Omar T. Atta

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Mind the “sustainability” gap

An organisational analysis on the integration of sustainability in the redevelopment of existing infrastructural assets

By

Omar T. Atta

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Thesis committee: Dr. J.A. Annema, TU Delft
Dr. M.L.C de Bruijne, TU Delft

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Content

Executive summary

Rijkswaterstaat is the executive agency of the Dutch State in charge of managing and maintaining the country's infrastructure, including roads, waterways, and flood protection systems. As a substantial portion of RWS's assets nears the end of its design life, renewal and revitalization have become important goals ensure continued functionality and sustainability. Infrastructure redevelopment is an important task for RWS but traditional maintenance approaches to infrastructure development have paid little attention to sustainability and environment. The Replacement and Renovation program, which translates as V&R (Vervanging en Renovatie), is a pivotal initiative within the realm of Rijkswaterstaat (RWS) WNN (West-Nederland Noord), in the North-Holland region. This program aims to modernize and upgrade aging infrastructure assets, integrating sustainable and environmentally friendly practices to meet current and future needs.

Adding sustainability to infrastructure redevelopment is necessary to ensure that V&R projects are aligned with the organisational sustainability goals. Projects in V&R transcend routine maintenance, demanding strategic planning and the allocation of significant resources. The program extends beyond the conventional scope of infrastructure management, requiring innovative solutions to achieve more sustainable practices. Therefore, it becomes imperative to investigate the intricate dynamics at play within the V&R organisation, striving to identify possible tensions and bottlenecks that halters the program with the overarching goals of RWS, in terms of sustainability. The main research question is “How can sustainability be implemented in the redevelopment of existing infrastructural assets?”

The research is based on a literature review, desk research and an in-depth case study of the V&R program, including in-depth interviews with civil servants of Rijkswaterstaat WNN that are involved in the V&R projects. This thesis provides a detailed and comprehensive analysis of the current sustainable approaches in V&R.

While the V&R organisation is organized as a separate division within the RWS organization the organization experiences barriers in the transition from pioneering and innovating to formalisation and standardisation. It is important to ensure the sustainability gap is closed compared to other aspects such as safety and accessibility. The currently stated ambition levels are unclear, especially regarding benefits to the V&R projects. To prevent having superficial sustainability measures in place, the ambition levels should be raised. Sustainability still lags behind in the standardisation process.

The results also reveal a tension in the definition of sustainability among civil servants that needs to be dealt with and a lack of clear subsidies and fundings to achieve innovative solutions and support sustainable infrastructure redevelopment.

Practical recommendations for achieving a more sustainable outcomes during the V&R plan phase include: the use of concrete contextual frameworks and concrete indicators and definitions of sustainability for IPM members. This would be beneficial for adding more focus on sustainability in the V&R projects. Also, having a financial project controller integrated within the IPM teams to sort out available subsidy and funding opportunities for sustainability measures in V&R projects. Finally, it is recommended that higher management gives more guidance when it comes to sustainability goals in the V&R projects.

1. Introduction

We have become more conscious of the nature surrounding us than before. Since the emergence of COVID-19, people have had opportunities to appreciate the outdoors. Whether its a stroll along the beach or a refreshing hike through the forest we've come to realize that these experiences are essential for our well being. Following this realization many of us have noticed a reduction in air pollution near highways and an improvement in biodiversity (Harvard University School of Public Health, 2020). The corona crisis inadvertently had some effects on addressing another pressing issue; climate change. However now that the corona crisis has passed what steps can the Dutch government take to mitigate climate change, in the Netherlands? This way we can continue enjoying pollution walks in nature.

In the Dutch Climate Agreement, which was signed in 2019 the government of the Netherlands has committed to a target of reducing CO^2 emissions by at least 50% before 2030 as compared to the levels recorded in 2019 when the agreement was signed (Ministerie van Economische Zaken en Klimaat, 2021). Since then, a lot has been done by the Dutch government to achieve this goal. For instance, policies have been designed to encourage the use of electric vehicles by offering incentives to expand the charging infrastructure for vehicles, and to phase out coal-fired power plants (Ministerie van Economische Zaken en Klimaat, 2020). However, in infrastructure, there are neither (strategic) plans nor protocols on how to transform existing infrastructural assets into sustainable assets in the Netherlands. This is because most infrastructural (re)development contracts have become outdated and based on situations at a time climate change and sustainability had less priority. Most bridges that are on the verge of redevelopment in North-Holland date back to the late 1960's (Rijkswaterstaat, 2019).

However, the scientific community identifies a significant knowledge gap when it comes to determining the best practices for environmentally friendly approaches in the redevelopment of existing infrastructure projects (Gilmour et al., 2014). This knowledge gap, which forms the core problem of this research, represents the absence of comprehensive guidelines and strategies for integrating sustainability into infrastructure renewal projects effectively. Current literature lacks a unified framework that considers the specific challenges and opportunities of redeveloping existing infrastructure while prioritizing sustainability and environmental concerns. This gap hinders the development of sustainable strategies for infrastructure renewal and limits the ability to address critical issues such as reducing the carbon footprint, enhancing resilience, and minimizing environmental impacts in these projects. My research aims to bridge this knowledge gap by delving into the existing literature on sustainability in infrastructure projects, exploring approaches taken in an infrastructure asset management organisation, and proposing practical solutions to advance sustainability in the redevelopment of aging infrastructure. Prior to commencing my research, I conducted an extensive literature review to understand the current state of knowledge in this field and identify areas where further investigation is needed, which confirmed the existence of this critical knowledge gap.

This challenge is exemplified by the statement made by Rijkswaterstaat (2020), which highlights the absence of definitive answers in this critical area of sustainability and infrastructure development. The reason why there is an absence of definitive answers is because the Netherlands have never dealt with sustainable redevelopment questions for infrastructure assets in the past.

The goal of this Master thesis is to research the redevelopment of existing infrastructure assets when it comes to implementing sustainability. Therefore, the research question will be:

"How can sustainability be implemented in the redevelopment of existing infrastructural assets?"

Before delving into the central question, it is essential to address preliminary inquiries, which need clarification before proceeding to answer the main research question. These preliminary inquiries, were the following:

1. What are the current areas of tension in the V&R of infrastructure organisations?
2. How do organisations that deal with infrastructure asset management incorporate sustainability into the V&R?

The research is done with the use of a case study. The case is Rijkswaterstaat's V&R department. Rijkswaterstaat WNN (West Nederland Noord) will be our case study in this research. Rijkswaterstaat is the executive agency of the Ministry of Infrastructure and Water Management in the Netherlands (before known as Traffic and Water Management). The organization's core tasks are to manage and develop the main public roads, waterways, and water systems. Its secondary tasks are biodiversity, living environment and sustainability (Rijkswaterstaat, 2018). The difference between the first and second tasks are that the first task traditionally receives more budget from the state (Rijkswaterstaat, 2018).

Rijkswaterstaat has the ambition to become energy neutral by 2030 (Rijkswaterstaat, 2017). According to RWS, this means it wants to generate as much energy as is consumed and CO^2 emissions are reduced to zero (Rijkswaterstaat, 2017). Rijkswaterstaat also stated it wants to work in a circular manner by 2030 (Rijkswaterstaat, 2017). On top of that, in 2020 Michele Blom (general director of Rijkswaterstaat) also sent a message in a company newsletter where she called on the Rijkswaterstaat officials to make sure that from now on "everything that will be done in the organization (whether you work at the construction site or being the cleaner), will be done in a sustainable manner (Ministerie van Infrastructuur en Waterstaat, 2020)." This message has influenced civil servants and the current work procedures that aim to fully embrace sustainability within RWS, such as in the R&R department.

