Within these process phases, an information flow is generated (Kor & Wijnen, 2005). Each of these phases is consisting of multiple knowledge areas, including project integration management, project scope management, project time management, project cost management, project quality management, project human resource management, project communications management, project risk management, and project procurement management. These knowledge areas are further divided into core (containing scope, time, costs, and quality management) and facilitating (human resources, communication, risks, and procurement management) elements (Chin et al., 2010). PMBoK is a result-driven way of management, where quality is guaranteed by using a universal project management approach (Kor & Wijnen, 2005). PMBoK is well-structured and contains comprehensive elements, which makes it very accessible for managers to use at a variety of projects. However, due to its very prescriptive and regulatory nature, PMBoK can impede process creativity (Chin et al., 2010), and therefore variation as shown in chapter **3.4** (Leendertse, 2019).

3.5.2 PRINCE2

PRojects IN Controlled Environments 2 (in short PRINCE2) is a unique project management approach, developed by the Central Computer and Telecommunications Agency (CCTA) (Chin et al., 2010). Based on quantitative data, this management approach is providing a framework for regulating predefined goals (Aritua et al., 2009; Harting & Van Heemst, 2015), considering the whole project-lifecycle. (Wideman, 2002; Lycett et al., 2004). The method is consisting of the management of organizational teams (defining what responsibilities and authority different actors in the team have), guiding the management processes of a project, providing structures and composition for important project documents, and providing guidelines for quality control strategies. PRINCE2 is often considered a project-based management approach, as it is including processes necessary for the accomplishment of a project, rather than abilities and techniques for managing the projects (Chin et al., 2010; Kor & Wijnen, 2005). Essential for these processes is the use of common sense and the focus on the end-product (Harting & Van Heemst, 2015). PRINCE2 is especially useful for projects in need of effective utilization. As PRINCE2 methods are focused on the process, it contains a certain form of flexibility to steer the project in order to maximize the project outcomes. However, its structured method is restricting managers to be adaptive (Chin et al., 2010).

3.5.3 Project-based working (in Dutch: projectmatig werken, in short: PMW)

PMW (in some other publications mentioned as Twynstra Gudde ProjectManagementMethode (Kor & Wijnen, 2005)) is a result-oriented and efficiency-based project management approach which is positioned between improvisation and routine. The method is useful in projects that are not entirely

unfamiliar for those involved, but demand for some flexibility as not all elements are known beforehand (Wijnen & Storm, 2007). The goal of the client is central in this approach (Kor & Wijnen, 2005). To achieve this predefined target, the original demands of the client are incrementally translated into detailed specifications in a way that involves the client's wishes in the incremental process. All details are subsequently divided into project phases, where additionally the allocation of resources is provided. Key is the improvisation within the process of negotiation and agreement with the client (Wijnen & Storm, 2007). This can be seen as a part of the stakeholder alignment, discussed in section **3.4**.

3.5.4 SCRUM

Alternatively, SCRUM is providing an agile project management strategy, originated from agile software functionalities. This approach is based on flexibility, rather than vast control (Koskela & Howell, 2002). Moreover, individual actions and interactions (for example
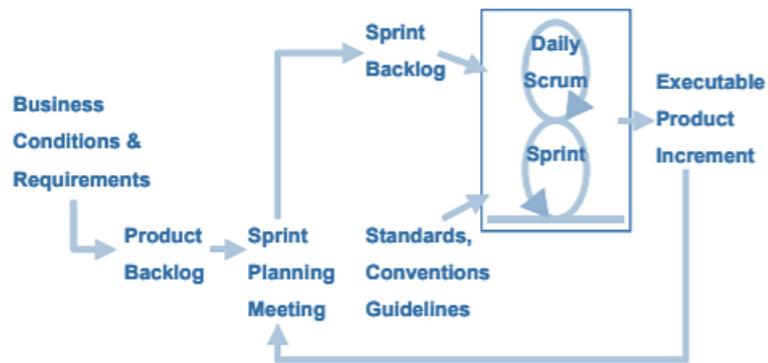
Figure 6. Overview of SCRUM (Koskela & Howell, 2002)

responding to disturbances) are placed above management tools and processes (Cervone, 2011). SCRUM is standing on the principle of evolution, resulting in the absence of both a Work Breakdown Structure and a centralized authority. Instead, SCRUM is consisting of two cycles (see Figure 6): The Sprint (duration of one month) and the daily scrum. During sprint planning meetings, the monthly performances of the project are discussed and defined. The sequential daily cycles are determined by the sprint cycle, where action is adhered to the contextual situation. Central guidance is decentralized towards the members of the project team, which are responsible for their own tasks. However, their daily work needs to be aligned with the rest of the team. Communication is therefore essential. Control is executed in threefold: the first level of control is on the individual scale, where progress is reported towards the daily SCRUM meetings. On the next level, the team is reporting their development to the client, where progress is compared to the planned achievements. The last level of control concerns the project in total. After each Sprint, the Project Backlog is revisited, and progress is evaluated (Koskela & Howell, 2002; Cervone, 2011). Hence, risk management is promoted more formally, and proactively than traditional management methods, as the sprint helps the team to identify threats to the process through constant feedback instead of risk analysis through a simple risk register (Tomanek & Juricek, 2015). Fundamental to the SCRUM method is the absence of central navigation. Alternatively, action comes directly from the team members and is derived from the particular situation (Koskela & Howell, 2002). Within the SCRUM management, short-term predictability, as examined in section **3.4**, is essential.

3.5.5 Integrated project management (In Dutch: Integraal projectmanagement, in short IPM)

To facilitate proper internal and external collaboration, Rijkswaterstaat is working within an integrated form of project management. This standardized strategy is distinguishing five separate roles:

- Project management: Aiming for quality insurance, stakeholder support, and coordination;
- Project control: Focusing on controlling risks within the project;
- Stakeholder management: Used for balancing the environment and stakeholders, and the project;
- Contract management: Focusing on the risks that are ascending from the project between the client and the project management team;
- Technical management: Responsible for managing the risks that occurs due to technical issues.

By distinguishing different roles within the project, Rijkswaterstaat hopes to clarify the task division and therefore improves efficiency (Rijkswaterstaat, 2019a).

3.6 The paradox in management: emergence of adaptive management

Traditional project management (section **3.2**) and process management (section **3.4**) are based on opposite principles and useful for different complexities in projects, hence they can be observed as two extremes of project management. These extremes can be fitted (Figure 8) into the rationality spectrum (De Roo 2010; Porter & De Roo, 2012) between technical rational and communicative rational approaches, hence both serve two extremes in complexity (not complex and simple problems towards high complex and wicked problems (see section **3.3.3**). Chapter **one** stated that infrastructure projects increasingly have become more complex (Eriksson et al., 2017; Locatelli, 2017; Love et al., 2014; Klakegg et al., 2016), which amplifies the need for more flexibility measures into project management. The bulk of issues however are positioned between the two extremes, for that reason finding profit from both management strategy extremes.
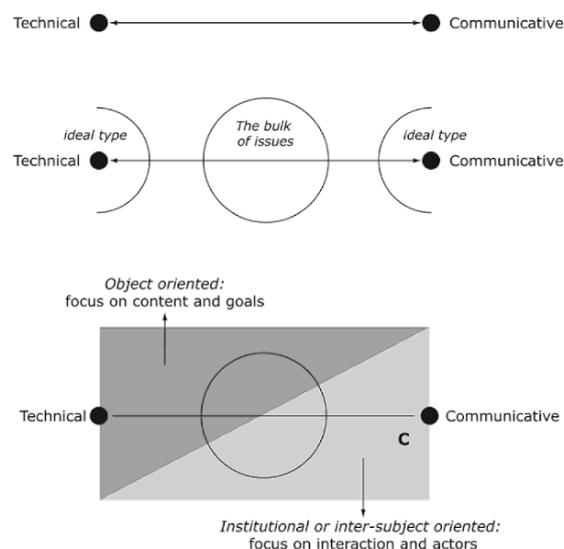
Figure 7. Two extremes in complexity (De Roo, 2010).

Figure 8. Management extremes (Source: Author, 2019, based on De Roo, 2010)

In order to be successful, a management strategy should include a proper balance of control (in order to regulate, predict, and decide) and flexibility (in order to adapt to uncertainty) (Hertogh & Westerveld, 2010). Contempered project management literature emphasizing the significance of a harmony between control and flexibility (Cooke-Davies, 2002; Koppenjan et al., 2011). Hence, the principles of project management (section **3.2**) and process management (section **3.4**) should be connected. However, this creates a paradox in management as combining these strategies can create tensions, as Figure 9 shows.
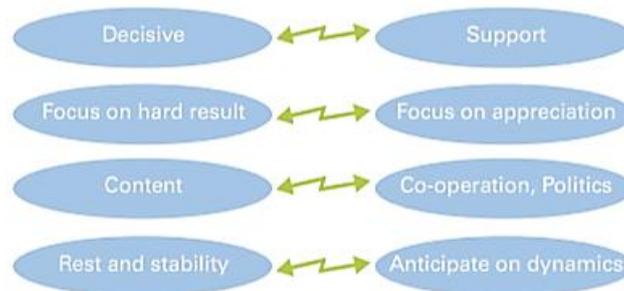
Figure 9. Tensions between control and flexibility (Hertogh & Westerveld, 2010)

Crucial in overcoming the tensions shown in Figure 9 is the idea of evolutionary resilience. According to Davoudi (2012) and Hertogh & Westerveld (2010), this concept can be described as the ability of systems to alter, adapt and transform as a reaction to external development (see section **3.4** for causes and clarification of system change). The idea of Folke (2006) that resilience also contains a certain form of absorption can be added to this notion. Adaptivity can be seen as the management capacity focused on the resilience property of the system. Adaptive capacity is the ability of a system to manage an altering context, by which the core of the system (for example the goal) is protected (Gupta et al., 2010). In the light of self-organizing capacities of a CAS and associated uncertainty, understanding and knowledge should be constantly updated and adjusted (Folke et al., 2005). Adaptive capacity promotes the resilience of a system (Walker et al., 2006). In management terms, it describes the capability of mobilizing project resources (which can be divided into "authority (legal and political mandate), human (knowledge, skills and labour), and financial (including access to technological) resources" (Gupta et al., 2010, p. 9)) to respond to external modifications that harm the management process (Adger et al., 2007). In other words: management action is needed after a process reaches the point where current action no longer leads to achieving the project goals, called tipping points (Haasnoot et al., 2013). These resources have to be assigned in a sense that it enables collaboration, flexibility, and learning processes (Hurlbert & Gupta, 2015), as each management action has to be observed as an opportunity to learn and, by doing that, adapt to the altering context (Folke et al., 2005). Haasnoot et al. (2013) are describing this phenomenon as a trade-off between the strategic vision of the future (control) executed through

short-term predictability (which generates the wished flexibility). Literature describes that adaptive capacity can be achieved through three pillars: creative capacity, learning capacity, and cooperative capacity (which corresponds to the extended management strategies described in section **3.4** (stakeholder alignment, flexible project scope, usage of short-term predictability, and variation), but are aligned with the concept of resilience):

a. Creative capacity enables variation (see section **3.4**) in management, which is generating potential alternative pathways (discourses and solutions), which increase the probability of a fitting, tailor-made approach (Axelrod & Cohen 2000; Hertogh & Westerveld, 2010; Gupta et al., 2010). To enable creative capacity, a variety of problem understandings and solution perceptions needs to be allowed in organizations. Moreover, a diversity of actors and levels need to be recognized to ensure a description of a solution which is tailor-made for the specific context. Lastly, accepting abundance in the short term is needed to improve the strategic plan in the long term (Gupta et al., 2010). This pillar can, in short, be observed via the following elements: allowing multiple understandings and solutions and allowing a diversity of actors and levels.

b. Learning capacity forms the basis for adaptivity (Teisman et al., 2009), as it allows the organization to recognize changed circumstances based on experiences (see section **3.4**: making use of short-term predictability). Crucial for learning capacity is collecting data (monitoring), evaluating this data, and using it (adaptation). Constant learning mechanisms result in iterative decision-making to adapt these in further actions on the basis of this learning process (Axelrod & Cohen 2000; Hertogh & Westerveld, 2010; Gupta et al., 2010; Hurlbert & Gupta, 2015). Folke et al. (2005, p. 447) are describing this process as 'sense making': "taking interpretations seriously, inventing and reinventing a meaningful order and then acting upon it." An adaptive management style encourages its actors to constantly learn, as they permit questioning in de organization nested ideologies, frames, assumptions and rules. As figure 10 shows, learning capacity can include single loop

Figure 10. Two types of learning (Willems et al., 2015).

learning (development of daily routines) or double loop learning (dispute existing frames and basic assumptions through experimenting) (Gupta et al., 2010; Willems et al., 2015). This pillar can, in short, be observed via the following elements: collecting data (monitoring), making sense of the data (evaluating), adjusting to this data (adaptation), encouraging organizational actors to learn, and discussing doubts (taking interpretations seriously).

c. Cooperative capacity is crucial for generating diversity and synergy within the process (Leendertse, 2019). Alignment of actors (see section **3.4**) can help to create a shared vision (Hertogh & Westerveld, 2010; Head & Alford, 2013). This can be more surpassing than a strategy based on the action of autonomous actors, as it makes use of the self-organization of

the CAS it is working in (Roberts, 2000). In order to enable cooperative capacity, the planning process should be open and transparent in early stages (Glasbergen & Driessen, 2016) and agendas (including the spread of power of production and to hinder) should be equally divided among the actors (De Bruijn et al., 2008). Project managers, however, need to keep in mind that an open process generates expectations from actors involved (Leendertse et al., 2016). Moreover, interests should be transparent and coupled (Edelenbos et al., 2013). Transparency is crucial for gaining trust. However, as it generates reactions, it can in addition develop tensions to the project organization (Leendertse et al., 2016). This pillar can, in short, be observed via the following elements: aligning actors, open and transparent planning process, and equally divided agendas.

3.7 Conceptual framework

A representation of the structure of this research is given in the conceptual framework (Figure 11). From theory, several project management challenges are derived (section **3.1**). Scope changes, due to unforeseen circumstances, lead mostly to costs overruns and project's delay. Moreover, working with a fixed budget and a set timeframe often challenge project managers. Furthermore, unclarity about the project ambitions and definitions are causing difficulties. Traditionally, project managers tried to counter these challenges with a management approach based on the idea of
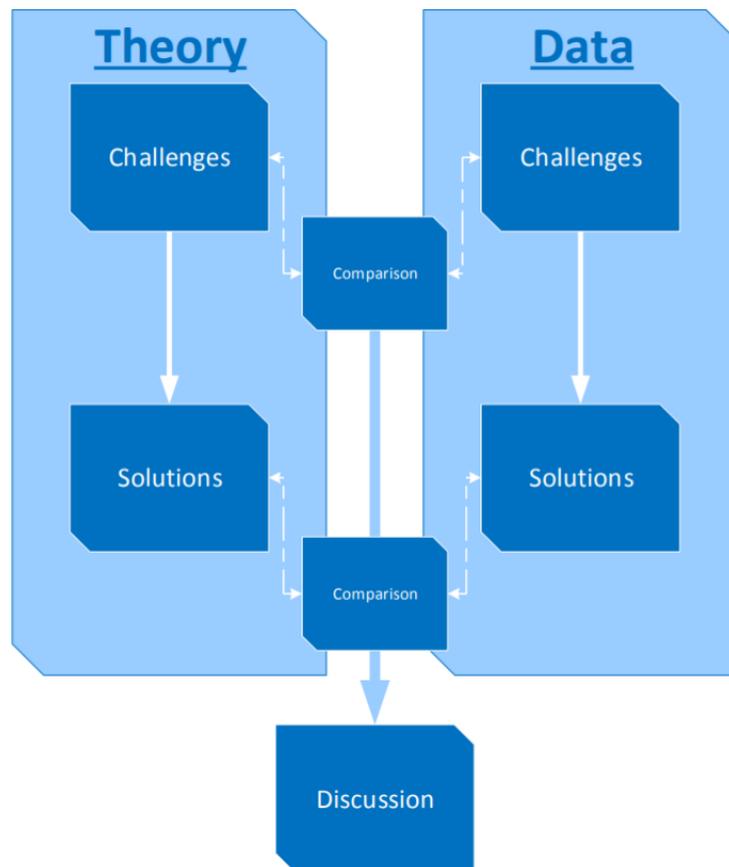
Figure 11. Conceptual framework (source: author, 2019)

closed systems and a world of certainty (section **3.2**). However, the notion of wicked problems changed that idea towards a process management strategy focussed on adaptivity (section **3.3** and **3.4**). These solutions can shortly be described as implementing creative capacity, learning capacity and cooperative capacity (section **3.6**).

This research is trying to find empirical answers to how adaptive management is interpreted and practised by managers in Dutch large infrastructure projects and how it can be aligned with the MIRT programme, in order to create guidelines for project managers. From data, several challenges (section **6.1**) and proposed solutions (section **6.3**) are derived. These are both compared with the findings from the theory, which are described above. Based on these comparisons, several discussions are held in chapter **7** to interpret the analysis. This is done by placing the results in an institutional context (section **7.1**) and by comparing scale levels (section **7.2**).

4. METHODOLOGY

This chapter amplifies the research strategy, and the motivation behind this plan of action (section **4.1** and section **4.2**) Hereafter, the choices for the cases are explained in detail in section **4.2.3**. Next to that, the methods for data collection (section **4.3**) and the analysis of the results (section **4.4**) are described and clarified. Lastly, the data management framework and ethics (section **4.5**) during the research are defined.

4.1 Research design

As chapter **3**, and more specifically sections **3.6** and **3.7**, indicates, combining management approaches based on control and adaptivity in projects is essential, but often creates tensions. As Glasbergen & Driessen (2004) already mentioned, the trade-off between these two extremes is context dependent, as it is focusing on the local social actors, which are varying from case to case. This is also specified as 'content' in the design principles of interaction by De Bruijn et al. (1998) (Table 3).

In order to answer the research questions, and thereby gain an understanding of the complexity of the research problem (how to be adaptable to uncertainties, and how this adaptive strategy can be implemented in a MIRT institutional context), the vision, opinions and meanings of project managers need to be understood in a given project context. To gain an in-depth understanding of behaviour of interrelated actors in complex situations, a qualitative research strategy is most suitable (Stake,1995; Clifford et al., 2010; Hennink et al., 2011), as causality is hard to examine and formulate by the researcher (Bueren et al., 1999). Although qualitative research is a broad term, it is described as a research approach that allows researchers to investigate people's experiences, by using a set of specific qualitative research methods, and by analysing the perspective of the participants (Hennink et al., 2011). The primary research question, *How can the project's management strategy during MIRT explorations be aligned to flexibility in a project's planning phase to be adaptable to uncertainties?,* for example, legitimizes the choice for a qualitative research design, as the relation between the strategy used in MIRT explorations and the flexibility in the planning phase is arduous to examine, due to the complexity of project management organizations.

In order to conduct proper qualitative research, the Hutter-Hennink qualitative research cycle (see figure 12) is used as a framework for the research. This framework is consisting of three interconnected cycles: the design cycle (conceptual phase of the research, including the construction of research questions, exploring academic and non-academic literature, and establishing a conceptual framework), the ethnographic cycle (field application, containing the development of the research instrument and the data collection), and the analytical cycle (analysis and theory development, encompassing the description and comparing of data) (Hennink et al., 2011).

4.2 Design cycle

The design cycle is the first element of solid qualitative research. According to Hennink et al. (2011), it is consisting of four components: research questions, literature and theory, conceptual framework and fieldwork approaches. The research questions can be found in section **1.2**. To gain a solid theoretical framework, various academic literature and non-academic literature (such as management novels and project documents) are studied, as presented in chapter **1, 2** and **3**. It is noteworthy that the various elements and components are interlinked (Hennink et al., 2011). This means that the theoretical framework is embedded in the research questions. To provide
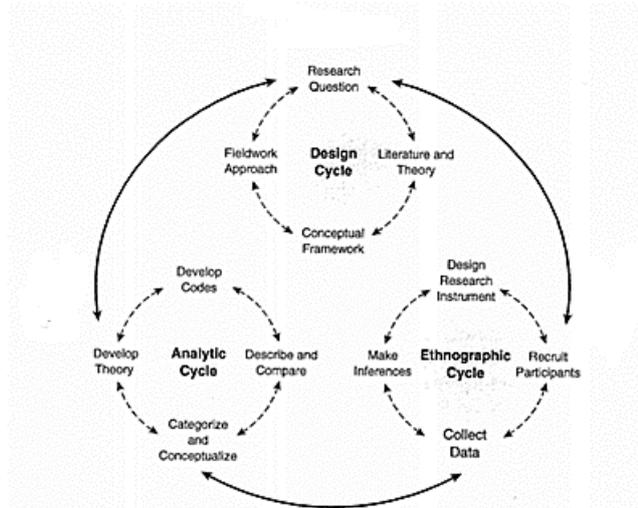
Figure 12. Hutter-Hennink qualitative research cycle (Hennink et al., 2011).

structure and focus to the research, a conceptual framework is designed on the basis of the theoretical framework. Lastly, in order to gain in-depth knowledge about understanding the connection between the project management strategy used in the exploration phase and aligned flexibility in the planning phase, this thesis made use of a multiple case study approach as fieldwork approach. "A multiple case study enables the researcher to explore differences within and between cases. The goal is to replicate findings across cases" (Baxter & Jack, 2008, p.548). As project management is by definition a field of research that is examined in various way in practice a multiple case study approach is chosen for this research.

4.2.1 Elucidating the problem description

In order to clarify and refine the research problem, small interview with project managers and MIRT insiders were conducted. Here, practical information about the (future of the) MIRT programme and about project phasing is obtained. In this way, the formulation and interpretation of these fundamental elements within the problem description are specified and the institutional context is further clarified (see chapter **2**).

4.2.2 A case study approach

Case study research is characterized by: a small number of research units, focus on depth instead of width, selective sampling, qualitative research methods and open examining on location (Bueren et al., 1999; Verschuren & Doorewaard 2005). Within case study research, four distinctive methods can be examined: document analysis, interviews with key actors, observation, and utilizing secondary data (Bueren et al., 1999). For this research, a document analysis, observation, and interviews are used (see Table 4). A researcher is required to make deliberate choices in defining the type of case study the logic of research design, data collection techniques, approaches to data analysis, interpretation and reporting (Yin, 2003). To gain the in-depth knowledge, this research has used extensive qualitative research methods, because these are useful especially in understanding underlying intentions of actors (Clifford et al., 2010) as it is exploring and interpreting people in their daily practice (Orb et al., 2000). In other

words, it concedes values and assumptions of key actors in the research (Yin, 2003). The downside of this method is that generalization and explanatory potential is limited (Stake, 1995; Clifford et al., 2010). In order to preclude a one-sided perspective on the research topic, the theoretical background is provided with multiple sources. Based on this framework, semi-structured interviews were composed, conducted, transcribed, coded and analyzed. Moreover, the results are strengthened through the use of multiple data sources (Clifford et al., 2010; Yin 2013): besides semi-structured interviews, various project documents were examined, and observations from within organizations are used. An overview of the research methods, the goal of this techniques and the practical application can be found in Table 4.

Table 4. Overview of research methods.

Research method:	Goal:	Practical application:
Interviews	Obtaining in-depth knowledge of underlying intentions from project management practitioners in a MIRT institutional context.	Semi-structured interviews with several project managers in a multiple case study framework.
Document analysis	Providing context to the management strategy and specify adaptive measures in project decisions and how these are communicated to outsiders.	Reading and coding various project documents.
Observation	Obtaining examples of practical implementation of adaptive strategies within a MIRT institutional context.	Through observation during days at project sights and during group meetings with practitioners.