Rijkswaterstaat is a major client for contractors. Both public and private actors must cooperate to achieve sustainability goals, and therefore contribute to reducing climate change. At the beginning of 2017, Rijkswaterstaat also signed the Green Deal GWW 2.0 together with 60 other parties (Ministerie van Infrastructuur en Waterstaat, 2021a). But the question is if this will be enough to become a fully 'green' and climate robust public organization. A challenging part is that this abstract goal of RWS needs to be translated into concrete achievements and actual procedures for the regional branches of RWS, such as RWS-WNN.

The department that is responsible for redeveloping the existing infrastructural assets in North-Holland, is called V&P (Verkenning en Planuitwerking). This translates into "Exploration and Planning" department. The Exploration and Planning department of WNN is responsible for shaping the infrastructure network development from the planning process and facilitating decision-making, in close cooperation with other public and private partners.

Currently RWS do this, among other things, for *the* Replacement and Renovation/Redevelopment of (V&R) infrastructure projects. In the coming years, significant numbers of infrastructural objects reach the end of their lifespan and need to be redeveloped (Rijkswaterstaat, 2019). However, there

are currently no clear procedures on how to tackle such projects in a climate and environmentally friendly manner.

1.1. Academic and social relevance

This research serves both scientific and societal purposes. It is primarily intended to benefit civil servants engaged in V&R projects, with a particular emphasis on decision-makers responsible for overseeing the redevelopment of existing infrastructure assets. Simultaneously, this thesis research holds significance for the academic community as it offers a comprehensive assessment of the current state of V&R procedures concerning the integration of sustainability into assets.

The objective of this research is to contribute to the scientific literature on the practical application of sustainability in the organisational structure of the departments that deal with redevelopment of existing infrastructure assets. Research on the concept of implementing sustainability in building new infrastructure is vast. However, research on the practical application of implementing sustainability in organisations to facilitate projects for the redevelopment of existing infrastructure assets are limited.

2. State of the Art

2.1. Literature review

The main topic of this thesis research is an organisational analysis on implementing sustainability for the replacement and renovation (V&R) of existing infrastructure assets and how the V&R department can add sustainability in their organisation. The term “sustainability” is a broad container term (Kuhlman & Farrington, 2010), and anything but a clear term. When we read the Oxford dictionary, the translation of sustainability is as follows:

“The degree to which a process or enterprise is able to be maintained or continued while avoiding the long-term depletion of natural resources.” (OED, 2012)

Existing literature identifies the social challenges associated with sustainability and sustainability transitions, highlighting their interconnectedness. Various viewpoints on energy transitions were subsequently consolidated.

2.1.1. The sustainability transitions and (social) challenges

The energy transition, climate adaptation, and circular economy are considered preconditions for each other’s success (Exter et al, 2018). Sustainable use of materials is needed to meet the material demand of the energy transition, and sustainable energy is needed to produce and reuse products and materials in a truly sustainable way. Circular economy can contribute to the climate challenge, including from reducing material use and associated production processes and reducing greenhouse gas emissions (Ministerie van Infrastructuur en Waterstaat, 2021b). The current global production of critical metals is insufficient for the transition to a sustainable electricity system. To ensure sufficient supply of critical metals, global and robust climate policies must go together with circular strategies to reduce dependence on critical metals reduce. The main point about mentioning this is to understand various perspectives to enable sustainability in practice and what it involves implementing it in the V&R organisation.

Transition management (Loorbach, 2010) (Rotman et al, 2001) (Roo et al, 2012) focuses on societal change processes. How transitions are shaped by and can be influenced by different actors: individuals, institutions or organisations. Transition management looks at the dynamics of the entire

transition process and is concerned with both renewal (construction) and changes in existing social institutions.

However, transition management lacks specificity regarding the transformation of existing infrastructure assets into sustainable ones. Its applicability seems more aligned with greenfield constructions rather than brownfield projects. As a result, this theory may not offer pertinent insights for this research. Furthermore, given its abstract nature, transition management may not be directly applicable to the practical realm of infrastructural asset management.

2.1.2. Organizational structures by Mintzberg (1979)

After reading literature on transitions in the previous chapter, it did not describe how this transition works on an organisational level with a focus on implementation, but rather combining various entities such as governments, individuals, and companies to gain a holistic view. For this thesis research, we are looking into challenges of the current V&R program and how that relates to sustainability. Hence, this is why organisational theory will give more clarity in this research topic. Therefore, Mintzberg's organizational structure theory is selected as the theoretical framework perspective. It is preferred due to its comprehensive approach in understanding the complexities of organizational structures and management roles considering the organizational activities. This framework aids the analysis of diverse functions, roles, and organisational structures within the V&R department. The theory helps to map processes and carry out analysis on implementation on an organisational level. In the department of V&P-V&R, Mintzberg's theory is used to analyse and interpret the intricate relationships, decision-making processes, and structural dynamics at play. Using this theory, a deeper understanding of the organizational complexities of the V&R department and its efforts in implementing sustainability in the redevelopment of infrastructure assets is obtained.

Henry Mintzberg's organizational structure theory, first proposed in his book "The Structuring of Organizations (1979)," focuses on the different ways in which organizations can be structured to achieve their goals. Mintzberg identifies five main organizational structures, which he calls configurations. However, in practice it is also possible that organizations have multiple (mixed) configurations at the same time. Mintzberg also identifies six coordinating mechanisms that organizations use to achieve their goals.

According to Mintzberg (1979), the most effective organizational structure and coordinating mechanism depend on a variety of factors, including the organization's goals, size, environment, and culture. Organizations select the structure and coordinating mechanism that will best enable them to achieve their goals and respond to changes in their environment.

2.1.3. Sustainability in infrastructure assets

A broadly shared perspective on sustainability exists in which three focal points exist, namely people, planet, and profit. And, as it happens, those are precisely the three pillars that Thomas (2020) is describing in relation to infrastructure construction management. According to Thomas (2020) when governments or construction firms are starting a construction project, they take three pillars in consideration to act sustainable.

The first pillar is called the social pillar. The design of every infrastructure construction project is tailored to the community it will serve. Although it may appear to be a straightforward principle, considering all relevant factors of the surrounding areas for the sake of sustainability is a complicated endeavour. In the past, an infrastructure object’s sole purpose was to serve as a means of transportation, but today's infrastructure construction endeavours to not only meet the needs of the

present population, but to also be constructed in a manner that will sustain its utility for future generations (Thomas, 2020).

The second pillar is called the environmental pillar. This aspect has received significant attention in recent years, as described in chapter 1. All industries, including the construction sector, consume a lot of resources such as oil, tarmac, concrete etc. However, the construction industry has been making significant progress in improving its environmental practices and becoming more environmentally friendly (Yılmaz & Bakış, 2015). Nonetheless, as noted by Tang (2015), simply reducing consumption and promoting the use of renewable energy through "greening" efforts does not address the root issue of sustainability that a sustainable outcome cannot be achieved if the balance of resources used, and resources produced remains negative.

The last pillar that is mentioned is the economic pillar. For the economic aspect of an infrastructure construction project, the result must provide equal or greater value for the construction company compared to the expenses incurred in its creation (Thomas, 2020). The cost-effectiveness of a constructure, in terms of the value it brings versus its raw material expenses, is evaluated before the start of the actual construction phase.