4.2.3 Case study selection

The unit of analysis, or the case, is determined by defining the spatial boundary, theoretical scope, and timeframe (Yin, 2003; Baxter & Jack, 2008). The spatial boundaries of this case-study research are the borders of the multiple cases that are researched, based on the MIRT overview 2018 and the Hoogwaterbeschermingsprogramma 2018 (which is following the MIRT guidelines). The research is using six cases in order to preclude a one-sided perspective. Following the theoretical framework (chapter **2**), which is based on the five key concepts: complexity, flexibility, project management, process management, adaptive capacity, the cases are selected based on the following criteria:

- Projects used need to be in the MIRT planning phase or at the end of the MIRT exploration phase (see section **2.2.1** and **2.2.2**). In this way, the project management strategy and difficulties of the exploration phase can be observed;

- There needs to be a certain form of complexity and aligning wicked problems (section **3.3**, more specific section **3.3.3**) within the exploration phase of the project. This is important as it is forcing managers to react to uncertainty;

- Cases are chosen at different scale levels (national and regional, including the administrative level of Dutch Provinces and Dutch Water boards) in order to examine how context is affecting the management strategy and investigating what the feasibility of learning between scale levels is.

In order to compare cases on the same scale level, the selection is made on the basis of the objective, scope and budget of the case (Engwall, 2003). Because actors are often interdependent (Hertogh & Westerveld, 2010), their relationship can change over time. Hence, it is of importance to set a clear timeframe. The research ran from 11-2018 towards 07-2019. Data collection was done from 04-2019 until 06-2019. This period is defining the time boundaries of the thesis. Table 5 gives an overview of the cases and aligning scale level used in this research. An elaboration on the cases is provided in chapter **5**. The cases that were chosen are comparable with the other MIRT cases, as they follow the same guidelines. Following the case study characteristics of section **4.2.2**, the beliefs and expectations of key actors in these cases are assumed representative for the whole MIRT programme.

Table 5. Overview of cases.

Case:	Scale level:
InnovA58	National
A67 (Leenderheide-Zaaderheike)	National
A15 (Papendrecht-Sliedrecht)	Regional, province administration
N33 (Zuidbroek-Appingedam)	Regional, province administration
Dyke improvement Wolferen-Sprok	Regional, Water board administration
Dyke improvement Noordelijke Randmeerdijk	Regional, Water board administration

4.2.4 Document analysis

An extensive literature analysis has taken place to derive an academic understanding of project management and adaptivity. Within the research, this is examined with data from the case study and further discussed. The literature analysis is conducted by using keywords such as 'project management', 'process management', 'MIRT programme', 'adaptivity', 'flexibility', and 'infrastructure development' (all in the English language), as these words are of relevance for the subject of this research. Google Scholar and SmartCat are used as literature databases in a period between 11-2018 towards 07-2019. Documents are selected based on the year of publication, relevance, and a scan through the abstracts. Moreover, a thorough document analysis is conducted to identify the general information about the MIRT programme, as well as the different cases. The documents are selected by performing desk research and by following recommendations from daily supervisors and participants. An overview of the analysed documents can be found in **Appendix 5.**

4.3 Ethnographic cycle

The ethnographic cycle is the second element of a proper qualitative research. This cycle is consisting of four components: design research instruments, recruit participants, data collection and making inferences (Hennink et al., 2011). As stated before, the data collection is consisting of a document

analysis, observations, and semi-structured interviews with relevant actors in the different cases (further elaboration provided in section **4.4.2**).

4.3.1 Semi-structured interviews

Using semi-structured interviews is a research instrument were verbal interchange between a participant and an interviewer is used as source of data. Through a predefined list, the interviewer tries to obtain information by asking questions (Clifford et al., 2010). The construction of these questions is crucial, as different types of questions are delivering different types of data. In this research, open questions are used to gain insights in values, perspectives and assumptions (McQuarrie, 2016). An interview guide (section **4.3.3** and **appendix 3**) is key in conducting semi-structured interviews. This list of questions is providing the basis for the interview, and is generally consisting of an introduction (for example background of the interviewer, goal of the research, permission for recording, and data management), opening questions (broadly related to the key topics), key questions (essential questions to the research topic), and closing questions (broader general questions, participant can ask questions to the interviewer) (Hennink et al., 2011; McQuarrie, 2016). These interview procedures can be found in detail in **appendix 3**. All interviews are conducted in person, on a place most suitable for the participant, and take approximately one hour on average. An overview of participants and interviews can be found in **appendix 6**.

4.3.2 Interview guide

The interview guide is formed after the structure provided by Hennink et al. (2011) (see chapter **3**). The interview guide, the connection with the theoretical framework and the aligning interview procedures can be found in **appendix 3**. This appendix is including the general interview procedures, containing behavioural precedents, emphasized by McQuarrie (2016).

4.4 Analytical cycle

The analytical cycle is the third element of the Hutter-Hennink cycle and is consisting of the following elements: development of codes, description and comparison of data, categorization and conceptualization, and theory development. In this part, the theory is established on the basis of data analysis (Hennink et al., 2011).

4.4.1 Coding

Coding is the practice of providing interpretive tags to a transcript of a document. Through proper coding, data can be categorized, and patterns can be observed (Clifford et al., 2010). In other words, it helps compare the different interviews and different cases sufficiently. Ideally, qualitative research has a mix of inductive and deductive codes (Hennink et al., 2011). This research mostly has focused on predefined deductive codes (see the conceptual framework (Figure 11) in section **3.7**), but also allows some flexibility in inductive codes derived from issues and measures raised by participants. The coding scheme can be found in **appendix 4**.

4.4.2 Policy document analysis

Several documents are analysed (see **appendix 5**) by extensive reading and relevant portions are coded, on the basis of the coding scheme (see **appendix 4** and section **4.4.1**).

4.4.3 Semi-structured interview analysis

The data obtained from the semi-structured interviews (see **appendix 6**) first have to be transcribed and anonymised before it can be coded on the basis of the coding scheme described in section **4.4.1** (Hennink et al., 2011). The data is analysed with the help of two software programmes. First, transcripts are made using Inqscribe, which helps conducting the transcripts thoroughly and efficient. Second, the software of ATLAS.ti is used for analysing the transcript and provide it with codes.

4.5 Data Management and ethics

As privacy is nowadays a key issue, the management and storage of obtained data need to be done safe and precisely. The data and analysis obtained in this research is directly anonymized. Moreover, storage is done thoroughly, as an external device and passwords on the files are used. On the moment this research is published, the raw data is deleted, and the transcripts are stored carefully. **Appendix 1** and **appendix 2** are used to provide the participants with information about the data management and about how the data is used.

Ethical affairs are consistently present in various types of research. The essence of the research process is creating tensions between, on the one hand, the aim to generalize, and, on the other hand, the right on the privacy of participants. Using advised ethical principles, harm for participants can be reduced or avoided (Orb et al., 2000). The following ethical principles are considered while doing this research (Hennink et al., 2011):

- Participants should be provided with sufficient and adequate information considering the goal of the research and the goal of the interview in a way they can make a voluntary decision to participate;
- Participants always keep the right to refuse participation or alter their interviews, without negative consequences;
- Researchers are not allowed to harm participants or bring them in danger;
- The identity of participants is protected at all times, which means anonymity (Clifford et al., 2010);
- All data is confidentially analysed and stored properly (see also section **4.5**).

In order to emphasize the above ethical principles and to make sure the participant is consciously engaged in this research, the forms "information sheet" (see appendix **1**) and "agreement to participate" (see appendix **2**) was signed on forehand of interviews. All participants agreed to sign this form.

5. INTRODUCTION OF THE CASES

5.1 InnovA58 (Combination of highway extension A58 Sint Annabosch-Galder and A58 Eindhoven-Tilburg)

The 160 km long Dutch A58 highway is an important connection between Vlissingen (Province of Zeeland) and Eindhoven (eastern part of the Province of Northern Brabant), as it is connecting most sizable cities in Northern Brabant from East to West. Moreover, the route is part of the economic crucial linkage between Rotterdam and Antwerp, and Rotterdam and the German Ruhr area. Two parts of the highway are being broadened in the direction of two times three lanes, in order to neutralize the predicted growth and aligning congestion, and accessibility of the region. Hence, improving traffic performance, striving for an average travelling time in the rush hour that is at maximum one and a half time as high compared to normal. Furthermore, the project has the additional ambition to explore in which way innovations can help improve the results of the project. This supplementary initiative focuses on the optimal lifecycle, smart mobility, energy neutrality, new services and the decrease of environmental hinderance (Movares, 2014; Ministry of I&W, 2019d; Smartwayz.nl, 2019). Nonetheless, during the exploration phase, the project faced some complications. Starting as a MIRT exploration for the whole highway, the project has faced many revisions, leading to the current combination of two elements (with two separate planning executions), with an important innovation assignment. This component is conducted within a living lab. One of the two elements, the Sint Annabosch – Galder part, is already delayed half a year behind the original schedule.

Table 6. Specifications InnovA58.

Area:	North-Brabant, Southern part of the Netherlands
Subject:	Highway
Main driver:	Ministry of Infrastructure and Water Management
Current Phase	Planning
MIRT exploration:	2013-2016
Budget:	€ 412 million ,-
Management strategy:	IPM

5.2 Reconstruction of highwayA67 (Leenderheide-Zaaderheike)

In order to neutralize predicted growth especially in freight traffic on the A67, the Ministry of Infrastructure and Water Management decided to start a MIRT exploration on this trajectory. The highway is an important connection between the brainport South-Eastern Brabant and the greenport Venlo, which makes is a project of national interest. Therefore, the highway is being broadened towards two times three lanes As the project is part of the Smartwayz.nl programme, the additional focus lays on the integration of smart mobility, such as communication between car and highway, spread of travelling, and improved in-car information (Antea, 2019a; 2019B; Ministry of I&W, 2019c; 2019e). The decision on the preferential alternative is almost definite. However, this preferential alternative is consisting of different elements from the original alternatives, resulting in an additional analyzation of the effects.

Table 7. Specifications A67.

Area:	North-Brabant and Limburg, Southern part of the Netherlands
Subject:	Highway
Main driver:	Ministry of Infrastructure and Water Management
Current Phase	Exploration
MIRT exploration:	2018
Budget:	€ 210 million ,-
Management strategy:	IPM

5.3 Reconstruction of highway A15 (Papendrecht-Sliedrecht)

The A15 highway is an important linkage between the Rotterdam harbour and the hinterland. The congestion on the Papendrecht-Sliedrecht-section is, on the one hand, causing severe economic loss, and on the other hand generating rat running on regional roads, leading to a decrease in liveability in surrounding municipalities. After the MIRT exploration, a decision is made to generate extra lanes on both sides in order to improve the traffic flow. These are replacing the rush-hour lanes. The communal costs and benefits analysis (MKBA) confirmed that the increased capacity has a huge problem-solving ability (Ministry of I&W, 2019a; 2019f). However, this decision is restricting the project team in the planning execution phase to see the project in a broader context.

Table 8. Specifications A15.

Area:	South-Holland, South-Western part of the Netherlands
Subject:	Regional highway
Main drivers:	Ministry of Infrastructure and Water Management; Province of South-Holland; Drechtsteden region.
Current Phase	Planning
MIRT exploration:	2017
Budget:	€ 16 million ,-
Management strategy:	IPM

5.4 Reconstruction of main road N33 Midden (Zuidbroek-Appingedam)

The regional highway N33 is the highway that connects the economic important Eemshaven and Delfzijl with the more vulnerable eastern part of the Province of Groningen. To enforce area development and to improve the accessibility of Eemshaven and Delfzijl, the N33 will be broadened towards two times two lanes. Sustainability is an additional pillar of this project, next to the regional social-economic development. Moreover, the safety will be improved in a way that it meets the national safety norms of 2030 (Ministry of I&W, 2019b, Rijkswaterstaat 2019b, N33midden). Due to the sustainability ambitions of the project, the scope was broadened. However, this created tensions on the budget. Moreover, the discovery of soil pollution led to some disruption.

Table 9. Specifications N33.

Area:	Groningen, northern part of the Netherlands
Subject:	Regional highway
Main drivers:	Province of Groningen and Rijkswaterstaat
Current Phase	Planning
MIRT exploration:	2017
Budget:	€ 99 million ,-
Management strategy:	IPM

5.5 Dyke improvement Wolferen-Sprok

Of the dyke of 15 kilometres between Wolferen and Sprok, 12,5 kilometres, divided over two sections, does not meet the legal safety norms of the national water policy: the dyke is too low and unstable. The national flood protection programme (in Dutch: Hoogwaterbeschermingsprogramma, in short HWBP) gave, therefore, the responsible waterboard Rivierenland the order to reinforce the dyke. Additional objectives of this project are nested in utilizing win-win games by incorporating regional ambitions into the project. The main goal of the project, however, is meeting the legal standards in 2022. After the integral exploration of the trajectory, the preferred alternative was predominantly consisting of a ground-based solution. Close to Oosterhout however, a research has finished to execute a dyke replacement. Nevertheless, this turned out to be too devious, resulting in some delay (Waterschap Rivierenland, 2016a; 2016b; 2018). The project is following the Hoogwaterbeschermingsplan guidelines (Hoogwaterbeschermingsprogramma, 2017; 2018).

Table 10. Specifications Dyke improvement Wolferen-Sprok.

Area:	Gelderland, South-Eastern part of the Netherlands
Subject:	Dyke improvement
Water body:	Waal river
Main drivers:	Waterboard Rivierenland
Current Phase	Planning
MIRT exploration:	2016-2018
Budget:	€ 60,3 million ,- (Hoogwaterbeschermingsprogramma. 2018).
Management strategy:	IPM & LEAN

5.6 Dyke improvement Noordelijke Randmeerdijk

The northern part of the 12,9 kilometres long Randmeerdijk, between Doornspijk and Noordeinde, needs to be improved over an area of 1,3 kilometres, as it is not meeting the legal safety norms of the national water policy. This is a tremendous reduction of the on forehand estimated 9 kilometres of improvement trajectory. With the use of new mathematics methods, this reduction is after intensive discussions achieved. The main goal is water safety, however, the waterboard sees utilizing win-win situations and public support as important additional goals. (Waterschap Vallei en Veluwe, 2018a; 2018b; 2018c; 2019). The project is following the Hoogwaterbeschermingsplan guidelines (Hoogwaterbeschermingsprogramma, 2017; 2018).

Table 11. Specifications Dyke improvement Noordelijke Randmeerdijk.

Area:	Gelderland, central part of the Netherlands
Subject:	Dyke improvement
Water body:	Drontermeer (lake of Dronten)
Main drivers:	Waterboard Vallei-Veluwe
Current Phase	Planning
MIRT exploration:	2017-2019
Budget:	€ 28,5 million ,- (Hoogwaterbeschermingsprogramma. 2018).
Management strategy:	IPM

6. FINDINGS AND ANALYSIS

This chapter presents the findings from the interviews, observations and documents (as conferred in Table 5, section **4.2.2**) of the in chapter **5** described cases, and is structured in line with the conceptual framework (Figure 11). Through inductive and deductive coding, data is organized in a way that clusters of challenges and solutions can be derived (see also chapter **4**). In section **6.1**, seven challenges faced by project managers in practice in the exploration phase and planning execution are presented. These challenges are directly derived from the data and are further clarified by citations. Moreover, in section **6.2** these challenges will be compared with the findings from theory. In section **6.3**, adaptive measures used in practice (directly derived from the data) are presented, further elaborated on by using citations and linked to the challenges given in section **6.1**. Furthermore, the adaptive measures that are conducted from the data are compared with the adaptive measures from theory in section **6.4**. Section **6.5** examines the differences and variation between problems and linked adaptive measures in the three researched scale levels: national projects, regional projects and projects under the supervision of water boards, as described in section **4.2.3**.

6.1 Challenges derived from data

The main goal of this section is to present the results to the sub-question (as presented in section **1.2**): "*Which problems are encountered by managers, dealing with risks and uncertainties, in practice in MIRT explorations and planning, using the current project management strategies?*" Although a large variety of problems can be abstracted from the data, seven main flexibility curtailing challenge themes in project management can be detected. These challenges are selected from data if they occur in 6 out of 12 cases and in at least 2 scale levels. In this way it is ensured that challenges are of frequent occurrence. For every challenge a short description of the problem is given. The challenge will be further elaborated upon through citations (translated and anonymized) from data, which gives the main character of the challenge. The challenges are mostly derived from project managers answering the following interview questions (**appendix 3**) or further questions that are built upon these: *"How do you think the exploration phase went?"* and "*"Did you encounter problems during [project]? If yes, which one?"*

Challenge 1: Handling a fixed time schedule, while anticipation of uncertainties is needed at the same time. **"Time is the biggest threat for projects." (P3)** The first major challenge encountered by project managers concerns time. Most projects do have very tight planning based on a fixed goal, where indistinctness and unnecessary activities need to be avoided. However, because it is often unclear what kind of – internal and external - developments a project will face, adaptive measures are used by managers to anticipate to a changing context. The following citation is illustrating that room to manoeuvre is very scarce, due to a fixed planning. **"The project needed to be finished on a certain date. On the moment that one scenario isn't going to work, and you don't already have a design for another scenario, you will not make the planning. And the planning was already tight." (P10)** The next citation shows that pressure on the planning can affect the quality of other aspects of a project, in this example the communication between client and contractor. **"It was always possible, but**

sometimes it just was not working. Sometimes this was due to pressure on a tight schedule. The feeling of being in a hurry was causing difficulties in communication." (P11)

Challenge 2: Achieving the project goals within a fixed budget. Similar to the first challenge is the restriction in financial resources. The budget for most projects is limited and therefore inflexible in use. Disruptions - internal and external - often create tensions within this financial allocation. Hence, project management is often focused on keeping costs down and reducing unnecessary and irrelevant work. **"You have to discuss what you want to achieve. If you want to prioritise certain aspects within the budget, you should discuss what is really important." (P6)** This citation indicates that often not every ambition can be achieved within budget. Therefore, certain goals need to be prioritized in a way that irrelevant tasks, that put pressure on the budget, are diminished. This statement is further amplified by the following citation: **"The fixed budgets are a big problem. Every small cost overrun need to be hard-fought and, in the end, this takes a lot of time, as it is the reason that a lot of things need to be revised. And this will also put pressure on the budget." (P3)** It is raising questions about how to realize the project goals within the budget, as illustrated by a project manager: **"That is the crux: how do you manage to do the right things, while at the same time limiting your budget?" (P10)** To get an idea about what this means for the project ambitions, a project member answered as followed on the question *"Did you encounter problems during [project]? If yes, which one?"* (see **appendix 3**): **"Budget. We have altered our project scope. The budget was fixed, but the objectives quite broad." (P1)**

Challenge 3: Dealing with an unclear project description. Project managers indicated that the project goal descriptions often lead to confusion, as the statements are often open for interpretation or inaccurate. This led to a variety of expectation by the project management team, the initiator/costumer, and those affected by proceedings of the project development. This leads to a planning process where resources are atrophied to negotiations about project ambitions. The following citation, for example, shows that different ideas about project assumptions eventually lead to a change in the planning process. **"We've asked them: Is it right? Is it stable? Does it work? The answers were yes, yes, yes. Fine, then that is also our assumption. Retroactively you can ask yourself if that was really true. Well, it was not. There still were strategic questions. Some results were wrong. Then you appeal your buffer." (P5)**

Challenge 4: Keeping information within the project while the continuity of the project management team is uncertain. The intended and unintended continuity of the project management team lead to challenges regarding information dependability. It occasionally happens that a member of the management team needs to be substituted. Moreover, project teams are regularly intendedly appointed for a singular MIRT-phase. Hence, the continuity of the project management team is frequently disrupted in the transfer period between the MIRT exploration phase and the MIRT planning phase as various persons are exchanged. For this reason, knowledge vanishes out of the project. This is illustrated with the following citations. On the question: *"What is the reason that information is vanished out of the project during two phases*?" a project manager answered: **"That is inherent to the system. If you put out two different tenders, which are won by two different consultancy firms, than information vanishment is**

always there." (P5) This is further amplified by the following statement: **"Such a crucial alternation in the project management team, especially in the beginning of a new phase, results in a period where nothing really happens. That is a shame. I think this is the reason that the project scope is narrowed." (P12)**

Challenge 5: Shortening the decision-making process. The decision-making process is often threatening the project's planning, as it often creates a delay or undesirable outcomes. Hence, the project itself will be delayed. **"Theoretically it is possible to execute a project within a year. However, the decision-making process takes a lot of time. So, the choices you make and constantly revise takes time. And I'm not talking about concept decisions open for public and administrative stakeholder reactions (in Dutch: zienswijzen). If I make a route decision which I want to propose to the minister, then only 10% or 20% budget overrun can cause half a year of extra delay." (P3)** This statement is further amplified by the following citation: **"The decision-making process will always take longer than you hope. So that took more time than we eventually thought it would cost." (P6)** The challenge lays in how to shorten the decision-making process or how to adapt to the given problem.

Challenge 6: Managing the difference in dealing with an institutional framework. In project management, there is a challenge entailing the supervision of involved institutions concerning the MIRT guidelines. Various participants indicated that although the reasoning behind the MIRT systematics is valuable for project management, the approach of institutions dealing with these guidelines could be improved. For example, the reasoning behind certain instructions and the level of detail on which research and aligning reports need to be conducted are often ambiguous, hence creating tensions between contractor and client. An example of this can be found in the following citations: **"The way the MIRT is used, with all prescribed the methods and approaches, just because it was always done in this way is obstructing. Is not about the MIRT programme itself. It is about the way people use it." (P5)** (answering the question: *"Is the MIRT programme obstructing or problem-solving?"*). **"It is up to the project manager how he deals with this. Whether he is willing to do so or not. That is the problem." (P3)** (answering the question: *"How do certain measures fit within the MIRT institutional structure?").* A practical example of this dissension is demonstrated with the following situation in the exploration phase of a project: **"The goal needs to be: generating a preferred alternative. So, the goal is not: certainty about what could happen in next phases. One always tends to wish that a MIRT research is on the level of a MIRT exploration, and that the first part of an exploration is on the level of later part of the exploration. If you observe what is demanded in terms of research in a MIRT exploration you must be on the level of a route decision. That is troublesome." (P7)** Here, due to different interpretations of the MIRT guidelines, the level of detail of research within the MIRT exploration needs to be on the level of a route decision.

Challenge 7: Dealing with unknown unknowns. Project managers are repeatedly having trouble with so-called unknown unknown (described in section **3.3.3**). In contrast with the earlier mentioned challenges, challenges regarding unknown unknowns are not found in risk management databases, as project managers do not know what to manage for. The acknowledgement of this challenge is founded on the

following citation, where a project manager answered the question *"How is your organisation dealing with unknown unknowns?"* **"An important management principle was to be robust in order to deal with unexpected circumstances." (P5)** On the question *"What would you pass on to other managers on the basis of your experiences?"* the same project manager answered: **"Good people in a good team is essential. Whose task it is to oversee complexity. And to manage uncertainties in that environment. That asks for experience. Experience to not panic immediately. People who are capable in creating their own certainties in a way the process continues." (P5)** The challenge regarding dealing with unknown unknowns is mostly concerned with the dynamic context a project is working in: **"What you realize in the outside world is invented with the knowledge of ten years ago. For a big part at least. That is a huge problem." (P8)** These uncertainties directly influence other processes. For example, using a fixed budget for exploration phases or the time a project can take to achieve its goals. **"Actually, in an exploration phase, encompassing so many uncertainties, it is impossible to set a fixed budget." (P9)**

6.2 Data compared with theory in terms of challenges

From data, seven project management challenges are derived. On the other hand, the theory is focused on risks regarding the so-called iron triangle: scope, costs/budget and time/schedule (see section **3.1**). The first challenge is derived from risks regarding time, as a fixed schedule does not leave room to manoeuvre in case of uncertain events. The second challenge is a derivative from the risks regarding budget, as again, a fixed budget does not include the possibility of disruptions. The third challenge is originated in risks regarding the scope or performance of the project, as an unclear project description leaves room for scope alternations. The theory suggests that these three risks are interlinked as a change in one automatically leads to a change in another. The following citations confirms this statement: **"You can't work with a fixed budget in the exploration phase because the scope is not definite. That just does not work. Neither does it in the planning phase. You never know what will happen." (P9)** Sometimes, pressure on one aspect can cause pressure on finishing projects in general: **"I've notified my client that with the budget we have access to the project cannot be realized. Or not be executed. So, in that scenario, I can go on with my planning, but I assume that I cannot execute it." (P4)** Moreover, the existence of unknown unknowns is acknowledged by project managers, hence this part of the theory is confirmed by the data. The link between the theoretical uncertainty and the threats to the iron triangle is illustrated with the following example of a project manager, answering the question *"How do you know what is really relevant for the project?"*: **"It is a matter of expertise. The wish for details is often due to uncertainties: you want to know things for sure. And if a project needs to be executed in a short time, then the details are not necessary, because this is only causing risks of tasks that cannot be executed." (P10)**

In addition, the data shows that not only challenges regarding time, budget and scope influence each other, but that there is also a huge institutional factor within risks, namely challenges regarding decision-making time, continuity of the project management team, and actors that interpret institutions in a different way. These challenges also affect the iron-triangle in a way that disputes lead to changes in scope, budget and/or time. A project manager questions for example the feasibility of a fixed budget and

a rigid planning, when several subjects are still open for discussion and different (political) actors need to interpret these subjects: **"How, on the one hand, one value certainty in the planning, and, on the other hand, one acknowledge the variables that can occur in a project and the room that these need. That is a very difficult clientship. With networks, lots of actors and a political influence. There, a lot of subjects are open for discussion. How much uncertainty do they allow? And considering that, how realistic is a planning and a budget?" (P5)** The influence of institutional challenges on the project's performance level is according to data a significant addition to the theory.