State of the art literature argues that achieving sustainability in infrastructure construction can be accomplished when public and private organisations try to strike a balance between the three pillars of social, environmental, and economic value (Gauvreau, 2018). Yet, by considering a fourth, often overlooked pillar of enhanced education, infrastructure construction, in particular, can reap the benefits of innovative concepts, added value, and a deeper understanding of sustainability).

However, this article by Thomas (2020) is related to construction of new infrastructural assets (greenfield) rather than redeveloping existing infrastructural assets (brownfield). Nonetheless, this theoretical concept of the three pillars as described above could be also applied to existing infrastructures that are ending its lifespan and thus need to be redeveloped. The same applies to the two articles about sustainability in infrastructure assets below.

Bridging the Gap between Sustainability and Resilience of Civil Infrastructure Using Lifetime Resilience

Yang and Frangopol (2018) explore the concept of lifetime resilience and its application in bridging the gap between sustainability and resilience of civil infrastructure.

The authors argue that sustainability and resilience are two essential aspects of civil infrastructure that must be considered together to develop a comprehensive framework for infrastructure management. While sustainability focuses on meeting current needs without compromising the ability of future generations to meet their own needs, resilience focuses on the ability of infrastructure to withstand and recover from adverse events.

The authors propose the concept of lifetime resilience, which integrates the two concepts by considering the entire life cycle of infrastructure, from design and construction to operation and maintenance, and incorporating sustainability and resilience into every stage of the life cycle.

The article also discusses the challenges and opportunities of implementing the lifetime resilience concept and provides examples of its application in various infrastructure systems. The authors conclude that lifetime resilience can provide a more holistic approach to infrastructure management, leading to more sustainable and resilient infrastructure that can better withstand and recover from adverse events.

For this master thesis, the information collected from this scientific article could help provide knowledge on how infrastructural assets at RWS deal with its resilience.

2.2. Literature search strategy

2.2.1 Search query

An initial step in developing a literature search plan is to craft a search query of key terms. In the table below, the outcomes of the search query are shown in table 1.

Table 1: search query

Search Query	**Search Results**
"Sustainable infrastructure projects" Netherlands	209
"Sustainable infrastructure projects" government	729
"Environment friendly" replacement bridges	16.800
"Sustainable policy strategies"	76
"Sustainable policy strategies" Netherlands	25
"Management of infrastructure assets" government	410
"Management of infrastructure assets" Netherlands	141
organisational structure sustainability in infrastructure redevelopment sustainability "organisational structure sustainability"	3

3. Research methodology

This thesis research can be described as explorative research, because of the limited knowledge about the implementation of sustainability in infrastructural assets, from an organisational perspective. In the following sections, the design of the research is described in depth. In section 1 the research approach is explained with a research flow diagram. In section 2 the research methods that is applied will be discussed. In section 3 data collection process is explained by using qualitative in-depth interviews and direct observations.

3.1. Research approach

The research approach outlines the steps taken in the research to answer the main research question. In figure 1, the research flow diagram for this thesis is shown.

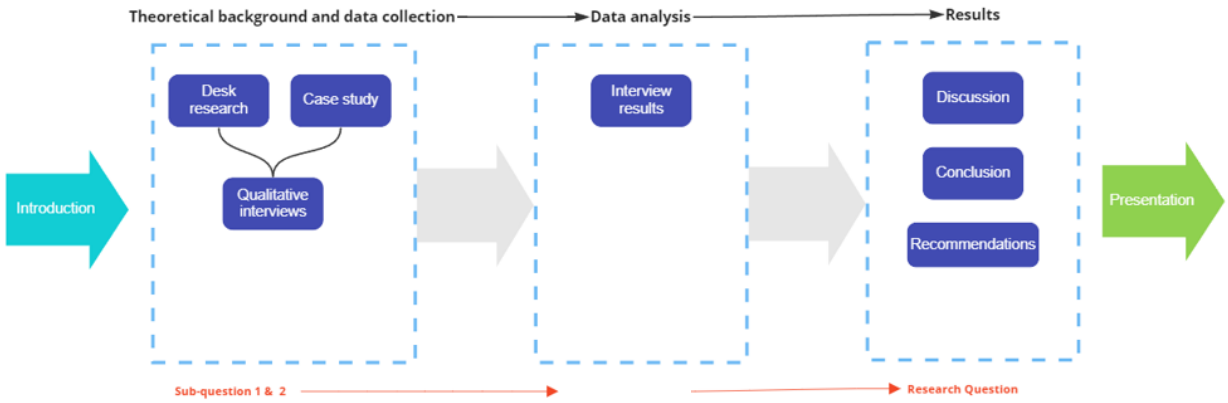

Figure 1: research flow diagram

Figure 1 shows the main steps of this research. These steps comprise a literature review (desk research) followed by a case study. The literature review yields the conceptual model - the lens through which I analysed the challenge of implementing sustainability in V&R programs by an infrastructure asset management organization. This model forms the foundation that described how I will analyse the case. This conceptual lens needs to be developed because the literature review did not provide a readily available model or detailed framework to help analyse how an organization managing infrastructure should implement sustainability in a V&R project. Initially, the studied literature about infrastructure, sustainability and sustainability transitions provided some insights, but not a comprehensive model. Therefore, I explored a different type of literature, one focused on organizations by Mintzberg (1979) that provides models of different archetypes of organizations. This approach delves into how organizations deal with new challenges and what kind of organisation structure would fit.

The case study was conducted by studying documents from RWS that are only retrievable when you are employed by RWS. After both types of literature were assessed and studied, the knowledge gained from the literature review and the case study were combined and served as the basis for semi structured interview questions. These questions were asked to six civil servants in the RWS.

After the qualitative interviews, the data analysis phase start. There, I managed to systematically analyse the answers during the interviews by adding codes in Atlas.ti. A detailed overview op this process is described in chapter 3.3.1. of this thesis report.

Once that was done, the results phase starts. Here, the answers and the theory of Mintzberg (1979) being connected, which leads to a discussion, conclusion, and recommendations. After going through all these phases, the research question is answered.

3.2. Research methods

3.2.1. Desk research

In the context of my thesis research, information gathering relied heavily on textual sources from RWS, constituting desk research. This encompassed two main approaches: document analysis from sources within RWS and conducting a literature review (see chapter 2). Document analysis entailed a comprehensive examination and scrutiny of written materials sourced from RWS, encompassing reports, articles, and other published content. This method was instrumental in acquiring insights and information regarding the V&R process. In contrast, the literature review consisted of a

systematic exploration and synthesis of previously published research on sustainability and organisation structures, intending to develop a framework to view the current V&R process regarding their sustainability implementation. Both document analysis and literature review (as shown in chapter 2) were helpful tools for gathering and combining data from different sources. They provided important viewpoints and insights that were relevant to the thesis research.

3.2.2. Case study

This Master thesis research is supported with a case study to answer the main research question. In this specific research, RWS WNN will be the case study because they are right now dealing with a large amount of infrastructure redevelopment projects in the coming years (RWS, 2019). A case study is a useful research method for gaining detailed, context-specific knowledge which enables insight how an organization seeks to reach a sustainable way of renovation existing infrastructural assets in the future. This method allows for exploration of the characteristics, meanings, and implications being studied. A case study offers an in-depth analysis of a single case, it provides a clear and concise way to define and investigate a topic (Yin, 2012).

A combination of in depth semi-structured qualitative interviews, observations and desk research are used, to triangulate the data collection process which increases the robustness of the data and subsequent analysis. This in turn increases the validity of the findings (Levinson, 2021). In chapter 4, a detailed description on the case study will be explained in more detail.