6.3 Proposed adaptive solutions from data

This section presents the results to the sub-question (as presented in section **1.2**): *"What adaptive solutions does practice develop in order to meet the given problems above?"*. With this question, the answer is given to how project managers create adaptivity in order to deal with uncertainty. The data is analysed through two types of coding (see also section **4.4.1**): inductive coding, where codes are directly derived from theory (adaptive capacity categories and the underlying elements), as shown in the conceptual framework (section **3.7**), and through deductive coding, on the moment that data gives cause to add adaptive solutions to the theoretical body or when practical examples of implementation is given. The practical solutions are selected from data if it occurs in 6 out of 12 cases and in at least 2 scale levels, to make sure that the results are grounded. The solutions are practically described and characterized by using citations from the data. Most adaptive measures raise when asking project managers the questions (see **appendix 3**): *"How did you solve these problems?", "What would you pass on to other managers on the basis of your experiences?", "How should you describe your adaptive capacity within your organization?",* and *"How can you incorporate more adaptivity into this transition?"*, or further questions that are built on these.

Solution 1: Extensive participation. The first solution that is brought in by the data is an extensive participation trajectory, where local actors (e.g. residents, local economic actors, local political actors, interest groups) are closely involved into the project. **"Within our strategy, we have chosen to make room for front-end public participation management. Not so rigid, but closely involve local stakeholders in the exploration phase. In this way, we could have a look at what really matters in this region. That how we developed our alternative. Through carefully listening to the stakeholders, our clients. To get a feeling for what is really important." (P1)** This is amplified by project documents, for example: **"In the interviews with the most important stakeholders we have searched for the interests of these stakeholders and the expectations they have concerning the exploration phase." (Movares, 2014).** The main goal of this solution is to familiarize the dynamic context and to generate ideas based on local knowledge in to enrich the project with new ideas and to enforce public support. These goals are illustrated with the following citation (answering the question: *"What was the goal of the design sessions with local actors?")*: **"The goal was to, on the one hand, generate societal support and involvement for, among others, a possible project outcome. On the other hand, experience teaches us that when you discuss with local stakeholders the quality of the plans will be higher than when you make them behind a desk. This is because local knowledge is entering the project." (P2)** When a participation process is omitted, project managers

can have trouble concerning uncertainties, as the following examples demonstrate: **"Problems are common, but what really matters is where to place a discussion. Do you want it in the beginning or at the end? The planning phase is expensive and time-consuming, so I rather have the interests of my stakeholders clear at the beginning." (P3)** And: **"When your participation trajectory is not sufficient frond-end, you will get into trouble later on." (P1)** Practical examples to embody a participation trajectory are opening a platform where actors can post their ideas, design sessions and information meetings.

Solution 2: Making use of scenarios. Data shows that working with scenarios is an often-used solution by project managers. The main goal of this strategy is to project potential alternative futures and to map the differences of outcomes. It can help to anticipate and adapt to future uncertainties, as the following citation shows: **"If something is not stable, because certain choices are still to be made, then you need to anticipate on what you expect can happen. These are your hypotheses." (P5)** Moreover, it can be used to increase the traceability of the project development. The following citation is illustrating this usage (answering the question: *"What are measures to adapt to future developments?)"*: **"You need scenarios to map differences. If you have five scenarios, what are the benefits of the first and what is the strength of the others? You need them to make a good consideration. And to show your environment how and why to make a choice." (P1)**

Solution 3: Building trust in the project management team. extensive level of trust enforces people's confidence to propose solutions for problems or give opinions about processes. Hence, it helps using people's or organizations strengths, beneficial for the project outcome. Moreover, it ensures alignment of tasks within the team, as any member is informed about the project development and aligning tasks. The following example shows how the characteristics of two organizations can supplement each other. **"Every organization got its own strengths. When encountering problems, you have to take the approach that fits best." (P1)** The same goes for different people, as the following citation illustrates: Generating trust in the project management team can be done in various ways and it is of importance to variate with approaches, as this project manager is indicating: **"The measures are on the soft side: investing in team building, getting to know the systems, common course days, weekly stands, lots of exchanges about the project development via email. So, sharing your approach, sharing bottlenecks and distributing it in various ways." (P5)** Which is further explained by the same project manager: **"Constantly mixing approaches in order to stay in contact with each other. Constant with different motivations. Continuously talking about content and the project assignment." (P5)** Another project manager adds to this notion: **"Clear communication about how to interact with each other. Creating safety, but, at the same time, search for discussions." (P11)** Creating a safe environment where everyone in the project management team feels comfortable to share opinions and discourses helps strengthen the project outcome.

Solution 4: Monitoring and evaluating. An important approach for project managers to deal with uncertainties is monitoring and evaluating the project at given times. In this way, potential obstacles can be observed after which the project management team can adapt to. **"When we use our gate-reviews we found certain bottlenecks that needed extra attention." (P1)** Following the next citation, this

measure can also be embedded into a preferred alternative in a way that the project keeps the room to manoeuvre in reaction to future developments: **"We will monitor and evaluate on the basis of what the future brings us because it remains uncertain. On every moment we can conclude that something more is needed in comparison with what we think now what is needed. So adaptivity is embedded in the preferred alternative. To constantly monitor if something needs to change, regardless of what we have decided now." (P6)** A project document is supplementing this statement: **"Monitoring will be used to check if the traffic development is in line with the future scenarios used in the exploration phase." (Antea, 2019a)**

Solution 5: Critically discuss assumptions. Making sure that at the beginning of the project the goals and ambitions of the project are specified in a way that it is supported by all stakeholders is according to data of great importance. Therefore, assumptions and issues need to be critically discussed between client and contractor front-end. **"The first step was to discuss the issues." (P11)** The basis of this conversation needs to be concerned with questioning the expectations and assumptions behind those. The following example is illustrating the manner and purpose of such questions: **"What do we really want to achieve? Now it is floating between quantitative concepts. To be adaptive, you must make sure that those concepts become more concrete. What do we really think is important? What are the criteria for us that really determine our decisions? That is something we need to improve together." (P6)** Clarifying the goal and ambitions is important at the beginning of a project, but also during the project, a critical attitude keeps the ambitions sharp: **"How do I determine that? I determine it by asking critical questions. By constant asking further, like: what does it mean? I don't have a lot of technical expertise, but I can ask the questions, like: what are the consequences?" (P10)** When, for example, new information is introduced within the project, it is of importance to take time to consider the value and usefulness of it, as illustrated with the following citation: **"Sometimes, new information is available. Then you must take a step back and think for yourself if you are still making the right decision. That needs to be embedded in the project." (P1)**

Solution 6: Early market involvement. Involving the market (most notable contractors concerned with project execution) within the planning phase or even the exploration phase can help increase the level of knowledge within these phases, hence, generating more tailor-made ideas. **"The market has also thought about this subject. What are their ideas?" (P4)** Incorporating market actors ensures that what is planned is also fitting the expectation of those who realize the project. Moreover, technical issues can be solved early on. **"We can anticipate on what they are going to build and how they are going to do it." (P10)**

Solution 7: Upscaling to the project lifecycle. In order to generate flexibility in a certain phase and to tailor products to the points within the phase they best fit, a widely supported idea is to examine a project in a bigger picture instead of just as separate phases. Ascertain levels of details or tasks are more purposeful in certain stages of the process. Generating flexibility in phases helps to execute certain task more efficient. The following citations demonstrate this idea: **"We have left some space to deal with the details in this phase. In this way, we can deal with setbacks. The scope is clear, but we have**

left some room in the design. To keep flexibility.” (P9) And: **“Some aspects we left open in the exploration phase so that we can do that now.” (P9)** New forms of contracts, which has the intention to enforce continuity of the project team but evaluate the performance of the project management team when finished with a phase, seems suitable for this concept. The following citation is confirming this perception: **“What can help in that situation is to stop to tender a phase separately but to initiate a prolonged relationship and a more far-reaching contract. For example, to combine the exploration phase and the planning phase.” (P8)**

6.4 Solutions from practice compared with theoretical ideas about adaptivity

Seven adaptive solutions in order to deal with challenges regarding uncertainty are derived from data (section **6.3**). The theory, on the other hand, specifies three main categories of adaptive capacity (section **3.6**). This section examines how the data relates to theory. The examination is based on the impressions of project managers from data and the perception of the researcher.

The intentions of organizing an extensive participation trajectory (solution 1) are twofold. First, a goal is to add suggestions and perceptions based on local knowledge into the project. These ideas are generated by local actors, such as residents, local economic stakeholders, and interest groups. These principles can also be observed in theory. Here, adding creative capacity ensures variation in management in order to achieve multiple additional pathways in the management strategy. In this way, the chance of a with the context fitting approach is raised. Creative capacity can be achieved by including multiple distinctive actors in the project, and by allowing them to provide values, opinions and solutions. This can be practically be achieved by investing in participation. Second, generating public support can also be seen as a purpose of participation. This is similar to what theory is describing as the alignment of actors. This pillar is seen as a part of cooperative capacity, where generating a shared vision can be seen as crucial for adding adaptivity. An open and transparent planning process helps generate a shared vision. The following citation explains what the main benefit of a shared vision is: **“If everybody recognizes the problem and understand that the chosen solution the best solution for this problem is and that a decision-making process is next then everything goes quite easy. Then there are few discussions left. If everybody is in recent years involved in the right way, then they understand that this is the best decision.” (P6)**

The second from data derived solution, working with scenarios has as main goal to provide multiple alternative futures. Through this way, various discourses and solutions are entering the project. This can support decision-makers to find opportunities and lock-ins, as these various hypothetical futures helping to create an overview, as illustrated with the next citation: **“The objectives are identified. All the scenarios are discussed from several points of view. This led to a few optimizations and various adjustments.” (P3)** The use of scenarios can be compared with the theoretical notion of allowing multiple opinions and notions, which is a pillar of creative capacity. However, as scenarios are based on current or former developments, it is questionable how big the adaptive capacity of this measure is opposed to new developments.

The third solution that is derived from data is the notion of generating trust within the project management team. In this way, several elements are encouraged to share their opinions and to take notice of other arguments, hence enforcing the quality of processes and decisions. This is illustrated by the next citation: **"Discussing the planning, the issues, the content, the questions that arise. Then common ground is generated. So, literally, visit each other and let the coordination arise there." (P8)** The theory is giving similar ideas about this notion. First, as it stimulated people and organizations to express themselves, multiple understandings are entering the project, generating variation. This is described by theory as allowing multiple understanding as solutions, as part of creative capacity. However, creating trust in the project management team is also an outcome of adding learning capacity to the management strategy, as it encourages actors to learn and to discuss doubts. When people or organizations are stimulated to share thoughts and to carefully listen to these arguments, the project management team is learning.

The fourth solution that is derivative out of data is monitoring and evaluation. By constant auditing and check the project, discrepancies can be observed early on. Based on this information, project managers can adapt to changing circumstances. This solution is also distinguished in theory. Monitoring, evaluation (grading the data received from monitoring) and adapting (take action on the basis of the evaluation) are observed as pillars of learning capacity, more specific as single-loop learning. By adding learning capacity to the project management strategy, the organization will recognize changed circumstances based on experience and in addition will adapt to these.