3.3. Data collection

This research makes use of various methods of data collection in the various steps of the research. To maintain oversight, the methods of data collection will be presented and described per research step.

First, data was collected via desk study research during the initial phase of the research. By gaining access to the employee portal of RWS I was able to retrieve documents on the V&R. During this period, I also took certain number of exploratory interviews. These were held with managers of the V&R department at RWS WNN. As the focus of the research turned towards the implementation of sustainability in the V&R, I spoke more with civil servants that have knowledge of that topic.

The second phase of the research revolved around literature research. Two different approaches were taken to research. First, I searched academic literature on how sustainability is embedded in the redevelopment of existing infrastructure assets. However, this literature was relatively scarce and not relevant to this research. Next, I searched for literature that could help gain an understanding of the organisational complexity of implementing sustainability in existing processes on asset management.

For the second phase of the research, , a case study was conducted. For this case study, several methods were employed, including observations, the examination of secondary data (with unrestricted internal access to project and organizational documents, as well as studies on asset management and interviews.

Semi-structured interviews took place via Microsoft Teams, each of them lasting approximately 1.5 hours. Prior to the interviews, all participants gave their explicit consent to record and transcribe the conversations. The respondents were questioned on various aspects related to sustainability within the V&R projects, as well as the organisational structure within the V&R program. An interview

protocol was set up based on the concepts of organisational structures theory by Mintzberg (1979) (see appendix I) and employed to guide the discussions on predefined key topics.

3.3.1. Qualitative in-depth interviews

In total X Semi-structured in-depth interviews were conducted with civil servants of Rijkswaterstaat WNN that are involved in the V&R projects. A semi-structured interview is a type of qualitative research method that combines elements of both structured and unstructured interviews. In this type of interview, there is a basic outline or set of questions to guide the conversation, but it gives also the flexibility to deviate from the script and explore additional topics as they arise. This approach allows for a more natural and in-depth conversation, allowing to gather rich, detailed information from the interviewees (Levinson, 2021). Qualitative interviews are a useful approach in an explorative research setting (Cresswell, 2018). By conducting semi-structured interviews with civil servants of Rijkswaterstaat WNN, valuable insights and information about the implementation of sustainability processes within the redevelopments of existing infrastructure assets are gathered.

Based on hierarchical layers of the V&R program of RWS WNN (figure 4), six civil servants from different management layers have been selected for an interview that are involved with the implementation of V&R projects and program at RWS WNN.

Civil servant 1 (CS1) is environment manager and is member of several project teams (IPM) directly involved with carrying out V&R projects (light green box). Civil servant 2 (CS2) is project manager of the same project teams where also civil servant 1 is part of. Civil servant 3 (CS3) is environment manager for the V&R program and is part of the program team, which is the middle management of the V&R program (orange box). Civil servant 4 (CS4) is program manager of the V&R program and is the chairman of the program team (orange box) where CS3 is also part of. His role is basically a delegated (by the board of directors) client for the IPM teams. Civil servant 5 (CS5) is department head of the V&P department that is end responsible for carrying out the V&R program. As department head, she is responsible for everyone from CS 1 to CS 4. Civil servant 6 (CS6) is a sustainability advisor that is neither part of V&P nor V&R, but for network development and vision (NOV). However, his role is not exclusively for NOV and is involved within every department of WNN that deals with sustainability issues.

3.3.2. Direct observation

During my time, as a thesis research intern at RWS WNN I utilized observations as a method for collecting data. This approach gave me insights into the workings of the organization and allowed me to access a wealth of information that is typically only available to government employees. Throughout my internship, which lasted for six months, I had the privilege of attending meetings at various departments within WNN focused on aspects of RWS operations, such as V&R and sustainability. These meetings provided the possibility of observing decision making processes, discussions and strategic planning related to V&R. Direct observations gave me a closer understanding of the challenges and opportunities faced by the organization and also enabled me to gather rich and contextually relevant data that would be extremely valuable for this thesis research. The information gained allowed me to compare theoretical notions, with real life practices.

3.4. Data analysis

The analysis process for this master thesis research combined the data from the previous research steps.

The interview transcripts were systematically coded. Initially, a process of open coding was applied to identify recurring themes and patterns in the interview data. This allowed for the extraction of key concepts, statements, and phrases relevant to the research questions and Mintzberg (1979). After open coding, the assigned codes were compared to each other and merged when they were related to each other, into an overarching code. This second step is also called axial coding. The last step is called selective coding. In this stage, the main categories identified in the previous step are taken, and the theory is constructed. This is achieved by organizing all the discovered data (or codes) within these categories and establishing relationships and connections between the data based on them.

The documents from the RWS organisation were compared to the data to see whether V&R processes were followed by the civil servants. This was done by comparing the answers of respondents on interview questions to the information from documents on the process of V&R. If the answers deviated from the V&R process documents, then one would ask further on the topic why s/he has a different approach than the V&R process documents. This was challenging as it could be quite confronting to ask civil servants why they deviated from the standard process. To minimize the impact, I usually asked them in the beginning if they have knowledge about documents on the process of the V&R.

Lastly, I managed to participate in various meetings on sustainability within RWS WNN. This gave me a more holistic view of how the perception of sustainability is perceived within RWS. This enabled me to understand the struggles and issues where civil servants deal with currently. The observations were also added to the data analysis. Interestingly, during the meetings I did not feel that the civil servants were giving politically correct answers. Rather, they were quite open about certain matters.

Through this systematic process, connections and relationships among the themes emerged, enabling a deeper understanding of the collected interview data. The results are shown in chapter 5 based on the interview questions of appendix I.

The results from the interviews were, together with the desk research and observations done during the internship period, compared to the theory of Mintzberg (1979). This is done to see how far the theory is related to the practice at RWS-V&R and where they differ. The observations were done during the DULO team meetings as well as meetings with V&R staff at the office in Haarlem. This went quite well as I was seen as a regular internal employee in their eyes, eliminating the feeling that staff members of RWS have when speaking towards someone outside of the RWS organization. I also was able gain access to the employee portal of RWS as well as an entrance pass to the office without any issue.

4. Case study description: The RWS WNN organisation

RWS WNN comprises of three directorates, each of them eventually led by a Chief Engineer Director (HID). These directorates include Network Development (NO), Network Management (NM), and Operations (BV). Network Development is responsible for developing and planning the road and waterway network in the North-Holland region. Network Management oversees daily maintenance activities for infrastructure assets in North-Holland. The Operations Directorate handles a wide range of supporting and facilitating tasks for the WNN organisation. Within the NO Directorate, there is also the V&P department, which is tasked with executing V&R (replacement and renovation) projects in North-Holland. The primary focus of this case study will be within this, in red circled, department.

Figure 2: organisation structure RWS WNN

4.1. The V&P Department

According to RWS (2019), the V&P (Exploration and Planning) department of West Netherlands North region (WNN) is working on the construction and maintenance process (A&O), the redevelopment process (V&R) and the environmental asset management process (OAM). The department consists of environmental managers, project managers for planned products and advisers on the living environment. The department is responsible for the plan phase of V&R projects. The plan phase is the last step of the redevelopment process before it proceeds to the realisation and execution of the plans made in the plan phase.

The V&P department supports the Network Development (NO) from its planning process. This is done by providing support for MIRT (Multi-Year Program Infrastructure, Environment, and Transport) studies, explorations and the execution of plan studies. The department also provides advice during the realization of a project and for the management and maintenance of the network and monitoring of environmental issues.

The V&P department has a wide range of responsibilities related to environmental management and planning. The main tasks of the department include the realization of plan studies, which involves producing crucial products like Environmental Impact Reports.

Moreover, the department offers substantive advice on a variety of topics, including exploration, plan studies, the realization and management & maintenance for nature, external safety, landscape, soil, water, air, noise, and quality of life. The V&R department is also responsible for regional monitoring of the aforementioned environmental topics and takes the lead in ensuring that environmental interests are considered in MIRT studies, plan studies, and V&R studies.

Furthermore, the V&P department is accountable for timely involvement of the management interests of the RWS in the determination of its scope for construction and maintenance purposes.

Lastly, the V&P department advises the management of RWS WNN and the Directorate-General for RWS (DG RWS) on the progress of projects, environmental aspects, and environmental management.

4.2. The V&R program

A significant part of RWS's infrastructure is approaching the end of its design lifespan (RWS, 2019). This means that RWS is facing a substantial replacement and/or renovation (V&R) challenge. This challenge goes beyond regular maintenance and management. To effectively manage this, RWS has established the V&R program in 2019. The V&R program is RWS's large-scale national initiative for rejuvenating and renewing its infrastructure in the coming years. The intended outcome of the V&R challenge is the sustainable renewal of the infrastructure, ensuring satisfaction among the surrounding communities and users, with RWS as a dependable partner in this process.

The V&R program has different types of infrastructure objects that need to be redeveloped. The objects that are currently taken in the portfolio are the ferry ports of Den Helder and Texel, the pumping station, the bridges and locks in IJmuiden and Schellingwoude. The expectation is that more and more different objects will be added to the V&R program in the coming period. For WNN, this means that the program will have a larger number of objects in its portfolio in the coming years.

These objects are assigned to V&R project teams, also known as integral project management teams (IPM teams). The objects are processed into four phases. The first phase is called object-in-view phase. In this phase, the main goal is to identify infrastructure objects that are nearing its end of lifespan. The second phase is the regional analysis, which aims to develop directions and determining what the role of the respective asset will be in the future in relation to the network and environmental context. After this phase, a decision moment (BM1) will take place with DGMO (Directoraat Generaal Mobiliteit), who are part of the Ministry of Infrastructure and Water management and are also the main clients for the V&R projects. To progress to the next phase, DGMO will check if the V&R projects fulfilled certain requirements that were stated together by DGMO and the V&R-project group. The third phase is called the plan phase, which is also the most elaborative phase. The main goal is to develop different alternatives for the V&R objects. After that, another and final decision moment (BM2) will take place with DGMO. If BM2 is passed successfully, the V&R project shifts towards the realisation phase in which the redevelopment of the V&R object will start.

Figure 3: phases of the V&R program

4.2.1. Internal collaboration model for V&R program

From the program plan (RWS, 2019), the internal collaboration model in figure 4 has emerged. This figure shows the hierarchy of different management layers are that are responsible in the V&R program. In the top yellow box, the director of NO is situated. In the green box (MT) the department manager of V&P is located. Members of the program team (orange box) are, among other, the program manager and environmental manager. Lastly, the project team box (light green box) are the members of the IPM (integral project management) team, which are formed as the various V&R projects are redeveloped. It is important to consider that this hierarchical order only exists during the plan phase. All other phases have different structures and members.

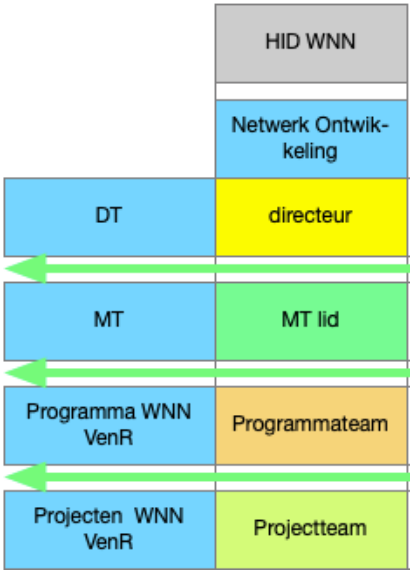

Figure 4: internal collaboration model V&R

5. Results

In this chapter the results of both the interviews and the observations are presented. Each sub question represents a question that was asked to the respondents. When necessary, I also present the observations gained during this (master thesis) period. In table 2, an overview of the responses of the civil servants to the various themes and questions is shown.

In appendix III, interview concepts for each respondent are shown based on the outcome of the interview transcripts (appendix II) which show what words are used the most per respondent.

Table 2: overview responses interview questions

	CS1	CS2	CS3	CS4	CS5	CS6	Remarks
5.1: Ambitionlevel			*+				*positive but additional remarks regarding this topic
5.2: Standarisation	large role	large role	large role	large role	large role	large role	regarding V&R program
5.3: Space							regarding sustainability in the V&R projects
5.4: Work culture			*+				*positive but additional remarks regarding this topic
5.5: Tension DGMO							*red=high tension, orange= moderate tension
5.6: Other departmens	-	-	-	+	-	-	
5.7: Challenges	+	+	+	+	+	+	*plus means experiencing challanges regarding sustainability
5.8: View sustainabiliy	*+	*+				*+	*positive but additional remarks regarding this topic
5.9: MB's Statement			*+			*+	*positive but additional remarks regarding this topic
5.10: Communication	both	both	both	both	both	informal	
5.11: Knowledge & skills							
5.12: Monitoring	T-reports	T-reports	T-reports	T-reports	T-reports	T-reports	

5.1. Realism of ambition level on sustainability in V&R projects

At RWS WNN, ambition levels are used in the V&R projects to define the level of complexity and innovativeness of certain sustainable components within a project. When a V&R project takes an ambition level 1 on sustainability, it means the project teams will only focus on the easy and quick gains on sustainability in a project. When ambition level 3 is taken, it means that the level of sustainable development within the project is complex and innovative. For instance, the reuse of bridge compartments. The higher the ambition level, the more complex and innovative it gets.

All the civil servants that were interviewed, were positive on the realistic achievability and the use of certain ambition levels that are currently used in V&R projects. CS4 stated how the ambition levels are applied in the V&R projects:

> *"Well, I notice in all projects that there are sustainability options and elements, and such an ambition level helps to generate or gather them as well. […] so everywhere it does have a place."*

According to him, it helps with generating sustainable options and elements.

CS6 provided a similar statement about the ambition levels:

> *"Well, you know, it's an 'ambition' level, right? So, in that sense, it's always realistic because you can simply have the ambition and you can either fulfil it or not. If you roughly divide it, Ambition Level 1 is simply the minimum. This is basically the baseline that we want to incorporate into all basic specifications and model contracts. And then you have Ambition Level 3, which is truly innovative, something that hasn't been done before. That requires more research competencies, so it's really cutting edge, so to speak. And Level 2 falls in between. Yeah, that's a reasonable distribution in itself."*

There, the interviewee focusses on the word ambition. According to him, it is just something you should strive towards to make V&R projects more sustainable. He also explains the different

ambition levels. However, he also had questions about who is responsible for giving the ambition levels in projects. That was something he was wondering about:

> *"Yes, we had a discussion about that yesterday with the project manager of the Naardertrekvaart and the A10 sound barriers. Who determines those ambition levels? And I'm not entirely sure how that works. Because, in some way, as a project, you have the space to choose an ambition level. But yeah, as a project, sometimes you just want the assignment, so it has to come from somewhere else…."*

CS3 find the ambition levels realistic, but also tells the problem that higher management (from the Ministry of Infrastructure and Water management, also called DGMO) does not give (enough) budget and clear decisions to achieve the ambition level that is given in the scope of the V&R project.