Solution five encompassing questioning ideologies, ambitions and assumptions within the project. Through this way, the project ambitions are clear and supported by all stakeholders. Or, as data described this: **"In a way that everybody understands that we have examined the problem from different points of views and that we have made a common decision." (P11)** This solution can also be found in the theory about adding learning capacity to a management strategy. Through the discussing doubts pillar, double-loop learning can be stimulated. This type of learning encourages actors to question the frames on with actions are build, hence influencing the outcomes.

The involvement of the market in early phases of the project lifecycle (solution 5) increase the amount of data (most notably on construction and realization of the project) in the organization. With this information, decisions are more tailor-made to the context. This is another example of adding values, knowledge and opinions to the project, discussed in the creative capacity category in theory. By adding more actors and through discussing their understandings and solutions, the chance of an approach that fits the circumstances is increased.

The last solution, considering the project in its total lifecycle instead of concentrating on the separate phases cannot be observed in theory on adaptive management. This, however, does not mean that is isn't generating flexibility in the planning process. Therefore, this solution derived from data can be seen as a new way to approach adaptivity.

7. DISCUSSION

In this chapter, the findings and analysis as presented in chapter **6** are interpreted and further explained in a broader discussion. This interpretation will be based on the comparison between theory and data (section **6.2** and **6.4**) and observations from the researcher, as examined in the conceptual framework (Figure 11). First, the results will be placed in an institutional context, viz the MIRT context (section **7.1**). With this section, the following sub-question from section **1.2** is answered: "*What are institutional barriers for the implementation of these flexibility measures or adaptive solutions?*" Moreover, section **7.2** examines the differences and variation between problems and linked adaptive measures in the three researched scale levels: national projects, regional projects and projects under the supervision of water boards, as described in section **4.2.3**. This section answers the sub-question "*What adaptive project management strategies seem appropriate for the Dutch practice and on what conditions can they be implemented?*" is resolved

7.1 Adaptive measures under MIRT regulation

Although some adaptive measures that are proposed in chapter 6 have proven to be very effective in generating flexibility, they need to be implemented in the Dutch institutional context, specifically in the MIRT programme. Here, the problem between control and flexibility as described in the problem definition (section **1.2**) comes forth. To obtain state funding, projects need to follow the mandatory MIRT guidelines. Participants indicated that the principles of these guidelines are helpful and logical, as shown with the following citations: **"The basic principles of the MIRT programme – that you first have an exploration and later elaborate more on that – is pleasant." (P7)** And: **"I do not question the funnel mechanism. That works beneficial and you need that." (P5)** However, some of the challenges described in section **6.1** and **6.2** cannot be seen separately from the MIRT programme. To answer the sub-question that investigates institutional barriers for implementing adaptive project management strategies it is of importance to investigate which adaptive measures fits within the MIRT institutional context. Three debates, derived from data, are presented:

Implementing adaptive measures within budget and planning. Implementing an extensive participation trajectory, using scenarios, and use monitoring and evaluation mechanisms (solution 1,2 and 4 in section **6.3**) do increase the adaptive capacity of an organization, hence generation flexibility. However, these measures also need some investments, as they take time to implement and perform and they need financial resources. This can put extra pressure on the fixed budget and rigid planning of projects in the MIRT programme (challenge 1 and 2, section **6.1**). On the other hand, using these adaptive measures in early phases of the project can eventually help release some pressure from the planning and budget. This is illustrated in the following citation, where a project manager answered the question: *"Does it need investments to implement this (scenario planning, Ed.)?"* **"It takes time. And more budget too. But it will pay for itself in a sequential phase. If the budget of a project is for example 100 million euros and you invest 20 or 30 thousand euros upfront to create an overview, then, in the end, it will pay for itself." (P1)**

Upscaling the project within MIRT phasing. Upscaling the project lifecycle and thereby soften the rigid MIRT phasing (solution 7, section **6.3**) is a way to generate more flexibility in projects. It helps, for example, reducing the amount of information vanishing out of the project (challenge 7, section **6.1**), as illustrated with the following citation: **"In the transition from exploration phase to the planning phase there is a lot of loss in common information (in Dutch: raakvlakverliezen, Ed.)." (P5)** Preventing this information dispersal is beneficial for the project. On the other hand, softening the phasing of a project can also have some drawbacks, as illustrated with the following citation: **"That possibly the concentration will be reduced. That the project management team wants to achieve an end result and becomes blind for questions like: is the problem-solving capacity of this preferred alternative sufficient? Everyone prefers to achieve results and the end result is, of course, realizing the project outside. But by using the phases you achieve several scope definitions, that you can use to evaluate with a fresh mind if you want to continue with some conclusions." (P8)** (Answering the question: *"What are possible drawbacks from no longer use rigid phasing?").* Moreover, the MIRT programme consciously designed the phasing, as it opens possibilities to not continue with a project. This is illustrating with the following citation: **"I think it relates to the budgeting system of the national government. The exploration phase leads to a preferred alternative, but that does not have to mean that a planning phase is following. They can decide that the problems are not sufficient enough. Or that it does not justify the investment." (P8)** The question remains how the solution of upscaling the project lifecycle can be implemented in the existing framework. Contracting can help implement more adaptivity, while at the same time keeps the benefits of the phasing. A project manager illustrated this when answering the question *"How does adaptivity fit here (in the transition from the exploration phase to the planning phase, Ed.)?"*: **"To consider it as one assignment, like we used to do in the past. On the other hand, maybe an exploration phase and a planning phase in one assignment will be too sizeable. However, it can make it more straightforward. In this project, it was a huge advantage that we had a contract that if we finished the exploration phase in a way all actors are satisfied, we could continue with the planning phase." (P10)** In that sense, new contract forms are suitable for this idea.

Adaptive measures and informal institutional change. Critically discussing assumptions and early market involvement (solution 5 and 6, section **6.1**) are both creating adaptive capacity within the project. Although implementing these adaptive measures is beneficial for the project, informal institutional change is needed to fulfil it. This is illustrated with the following examples from data: **"What I see is that there is a lot of knowledge and experience, but that it is locked within persons and systems." (P4)** And: **"The way it is used and executed, just because it happens to be used in that way for a very long time, in particular when planning phase-methods are prescribed in the exploration phase." (P7)** Overcoming these formal institutional barriers is not easy, but according to the following citation it has to be done, although it takes time: **"It is just a matter of doing it. But you need projects for that, and that takes time." (P7)** Another project manager is summarizing it as followed: **"Sometimes the rules are obstructing the intentions, and everybody is dealing with in their way. Also, how you are working together. One is natural more open-minded and more approachable, while another just wants a concrete proposition. I think that the last one does not always work**

very effective. So, it is better to stay in touch and create a shared proposal." (P11) And further: **"You should also be willing to get over your own interest and to be curious to the interest of another actor. How can you think along and support?" (P11)**

<u>Adaptive measures and the future MIRT programme.</u> In section **2.2.6**, the future of the MIRT programme is discussed. To deal with the lengthy period of infrastructure development preparation and the aligning uncertainties, three main future additions are proposed: intensifying the integral approach, facilitate monitoring mechanisms and closer collaboration between governmental actors. The lengthy decision-making process and the aligning entry of uncertainty are also recognized by theory and data. As for adaptive solutions, the building trust in the project management team and critically discussing assumptions (both to enforce the collaboration between governmental actors) and applying monitoring and evaluation mechanisms fits perfectly with the future of the MIRT programme. Moreover, through participation, early market involvement and the use of scenarios, more pathways are generated to enforce the integral approach, as knowledge from other areas then infrastructure planning is integrated into the infrastructure development preparation.

7.2 Adaptive measures on scale levels

According to the data, the returning challenges appear at every scale level, and so are the adaptive measures. However, it appears that challenges concerning dealing with MIRT institutions are more challenging on the national scale level, then on other scale levels. This is illustrated by the following citation, where an example is giving about a discussion about the curtailment of flexibility within the MIRT programme: **"The programme itself is flexible. If you read the MIRT you find a general framework with clear process guidelines. However, it is about dealing with these guidelines. Do you want a MIRT exploration on the level of the planning phase? Or do you decide on the outlines with the details that fit this decision, what in my opinion is the intention of an exploration." (P7)** Later, the same project manager argued: **"It is about the people that want to diminish every risk by gaining a lot of information." (P7)** This kind of arguments return more often at the national scale level than on the other researched scale levels. Moreover, it is pointed out that strategies based on an extensive participation trajectory are more effective on the scale of the province because they are closer to local actors. This is illustrated by the next citation: **"It depends on how you approach it. And how the attitude of the organization. The provincial board is far closer to residents than for example a minister. The distance is bigger. Hence, you are more flexible indeed." (P1)**

8. CONCLUSION

8.1 Answering the sub-questions

In order to answer the main research question, this research derived six sub-questions (see chapter **1**). These sub-questions are answered throughout the research. This section looks briefly to the answers and refers further to the sections where an explanation can be found.

Theory on project management describes three main adaptive strategies: creative capacity, learning capacity, and cooperative capacity (sub-question 1, section **3.6**). These need to be incorporated in the current project management strategies, described in section **3.4** and **3.5** (sub-question 2). This research found seven challenges encountered by project managers dealing with risks and uncertainties, regarding: a tight planning, a fixed budget, an unclear project description, the continuity of the project management team, the lengthy decision-making process, how organizations deal with institutions, and unknown unknowns (sub-question 3, section **6.1**). To meet the given problems, practice proposed several solutions: an extensive participation trajectory, using scenarios, stimulating trust in the project management team, implementing monitoring and evaluation, critically discussing doubts and definitions, involve the market more early, and overcome phasing (sub-question 4, section **6.3**). Both challenges and solutions are compared with the theory in section **6.2** and **6.4**. Some institutional barriers can be observed, namely implementing adaptive measures within: budget and planning, the current MIRT phasing, and current informal institutional frameworks (sub-question 5, section **7.1**). Conditions on what these adaptive measures can be implemented can be observed in chapter **7** (sub-question 6).

8.2 Answering the main research question

The goal of this research is to develop guidelines that add adaptive capacity to a project management strategy, hence meeting the preference of managers to have more flexibility in the project's exploration and planning phase. Several solutions to reoccurring challenges in MIRT projects are conducted from data (see chapter **6**). These are contextually considered and thoroughly discussed. (see chapter **7**). Having answered all secondary research questions, the main research question of this thesis can be answered.

How can the project's management strategy during MIRT explorations be aligned to flexibility in a project's planning phase to be adaptable to uncertainties?

This chapter suggests guidelines for incorporating adaptive capacity in management strategies. These guidelines help project managers in implementing adaptive management. The guidelines have the following structure: a small explanation, a theoretical background, practical implementation examples, the advantages and disadvantages of implementation, and consistency with other guidelines.

Guideline 1: Implementing an extensive participation trajectory into the project management strategy. By adding this measure, the organization is enriched with contextual information and knowledge, as e.g. residents, local economic stakeholders, and interest groups sharing their opinion about the project. Hence, creative capacity is added to the organization, making it more adaptive, as the alternative

pathways increasing the chance of a fitting approach. Furthermore, a participation process aligns actors and thereby generates public support. In this way, cooperative capacity is added to the organization. This will make it more adaptive, as it unites people under a shared vision, hence making use of the self-organizing capacity of the complex adaptive system itself. Participation can be incorporated by initiating information meetings, online platforms where stakeholders can share their opinions, and design sessions. This adaptive measure is most effective early in the planning process and is enforced by using an open and transparent planning process. Although organizing a participation process needs investments regarding time and finance, data implies that it will pay for itself in the long term.

Guideline 2: Implementing a scenario strategy. Using scenarios in a management strategy generates various pathways and solutions to problems. Hence, decision-makers are supported in their process, as opportunities and lock-ins are inspected. Using hypothetical futures incorporates creative capacity to the management strategy, as it allows multiple pathways to enter the organization. In this way, the definite solution is more tailor-made to the context. Implementing a scenario strategy will cost financial resources and puts extra pressure on the planning. However, data indicates that it is worth realizing.