> *"Yes, so far, yes, and you know what's sometimes a problem? They'll set an ambition level, but then they don't have the fundings available. That can be a problem sometimes. Yes, then you have to go back again, but often you already describe that in the scope, right? So essentially, in the scope, you're saying and you're also aligning with DGMO that "This is the ambition level we agreed upon. Under that ambition level, we can do this and that and that and that, and it will cost this and that and that." Well, you're basically ticking those off, and they give their approval on that, and then you can proceed with that."*

5.2. Standardisation of the V&R program

All civil servants were asked the question if and how standardisation plays a role in the V&R program and organisation. All of them acknowledged the fact that the V&R program is relatively new and therefore there is a lack of experience among the civil servants of working in this type of work structure. At the start of the V&R Program in 2019, civil servants were pioneering and innovating their way through the projects. As of this year, in 2023, the middle and higher management levels are starting to shift work methods within the program more towards streamlining and standardising. They see the need to standardize the program in order to achieve goals that are set by the DGMO.

CS1 told the following about the standardisation of the V&R program:

> *"Well, you know, it's a bit of pioneering, and it's also because V&R [program] is still relatively new, which means that all the processes aren't fully established yet, like you would have with, for instance, a MIRT structure. So, there's a clear outline of the steps you always go through, who needs to be involved, who makes the decisions, and so on. And that structure just isn't fully in place for V&R, so it means you have to be prepared for the rules to change occasionally during the game."*

She basically tells that the V&R program structure is still evolving. However, she also added the following statement about standardisation when it comes to sustainability in the V&R:

> *"It is becoming more integrated into the [V&R] process, but I believe that sustainability is not fully incorporated at this moment, so the organization is still learning in that regard, I think. Previously, it was mainly about stating an ambition, an ambition level, and from there, you had certain steps to follow. However, it was quite optional, and now it's becoming more significant, indicating that a sustainability role can also be part of an IPM team."*

She again indicates that standardisation of V&R is developing. Also, an interesting take from this statement is that a sustainability role, in other words sustainability advisors from the DULO department used to be an optional addition rather than obligatory for an IPM group. However, now the voluntariness of sustainability is decreasing in the IPM teams.

CS4, from the middle management of the V&R program, gave the following statement when asked about the role the standardisation plays within the V&R program:

> *"A significant role. V&R is still relatively new, and we all feel the need to accelerate, to move through the processes more swiftly, and to tackle more objects. And that's where standardisation comes into play. […] However, of course, we deal with various objects - bridges, tunnels, sluices, you name it - and they're all unique. Ultimately, the goal would be to turn them into standard objects that can also be approached in a standardized manner, but we're not there yet. So, I primarily see the benefit in standardizing the [V&R] process and the approach [for tackling V&R projects]."*

He says that standardisation plays a significant role in the V&R program because of the need to accelerate the output of the program. Also, he thinks the ultimate goal is to turn assets into standard objects on process level. Lastly, he also mentions the shift from pioneering to standardisation and streamlining. According CS4, it is a challenge but not an impossible task.

> *"Well, as you said, we're transitioning from innovating and pioneering to streamlining and standardizing. That doesn't happen immediately, you know, it's a process with its ups and downs. But major dilemmas, not really. I think it has proven to be possible."*

However, when the sustainability part was discussed in the V&R, CS4 said in relation to standardisation:

> *"What is a sustainability measure in V&R? Or in other words, how do we carry out V&R sustainably? That hasn't been standardized yet."*

So CS4 admits that the standardisation for the V&R program, and then in particular the process, has been transforming into a more standardized environment, but the sustainability development is still lacking behind.

When speaking with CS5 about this topic, which is from the higher management, she mentioned that this question about standardisation is more fitting for CS4 (middle management) to answer. This indirectly indicates the significant role which the middle management have in the V&R program:

> *"Yes, that's more of a question for [CS4], but I can give you a general view about this. Yes, we started with the V&R process being open-ended, and that results in a wide variation in how each project is presented and what it entails. So, I'm glad that we, based on the 'Click-through Sheet V&R,' now have a clear view of all the elements included in a planning phase, and that's helpful."*

The above statement indicates the importance of middle management (CS4) in terms of knowledge about standardisation. A click-through sheet is an Excel guide developed by RWS to help civil servants that are working on V&R projects to understand the process of the V&R. This is a first draft in order to standardize the V&R process. The elements he mentioned that are included in the planning phase are about time, budget and capacity. It is unclear in how far sustainability is being incorporated into this.

5.3. Space for implementing sustainability in the V&R projects.

Interviewees were asked whether they felt the V&R program gives enough space for implementing sustainable options in the V&R projects. In general, everyone agreed that the current V&R program gives civil servants enough space in shaping and developing sustainable options and alternatives for V&R projects. Some answers of the interviewees are directly related towards standardisation and other topics.

CS6 who, as a sustainability advisor, is part of the support staff said:

> *"Yes, I do think that collectively we're still searching for. But how are we going to shape this concretely and precisely? And also that scaling up, so to speak, scaling up is a good term. Something that's*

> *currently happening somewhere as an innovation, how are we going to ensure that we're going to standardize it? That it becomes the norm? […] That's the trick."*

CS6 tells that in general the sustainability part in the V&R has enough room to be developed and implemented in the projects. This is also mainly based on the sustainability guide in the planning phase of V&R (Rijkswaterstaat, 2021). This guide is mended to give a direction to what is expected in the planning phase on sustainability. However, it is not specified what kind of decisions should be made.

CS4 also stressed that the project teams are also motivated to tackle the sustainability task within the V&R projects:

> *"Yes, I think so. The teams are willing, you know, they're also committed to sustainability. It's just about how it's done […] but it's still limited when it comes to tangible results. And I believe that's the biggest challenge. The teams want it, but sustainability needs to be made concrete or operational. What is a sustainability measure in V&R? Or in other words, how do we carry out V&R sustainably? That hasn't been standardized yet."*

So, this means that every management involved in the V&R program feels the same about the commitment to sustainability in the V&R program, which is high. However, the need of standardized sustainability measures is also present in the V&R projects to achieve the goals for sustainability in the V&R. It is important to create an intrinsic motivation to reach specific sustainability goals for each V&R asset. During the "V&R session afternoon" organised by the V&R department to everyone at RWS WNN, it was observed that everyone attended had a high commitment to sustainability. This because the attendees were actively participating during this session and gave their input on "how to do it" rather than "why to do it".

5.4. Work culture

All interviewees, from the civil servants working in the V&R projects till the higher management, agreed that there is a positive work culture in the V&R program and at Rijkswaterstaat WNN in general. One can see that based on the reason why most civil servants decide to stay at RWS for a long time. This means that employees are quite satisfied with RWS as employer. It is also consistently ranked in the top 10 best employer in the Netherlands (Heurman, 2022).

CS3 stated the following about the work culture at RWS WNN:

> *"I believe there's a positive culture here. However, sometimes we face setbacks, primarily related to external factors and developments beyond our control. […] Well, that certainly affects the people who are working hard on it. Nevertheless, overall, I think there's a very good work culture in place."*

CS3 experiences that some setbacks within the organization causes some upsets to colleagues, even though it is beyond their control.