Guideline 3: Generate trust within the project management team. Through this measure actors (people or organizations involved) will feel more confident to share their opinions and understandings about issues and decisions and are more willing to doubt existing discourses. Trust enables actors to recognize and dispute arguments, hence the decisions are improved. When learning and creative capacity are embedded in the management strategy, the adaptive capacity of the organization increase. Creating a safe environment to share opinions is crucial for this measure. Examples to enforce this guideline are weekly stands, common course days and investments in team building.

Guideline 4: Implementing monitoring and evaluation. Through these mechanisms, potential obstructions can be investigated, after which the project management team can react and adapt. While monitoring, drawbacks can be found. These need to be discussed in order to find appropriate solutions. Implementing these mechanisms enforce the learning capacity of the organization, as it automatically responds to uncertainties, hence making use of capacities of the complex adaptive system itself. Examples of mechanisms that can be used are gate reviews or single-loop learning approaches. Using monitoring and evaluation will require financial resources and takes time. However, it helps the organization dealing with uncertainties, thus pay for itself in the long term.

Guideline 5: Critically discuss assumptions and decisions. A clear project ambition and supported goals are crucial for a proper planning process. Therefore, in the beginning, and during the project, time needs to be invested in doubting assumptions and discourses between client and contractor. This generates a double-loop, hence enforcing the learning capacity of the organization. In this way, the organization recognize wrong assumptions, where they can adapt to. Both client and contractor need to be willing to and open for this approach. Sometimes, informal institutional change might be needed to fully implement this guideline, most notable as the scale level rises. However, it will generate better and faster decisions.

Guideline 6: Involve market parties earlier in the process. These actors (most notable contractors concerned with project execution) has different types of knowledge than that normally exist in the

exploration and planning phase, thus more fitting decisions can be made. In this way, the creative capacity of the organization is increased as more actors and thereby solutions enter the project. Incorporating these market parties might need some informal institutional change. On the other hand, the quality of the decisions will be improved.

Guideline 7: Upscaling the project lifecycle in order to overcome phasing issues. By doing so, products and processes can be fitted to the phases where they are most effective. Through this flexibility, the efficiency and effectivity of actions are increased. Incorporating this guideline in the MIRT guidelines could be burdensome. However, new types of contracts that have the intention to continue with the same project management team after a phase is ended based on an evaluation at the end of the phase seem promising.

9. REFLECTION

This chapter reflects on the research process, the personal impressions of the researcher, and gives some reflections for further and sequential research. First, section **9.1** elaborates more on how the research objectives are met, and what could have been improved in the research process. Section **9.2** gives an impression of the personal development of the researcher. Lastly, section **9.3** is proposing ideas for further research. On the one hand, because certain topics which could be helpful were out of the scope in this research, due to time limitations, and on the other hand because of new impressions and suggestions derived from the results of this thesis.

9.1 Reflection of the research process

The main research objective as presented in section **1.2** is to find ways to align project management strategies based on flexibility (with an eye on complexity theory) and control (for example due to MIRT guidelines). Due to a lack of (sufficient) empirical data, adaptive project management research is often described as too theoretical. This thesis has in that sense met the main research objective, as adaptive management guidelines, based on thorough empirical research, are proposed, and the gap between theory and practice is filled with a better practical understanding of adaptive management. By answering several research questions (see chapter **8**), adaptive management theory is combined, connected and clarified, and complemented by empirical suggestions. Moreover, practical barriers to implementing adaptive measures are identified. Lastly, a discussion on how adaptive strategies should be implemented in the Dutch planning context bridged the gap between theory and practice. Hence, this research reasonably proves itself relevant for societal, as well as academic purposes.

To achieve more depth in the findings and to establish more tailor-made and fitting guidelines, the similarities and differences between project managers on the client-side and the contractor side could be better explained and elucidated. Although both sides of managers are forming a project management team together, they have different responsibilities within the project and are from contrasting organizations, hence having different assumptions and opinions about institutions.

Moreover, it needs to be noticed that project management is practised in a highly dynamic and complex environment. During this research, several innovations and developments have taken place, as well as academic and non-academic research. This is limiting the relevance of the research, as participants could have been affected by one of these developments. However, this is inherent to qualitative research, where an understanding of the world's complexity is investigated.

9.2 Personal reflection

From a personal point of view, writing this thesis was an educational, challenging and exciting exercise. The thesis is written along with an internship at a consultancy firm. This was a unique opportunity to step into the practical world of project management, hence it fuelled my perspective with practical information. On the other hand, it could be possible that working in collaboration with practice also limited

my independent view as a researcher. Although I tried hard to keep this autonomous perspective, this notion needs to be considered.

9.3 Suggestions for further research

Although chapter **8** gave conclusions in terms of adding adaptive capacity to a management strategy, some aspects need further elaboration. Moreover, section **9.1** gave some suggestions on elements to consider in further research. An overview is provided:

- An important restriction of adaptive management implementation is the way institutions were dealing with the MIRT guidelines. Although a major institutional revolution is not in line with expectations, further research should elaborate more on how institutional development should take place. Two concepts seem promising. This research already introduced the theory of single-loop learning and double-loop learning as methods for organizational learning. Triple-loop learning (Romme and Witteloostuijn, 1999; Tosey et al., 2012; McClory et al., 2017) however can be introduced in order to understand the organizational impact on learning mechanisms, and how institutional change could be beneficial for the adaptive capacity of the organization. A similar understanding can be derived from the multi-phased transition model, discussed in Van der Brugge et al. (2005) and Loorbach (2010). Here, communication between three levels (micro: niche, meso: regime, and macro: system) is proposed as a perspective on organizational change. Additionally, further research in the concept of adaptive decision-making (e.g. Laureiro-Martínez & Brusoni, 2018) can help create more flexibility in the MIRT programme;

- As participants see opportunities for adaptive strategies in terms of new contract forms and adaptive programme management (e.g. Rijke et al. 2014), both of these aspects can be researched more intensive;

- Moreover, as the MIRT programme is constantly developing (see section **2.2.6**), guidelines are fluctuating and adapting to changing insights and knowledge. Further research in the direction of this innovation can be aligned with further insights in adaptive management and vice versa, as innovation in adaptive management can help shape the MIRT programme;

- Lastly, as the similarities and differences between organizations, hence the project management strategies, is seen as a limitation of this research, this aspect is recommended for further research. Insights could help to align the project management strategies of these actors, consequently creating better-coordinated management strategies.

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APPENDICES

Information sheet - Research Ethics Committee (REC)

for research project:
Work Title: Building adaptive capacity in project management strategies in a MIRT institutional context.
Subtitle: A case study research into project management principles.

Thank you very much for taking the time to consider getting involved in my (doctoral) research project.

> *The purpose of the research is to understand the relation between the MIRT programme on the one hand, and adaptive management strategies (in order to improve the flexibility in the light of complexity) on the other hand.*
>
> *A project, within the MIRT regulation, need to follow mandatory, predefined steps in order to achieve state funding while at the same time, project managers have to deal with increasing uncertainty and therefore see adaptive project management strategies as a necessity. The balance between these two management strategy extremes is crucial. However, the principles of both create tensions, which implies a paradox between control and flexibility. The concept of evolutionary resilience is giving insight into how these approaches could be mixed. By applying adaptive management, where acting is based on creative capacity, learning capacity, cooperative capacity, and adaptive pathway, a proper balance between the two boundaries can be found. Nonetheless, how this adaptive capacity should be applied in relation to the institutions of the MIRT procedures is unclear. This research is trying to find empirical answers in order to create guidelines for managers.*

Confidentiality and participant rights:

- The interviews will be audio-recorded, and notes will be taken during the interview.
- You have the right to ask to have the recording turned off whenever you decide and you may also end the interview at any time.
- If you wish so you will be sent a copy of the interview notes, and you will have the opportunity to make corrections or request the erasure of any materials you do not wish to be used.
- The information you provide will be kept confidentially in a locked facility or in a password protected file on my computer up to five years upon completion of my research.
- The main use of the information you provide will help me towards my thesis, which upon completion will publicly be available on Internet.
- The data may also be used for articles, book chapters, published and unpublished work and presentations.
- Unless you have given explicit permission to do so, personal names or any other information which would serve to identify you as an informant will not be included in this research or in any future publication or reports resulting from this project.

As a participant you have the right to:

- Decline to participate;
- decline to answer any particular question;
- ask for the audio-recorder to be turned off at any time;
- end the interview at any time
- withdraw from the study up until three weeks after participating in the research;
- ask any questions about the study at any time during participation; and
- ask for the erasure of any materials you do not wish to be used in any reports of this study.

Once again, I thank you for taking the time to find out more about my (doctoral) research. I am at your disposal for any questions you might have. You can also contact my supervisors at the Address below.

Yours sincerely,

Researcher contact details:	Main supervisor contact details:
C. (Casper) van Mastrigt	Prof. ir. W.L. (Wim) Leendertse
C.van.mastrigt@student.rug.nl	W.l.leendertse@rug.nl
06-27510330	050-3633895

This research project has been approved by the Research Ethics Committee of the Faculty of Spatial Sciences. Any questions about the ethical conduct of this research may be sent to the Secretary of the Committee Ms. Tineke Dijkman: email: gradschool.fss@rug.nl Physical address: Faculty of Spatial Sciences, University of Groningen, Landleven 1, 9747 AD Groningen, The Netherlands.

Agreement to participate - Research Ethics Committee (REC)
in research project:
Title: Building adaptive capacity in project management strategies in a MIRT institutional context.
Subtitle: A case study research into project management principles.

The purpose of the research is to understand the relation between the MIRT programme on the one hand, and adaptive management strategies (in order to improve the flexibility in the light of complexity) on the other hand.

- I have read and I understand the information sheet of this present research project.
- I have had the opportunity to discuss this study. I am satisfied with the answers I have been given.
- I understand that taking part in this study is voluntary and that I have the right to withdraw from the study up to three weeks after interview, and to decline to answer any individual questions in the study.
- I understand that my participation in this study is confidential. Without my prior consent, no material, which could identify me will be used in any reports generated from this study.
- I understand that this data may also be used in articles, book chapters, published and unpublished work and presentations.
- I understand that all information I provide will be kept confidentially either in a locked facility or as a password protected encrypted file on a password protected computer.

Please circle YES or NO to each of the following:

I consent to my interview being audio-recorded   YES / NO

I wish to remain anonymous for this research   YES / NO

If YES
My first name can be used for this research   YES / NO

OR
A pseudonym of my own choosing can be used in this research   YES / NO

 "I agree to participate in this individual interview and acknowledge receipt of a copy of this consent form and the research project information sheet."

Signature of participant:_____Date: _____

"I agree to abide by the conditions set out in the information sheet and I ensure no harm will be done to any participant during this research."

Signature of researcher:_____Date: _____

Please fill in the following information. It will only be used in case you want to be sent a copy of interview notes so that you have the opportunity to make corrections.

Address:
Email:

Appendix 3: Overview of interview procedures, interview guide and the linkage with the theoretical framework

According to section **4.3.1** and **4.3.2** the interview procedures, interview guide and the connection with the theoretical framework will be provided. The questions that were asked during the interview are linked to several points made in the theoretical framework (see chapter **3**) and are aimed to answer the various questions and sub-questions, which are presented in section **1.2**.

Considering that all the participants and the interviewer are natively Dutch, the interviews were held in the Dutch language. Consequently, all questions are first written down in Dutch, and later translated to English. Before the interviews are conducted, the researcher has followed the procedures underneath:

- Introduction of interviewer (name, study, internship);
- Explanation of the research (main goals and research objectives);
- Clarification of the interview procedures (structure, confidentially);
- Signing of the agreement to participate (appendix **1**), were the ethical procedures (as described in section **4.6**) are emphasized and to make sure the participant is consciously engaged in this research.

Hereafter, the questions that are presented in the interview guide were asked. Although the interviews are prepared thoroughly, the sequence of asked questions can deviate from the order of the questions in the guide due to the circumstances (aligned with the nature of semi-structured interviews, see section **4.3.1**).

All interviews were finished with the following concluding remarks:

- Space for the participant to ask questions that have are not asked before, and to amplify certain subjects that haven't been discussed;
- A general word of thanks for the participant for their time and contribution;
- Iteration of ethical rights of the participant (the research can bring no harm to the participant and the identity of the participant is protected at all times);
- Question of respondent have any relevant documents or studies to add to the research;
- Option for receiving the results, a summary and/or the entire research after it is finished.