When CS1 was asked about work culture in relation to standardisation of the V&R organisation, she answered the following:

> *"Well, I think it's useful to document things [such as decisions, agreements on tasks you have to carry out] regardless, so in that regard, that hasn't changed. But I don't necessarily think that it has a negative impact on a work culture or anything like that."*

She stressed that there is no negative relationship between standardisation of her work and the work culture of RWS WNN.

CS4 stated:

> *"Within V&R, the prevailing culture is solution-oriented and engaged. To some extent, it's also pioneering, as there are still many things that need to be invented for the first time, especially in the plan phases, but it's also problem-solving. […] "*

What is noticeable, is that he mentions that there is still a "pioneering" culture in the V&R (Plan phase) organisation. Which is indicating that V&R program is still "seeking" to find the best practices when in comes to executing the V&R projects.

So, the consensus from interviews, spanning civil servants at various levels within the V&R program to higher management, is that there is a positive work culture at Rijkswaterstaat WNN. This is evidenced by the high retention rates of civil servants, reflecting their satisfaction as employees. Despite occasional setbacks related to external factors, the prevailing sentiment is one of a robust work culture. Specific insights from respondents highlight the resilience of the work culture, with CS3 acknowledging the impact of external setbacks but emphasizing an overall positive environment. CS1 notes that the standardisation of V&R organization does not negatively affect the work culture. CS4 describes the prevailing culture within V&R as solution-oriented, engaged, and pioneering, indicating an ongoing exploration for optimal practices in executing V&R projects, particularly in the plan phases.

5.5. Tensions V&R program and DGMO

Interviewees were asked about their opinions on the relationship with DGMO (part of Ministry of infrastructure and Water State) and the V&R program and whether those two organisations are aligned with each other when it comes to sustainability and the way V&R is currently handled. The operating core, which in this case exists of the IPM project teams, perceives tensions between their organization and DGMO when it comes to having a feeling on how the V&R is done in practice and in the projects. This is based on the responses of the interviewees as well as what I observed during different meeting with sustainability managers and managers directly involved with V&R. However, these tensions are slowly decreasing according to the interviewees. The middle management mainly see tensions between RWS and DGMO when it comes to resources such as staff, financial support and budgets. In most cases DGMO highlights the importance of sustainability in V&R projects but it does not necessarily make more funds or staff available. This is problematic because DGMO stimulates innovative sustainability ideas in the V&R with ambition levels. Creating a higher ambition level does cost more money and time because you spend a significant amount of resources into sustainability innovation. However, when there are no funds available, it will not be attracting to achieve a higher ambition level and therefore sustainability innovation is being stagnated. Higher management sees tensions with DGMO on the level of commitment to sustainability. Questions such as how far DGMO wants to get when it comes to enabling sustainability in the V&R remains quite unclear. The V&R program wants to be as sustainable as possible, but DGMO is only in favour of this when it does not exceed budget.

CS1 said the following about the decision-makers at DGMO:

> *"Well, I think many decision-makers still tend to be in their ivory towers and don't really know what's happening within the organization and in the environment. And I believe that it's very important to involve them in that. […] they naturally have a very different perspective on that, and they're probably also being assessed against completely different targets, right?"*

CS1 thinks that decision-makers who are responsible for giving tasks to the V&R projects either don't know or have another view on how her organization works. She also believes that it is important to take the decision-makers at an early stage of the V&R projects.

CS2 has a different view than CS1, based on the answer he gave about possible tensions between DGMO and V&R:

> *"I haven't perceived that tension, and where that might have been the case in the past, […]. I see those tensions decreasing, and I consider this a positive development."*

CS3 told in the interview that she perceives tension with DGMO when it comes to financing and budgets for the V&R projects:

> *"Yes, because you simply notice that we're often being pulled back, that we're not allowed to do certain things [making decisions about costs for sustainable elements]. So, that's quite intense. Sometimes you really think, well guys, how can that be? That's how I've been feeling lately."*

CS5 also perceived tension between DGMO and the RWS-V&R organisation. She stated the following:

> *"[..] I'm very curious about the extent to which, because then you're back to that tension between DGMO and RWS, how far do they want to go with it [sustainability]? […] So, if you were to set up an additional research question there, well then I wonder to what extent that's also facilitated by the organization [DGMO]."*

CS5 wonders how far DGMO wants the V&R projects to be successful in implementing sustainability, and what that means budget wise for the V&R projects.

5.6. Attention of other departments

When the interviewees were asked about whether the attention of other departments within RWS distracts them from their core tasks, they all gave similar answers. The civil servants did not perceive any distraction from other departments (such as HR, WVL, etc) for the fulfilling of their core tasks.

CS2 gave a clear answer about distraction from other departments in the underlying statement:

> *"No, not really, fortunately, and that's because we work under a program. As far as I'm concerned, that's one of its significant advantages. [..] One of the major advantages is that the program team handles a lot of those questions. They basically ensure that we can just do our job without being bothered with questions that aren't essential for the project."*

He states that one of the benefits of working under the V&R program structure is that the program management forms an umbrella to protect the V&R IPM teams from distraction of other departments. Working in the IPM group, he states that the teams are formed by specialists from various departments within and outside of the RWS WNN organisation.

> *" We work very collaboratively with other departments.[…] All our specialists and advisors actually come from various branches within the WNN organization and beyond. […] It's actually quite diverse."*

From the middle management, CS4 stated:

> *" Yes, almost all departments […] You have to imagine that we're in a phase of development. […] It's becoming increasingly important, so that means many departments are involved, and you're still figuring out 'where is my boundary?' […] So, all those peripheral aspects are being identified, and then we need to make agreements, formalize, 'who is responsible?' and 'who takes the lead?' […] So, those*

peripheral aspects are really improving the V&R program. There are quite a lot of them, in development."

In this statement, CS4 tells that he deals with most departments at RWS WNN. This confirms what CS2 before talked about the role of the middle management in regarding to dealing with other departments outside of the V&R program.

5.7. Complexities & challenges regarding implementing sustainability in V&R projects

When the interviewees were asked about if and what kind of complexities and challenges the implementation of sustainability in the V&R encountered according to their opinion, they gave various answers. The main challenges and complexities regarding sustainability in the V&R were about unclear goals, the concreteness and formulation of what sustainability is and the capacity issues in the V&R project teams.

About this matter, CS1 had to say the following:

"The goals aren't always clear. For example, if your goal is to restore objects as cost-efficiently as possible, that's a different goal than it also needing to be safe, sustainable, and in compliance with current guidelines."

"However, to arrive at a good decision, you need a solution that is well-supported. This means you shouldn't just involve the decision-makers, but also ensure that everyone who has an opinion is included in the entire process leading up to it, and that's often where the challenge lies."."

However,, having more people involved also means using different processes and for example hiring differently skilled employees. But the availability of employees is already a bottleneck for RWS as it is difficult to hire new qualified staff.

CS1 also says that one of the challenges is to include every person to the decision-making process of the V&R during the planning phase when it comes to implementing sustainability. In practice, I noticed that both V&R department and the DULO department made efforts to reach each other in this phase. However, it is still on a voluntary rather than obligatory basis due to the lack of experience on the V&R process.

CS2 mentioned other complexity/challenges regarding this topic:

"We have a long list of projects to undertake, so many that we don't have enough teams. So, there are also projects waiting on the shelf, so to speak. That already indicates the bottleneck, which is capacity."