	Interview guide with questions, and connections towards the theoretical framework and (sub-)questions				
Category:	Interview question:	Translation:	Connection to theoretical framework (section):	(Sub-)question:	Keywords:
Introduction:	Wat is/was uw functie binnen [project] en wat zijn/waren uw verantwoordelijkheden?	What is/was your function within [project] and which responsibilities do/did you have?	-	-	-
	In welke fases was u specifiek betrokken bij [project]? Welke periode?	In which specific phases where you involved in [project]? Which period?	-	-	-
	Hoe zou u [project] omschrijven? Wat was/is het doel van [project]?	How would you describe [project]? What was the main goal of [project]?	-	-	-
	Wat is de huidige stand van zaken van [project]?	What is the current status of [project]?	-	-	Exploration phase; planning phase.
	Hoe heeft u het MIRT-programma ervaren?	How do you feel about the MIRT programme?	1.2.1, 1.2.2, 2.2.1, 2.2.2, 2.2.5	3	Decision moments; robustness; solid; helping; guiding.
Management strategy:	Heeft u een vaste managementstrategie gekozen voor [project]? Zo ja, welke was dit?	Did u used a prefabricated management strategy for [project]? If yes, which one?	3.5	2	PMBoK; PRINCE2; PWM; SCRUM.
	Hoe zou u de managementstrategie van [project] omschrijven?	How would you describe the management strategy used in [project] ?	3.4, 3.5	-	Project management; process management; a prior defined; hierarchy; planning is essential;

				informing citizens; flexible; adaptive; stakeholder alignment; involvement.
	Wat zijn de voor en nadelen van de door u gekozen strategie?	What are the pros and cons of the chosen management strategy?	3.5	2	Complexity, uncertainty, wicked problems.
Problems encountered (exploration phase):	Hoe is de verkenning volgens u verlopen?	How do you think the exploration phase went?	-	3	-
	Bent u problemen tegengekomen tijdens de verkenningsfase van [project]? Zo ja, welke?	Did you encounter problems during [project]? If yes, which one?	3.2, 3.3, 3.4, 3.5, 3.6	3	Complexity, uncertainty, wicked problems.
	Hoe kunnen deze problemen worden toegewezen aan het MIRT-programma?	How can this problem be related to the MIRT programme?	1.2.3, 1.2.4, 1.2.5	3, 5	Robustness, solid, pre-defined steps, less flexibility.
	Hoe heeft u deze problemen opgelost?	How did you solve these problems?	2.4, 2.6	4	Adaptive, flexible planning, flexible resources, learning capacity, variation, scenarios.
	Wat zou u managers willen meegeven op basis van uw ervaringen?	What would you pass on to other managers on the basis of your experiences?	2.6	4	Context.
Problems encountered (planning phase)	Bent u ook actief betrokken geweest bij de verkenningsfase?	Did you actively take part of the exploration phase?	-	-	-
	Zijn er problemen geweest tijdens de verkenning?	Were there problems during	-	3	-

		the exploration phase?			
	Bent u problemen tegengekomen die voortkomen uit de verkenningsfase?	Did you encounter problems that are emanated from the exploration phase?	2.2, 2.3, 2.4, 2.5, 2.6	3	Complexity, uncertainty, wicked problems.
	Hoe kunnen deze problemen worden toegewezen aan het MIRT-programma? Ervoer u de regels en de uitleg daarvan als remmend of als oplossingsgericht?	How can these problems be related to the MIRT programme? Did you experience the rules and explanation as inhibitory or as aimed to solutions?	1.2.3, 1.2.4, 1.2.5	3, 5	Robustness, solid, pre-defined steps, less flexibility.
	Hoe heeft u deze problemen opgelost?	How did you solve these problems?	2.4, 2.6	4	Adaptive, flexible planning, flexible resources, learning capacity, variation, scenarios.
	Wat zou u managers willen meegeven op basis van uw ervaringen?	What would you pass on to other managers on the basis of your experiences?	2.6	4	Context.
Adaptative capacity:	Hoe zou u de adaptieve capaciteit omschrijven in uw organisatie?	How should you describe your adaptive capacity within your organization?	2.6	4, 5	Creative capacity: allowing multiple understandings and solutions, allowing diversity of actors and levels; Learning capacity: monitoring, evaluation, adaptation, learning,

					discussing; cooperative capacity: aligning actors, open and transparent process, front-end development; scenario's: tipping points, alternative futures, scorecards.
	Hoe heeft u de flexibiliteit binnen het MIRT ervaren?	How did you experience flexibility within the MIRT programme?	1.2.3, 1.2.4, 1.2.5, 2.3, 2.4, 2.6	5	-
	Heeft u ideeën om deze te vergroten?	Do you have recommendations to expand this flexibility?			
	Hoe kijkt u tegen de overgang van verkenningsfase naar planningsfase aan?	How do you feel about the transition of the exploration phase towards the planning phase?			
	Hoe zou u hier meer adaptiviteit kunnen inbouwen?	How can you incorporate more adaptivity into this transition?			
	Wat zijn in de planfase typische problemen die voortkomen uit de verkenningsfase?	What are in the planning phase typical problems, derived from the exploration phase?			
	Hoe ziet u de toekomst van het MIRT?	How do you feel about the future of the MIRT programme?			

Appendix 4: Coding scheme

Code	Sub-)question:	Sub-code:	Sub-sub-code:	Connection to theoretical framework (section):
Project scale:	-	National level		-
		Province level		-
		Water board level		-
Project phase:	-	Exploration phase		2.2.1; 3.1
		Planning phase		2.2.2; 3.1
Problems encountered during project's exploration phase	3; 5	Details in project descriptions	Too much	2.2
			Not enough	2.2
		Time		3.1; 3.2
		Budget		3.1; 3.2
		Continuity of the project teams	Intended	3.1
			Unintended	3.1
		Uncertainty	Encountered	3.3
			Unencountered	3.3
		Institutional	MIRT related	2.2
			Non MIRT related	2.2
Problems encountered during project's planning execution phase	3; 5	Details in project descriptions	Too much	2.2
			Not enough	2.2
		Time		3.1; 3.2
		Budget		3.1; 3.2
		Continuity of the project teams	Intended	3.1
			Unintended	3.1
		Uncertainty	Encountered	3.3
			Unencountered	3.3
		Institutional	MIRT related	2.2
			Non MIRT related	2.2

		Transfer period	Continuity	2.2
			Wrong information	2.2
			Lack of information	2.2
			Decision-making	2.2
		From the exploration phase	Wrong assumptions	2.2; 3.3
			Wrong decisions	2.2; 3.3
			Decision-making process	2.2
			Makeability	2.2; 3.3
			Changing context	2.2; 3.3
Management styles:	2	PMBoK		3.5.1
		PRINCE2		3.5.2
		Project-based working		3.5.3
		SCRUM		3.5.4
		IPM		3.5.5
Proposed Solutions:	1; 4; 6	Using second opinions		-
		Clearing definitions		-
		Contracting		-
		Databases		-
		Evaluation		-
		Gate reviews		-
		Early market involvement		-
		Using programmes		-
		Generating trust in PM team		-
		Upscaling projects		-
		Extensive participation		-
		Scenario		-
Adaptive measures from theory:	1; 4; 6	Creative capacity	Allowing multiple understandings and solutions;	3.6; 3.7

			Allowing diversity of actors and levels.	3.6; 3.7
		Learning capacity:	Monitoring;	3.6; 3.7
			Evaluating;	3.6; 3.7
			Adaptation;	3.6; 3.7
			Encourage organizational actors to learn and discussing doubts (taking interpretations seriously).	3.6; 3.7
		Cooperative capacity:	Aligning actors;	3.6; 3.7
			Open and transparent planning process;	3.6; 3.7
			Equally divided agendas.	3.6; 3.7
			Other	3.6; 3.7
			Contracting	-

Appendix 5: overview of analysed documents

#	Title (translated):	Author:	Year:	Case:	Reference (See also chapter 10):
1	Starting decision MIRT exploration A58 St. Annabosch – Galder.	Ministry of Infrastructure and Water management	2010	A58	Ministry of I&W (2010).
2	Starting decision MIRT exploration A58 Eindhoven – Tilburg	Ministry of Infrastructure and Water management	2013	A58	Ministry of I&W (2013).
3	MIRT exploration A58 Eindhoven – Tilburg. Final report effects and appreciation possible solutions	Movares Nederland BV	2014	A58	Movares (2014).
4	Summary MER A67	Antea Group	2019	A67	Antea (2019a).
5	Overarching framework vision (design)	Antea Group	2019	A67	Antea (2019b).
6	Trace Decision/MER-appreciation A15 Papendrecht – Sliedrecht. Effects report	Tauw	2018	A15	Tauw (2018)
7	Notification Doubling N33 Midden Zuidbroek – Appingedam	N33 midden	2018	N33	N33 midden (2018).
8	Exploration/1st phase MER Doubling N33 Zuidbroek - Appingedam	Sweco	2018	N33	Sweco (2018)
9	Exploration Dyke improvement Noordelijke Randmeerdijk	Witteveen+Bos	2018	Dyke improvement Noordelijke randmeerdijk	Waterschap Vallei en Veluwe, 2018c)

10	Preferred alternative Noordelijke Randmeerdijk	Waterschap Vallei en Veluwe	2019	Dyke improvement Noordelijke randmeerdijk	Waterschap Vallei en Veluwe (2019).
11	Dealing with new design instruments: how to stabilize your project.	Witteveen+Bos	2019	Dyke improvement Noordelijke randmeerdijk	
12	Dyke improvement Wolferen-Sprok. Assessment and analyses spatial plans.	Witteveen+Bos	2016	Dyke improvement Wolferen-Sprok	Waterschap Rivierenland (2016a).
13	Spatial quality framework Wolferen-Sprok	Witteveen+Bos	2016	Dyke improvement Wolferen-Sprok	Waterschap Rivierenland (2016b).
14	Note on preferred alternative. Integral exploration Dyke improvement Wolferen-Sprok and dyke replacement.	Witteveen+Bos	2018	Dyke improvement Wolferen-Sprok	Waterschap Rivierenland (2018).

Appendix 6: Overview interviews and participants

#	Date:	Case:	Name of participant:	Organization:	Function:	Place:
1	29-04	InnovA58	M. Bakermans	Rijkswaterstaat	Project manager of the exploration phase	Zuidwal 58, Den Bosch
2	29-04	InnovA58	P. Van Zwam	Rijkswaterstaat	Project manager of the planning execution phase	Zuidwal 58, Den Bosch
3	30-04	Dyke reinforcement Wolferen-Sprok	G. Westerhof	Waterschap Rivierenland	Technical manager of the planning execution phase	Koppeling sweg 2, Andelst
4	30-04	Dyke reinforcement Wolferen-Sprok	J. Bunsink	Witteveen+Bos	Project manager of the exploration phase & Product manager in the planning execution phase	Koppeling sweg 2, Andelst
5	03-05	A67	S. Zondervan	Antea Group	Project manager of the exploration phase	Zuidwal 58, Den Bosch
6	13-05	Dyke reinforcement Noordelijke Randmeerdijken	M. Nieuwenhuis	Waterschap Vallei en Veluwe	Project manager of the exploration phase	Steenbok straat 10, Apeldoorn
7	13-05	Dyke reinforcement Noordelijke Randmeerdijken	J. Lansink	Witteveen+Bos	Project manager of the exploration phase & Project manager of the planning execution phase	Leeuwen brug 8, Deventer

8	14-05	InnovA58	E. Rijsdijk	Witteveen+Bos	Project manager of the planning execution phase	Hoogoord dreef 15, Amsterda m
9	21-05	A67	T. Van Tilborg	I&W	Project manager of the exploration phase	Rijnstraat 8, Den Haag
10	22-05	A15	F. Eenink	Tauw	Contract manager and control manager of the planning execution phase	Australiël aan 5, Utrecht
11	25-06	N33 Midden	B. Bouma	Provincie Groningen	Technical manager of the exploration phase and planning execution phase	Martiniker khof 12, Groninge n
12	25-06	N33 Midden	Robert-Jan Jonker	Sweco	Stakeholder manager of the exploration phase	De holle Bilt 22, De Bilt