"But very innovative methods, for example, highly innovative construction materials or very innovative implementation methods, creates tension at RWS because we always want to rely on tested methods. So, if you want to apply something very innovative where there are no standards yet, no safety standards or maintenance standards, or there's little experience with it, we always have some reservations. We're a bit afraid of that […]. If you're too innovative, it can be challenging to get full approval within the RWS organization."

CS3 said:

"[…] our processes aren't standardized because V&R is new, and that means we're actually reinventing the wheel sometimes. We're trying to prevent that by standardizing our processes."

CS3 says the main challenge lies in standardizing the work process for the V&R projects.

CS4 also said the same as CS3 and CS2, which can be derived by the underlying statements:

> *"I find sustainability complex. […] And what we don't have yet is sustainability fully integrated into the standard approach. […] So, I think there's still room to make progress in that area."*
>
> *"[…] You can see that sustainability is still largely good intentions, like raising awareness, in my words, but it is still limited to actual physical results. And I think that is the biggest challenge. The teams are willing, but sustainability needs to be made concrete or operational. [...] That hasn't happened yet, there's still no standard in place."*
>
> *"Capacity remains a point of concern. We're facing a significant staff shortage, personnel turnover is high, so teams are often not fully staffed, which poses a substantial risk of delays."*
>
> *"[…] but we have had a lot of capacity issues in the past years, and we now have all teams staffed. As a result, the goals are progressing well, but it took a lot of effort and hard work to get those teams staffed. Now, it's especially important to ensure continuity. […] We have that sorted now {capacity], but it's also about constantly ensuring that it stays in order."*
>
> *"Well, sustainability is quite [a] broad [term], you know, so what is actually concrete? And if it's not concrete... so for me, there are two pain points. It's both not concrete enough, which means we don't know what we need to do, and it's not yet part of our standard process, […]. Those are the two main pain points for me."*

CS5 says:

> *"[…] Because, of course, we also have a huge capacity issue, so we're not going to say, "Okay, then we won't do a certain project because we're going to focus more on sustainability." It's not that straightforward, so that's an interesting tension."*

Just like others, CS5 also mentions the capacity as an important constraint in regarding to implementing sustainable measurements in V&R projects.

Lastly, CS6 gave his view:

> *"So, I think success in terms of sustainability isn't really institutionalized yet, it's not fully integrated, but relies on individuals. And the big challenge for Rijkswaterstaat, I believe, is to replicate those successes in another project. [...] Essentially, you want to scale up. It's like being a startup – you've come up with something good once, and now you need to scale up, you need to start doing it systematically."*
>
> *"So, the importance of economic growth and accessibility is still considered higher than sustainability. And I mean, I don't have a judgment on this, there's no right or wrong. But yeah, you always have to make trade-offs."*
>
> *"We have a lot of guidelines and things listed in the 'Werkwijzer', but difficult to find them. So, I think that's also our role from DULO to point out those resources to people who are looking for those specific information [...]."*

CS6 mentions the lack of institutionalization and standardisation as a main challenge to replicate previously successfully implemented V&R projects. Successful implementation of sustainability relies heavily on individuals' intrinsic motivation and therefore it should be more integrated in the V&R projects. Lastly, CS6 believes that there is plenty of information and guidelines on 'Werkwijzer' (which is an internal library full of documents by RWS), but it is unclear how to find this information on the employee database. During my observations at RWS, I noticed that not all information regarding V&R and sustainability is easily found. The main database RWS uses for guidelines and

information is called “Werkwijzer”. But besides that, there are plenty of other online places such as Intranet to retrieve information from. This made it sometimes difficult to find the correct information online.

5.8. Views on sustainability in the V&R projects

All interviewees were asked about their views on sustainability and how it should be shaped within V&R projects. Every interviewee thought it necessary to include sustainability in the V&R projects. However, they have different opinions about how to formulate sustainability within the projects. On one hand there is a demand for more concreteness on how to develop sustainable elements, but on the other hand there is a call to be less tight in the formulation of sustainability goals to give the project teams freedom to develop sustainability in their own way.

CS1 said:

> *“I find sustainability to be such a catch-all term. So, what choices are available for circularity? What should you definitely do in terms of energy supply? You actually want to have these "must-dos" in place, what you need to do and where you should focus, because then you can apply it very specifically to your project [...].”*
>
> *“See, an environmental manager has another 10 things to do, so it's nice if there's someone who's really focused on sustainability. […] In the planning phase, you're already too late if you involve someone at that point. You need to do it in the earliest possible stage, because if you already know where the opportunities for sustainability are, you can focus on them and make it concrete in your plan phase.”*

According to CS1, the term ‘sustainability’ is too ambiguously formulated at RWS. Consequently, CS1 poses open ended questions that needs to be answered, such as “what choices are available for circularity?” She thinks ‘sustainability’ should be operationalised to apply it in V&R projects. On top of that, she also says that she would like to see someone in the projects who is solely dedicated and responsible for sustainability matters (such as the DULO department), as that will give more breathing space to other work activities of CS1 and less stress to rush sustainability into the V&R projects. At least this is what CS1 explained during the interview.

CS2 gave a series of statements about sustainability:

> *"Sustainability is getting closer to the safety and availability aspects in terms of importance in the [V&R project] preconditions, but it's not yet at the same level."*
>
> *"I think we do need more concrete sustainability aspects that can be included in your request specifications and the question you pose to the market in the plan phase."*

CS3 says the following statement about sustainability within the V&R projects:

> *"And you see, without realizing it, you are already doing things sustainably, because if you, for example, make certain agreements with contractors, there's already a lot of sustainability and sustainable elements embedded in it, without you being fully aware of it, you know."*

Sustainable elements that are used are for instance on planning level. At RWS, they try to combine renovations and reparations on infrastructure assets as much as possible based on the location of the assets. In this way, you do not need to close off a highway twice, but once. That will benefit the (less) use of resources at that point of time.

CS4 gave the following statements regarding this topic:

> *"We want to move towards having sustainability embedded as much as possible within the frameworks and standards. So, that it's not an option, but rather a part of our methodology and approach. Well, we're trying to achieve that, and RWS is striving to implement this as extensively as possible."*
>
> *"And I even think it must. I notice very much that sustainability is often seen as an option, and it disappears very quickly. Because it takes longer, because it's more expensive, because it's complex. And you actually want to ensure that it's not an option, but rather a standard part of your approach."*
>
> *"You know what's interesting? Making the most of your existing assets for as long as possible is indeed sustainable, as you're extending the usage of components".*

In the statements given by CS4 above, he thinks that sustainability should be embedded within framework and standard approach. In other words, he means that it must be more concretely formulated what sustainability is, because he thinks that now sustainability is seen too much as an optional choice.
In the last sentence, his opinion is that making longer use of existing infrastructural assets is also a sustainable measurement. This also highlights that sustainability is indeed a broad term, as is discussed earlier.

CS5 also had some interesting opinions compared to the other civil servants:

> *"Yeah, well, in my opinion, sustainability should never be the critical path. That's not in line with the [V&R] task, and I also don't see it [delays] happening in practice, leading to those kinds of situations."*
>
> *"[…] So, the various elements that fall under sustainability were also mentioned earlier. Only now, the voluntariness has been removed."*
>
> *"I noticed that there were quite a lot of guidelines and recommendations available at the national level, but they were not very applicable, concrete, or specified. So, I think the project teams themselves are responsible for addressing this."*
>
> *"I also believe that [V&R] projects should have some flexibility in this [sustainability] regard, so I don't mind that everything is not tightly regulated. That's why I'm quite... Well, I want to keep that space open and not be too prescriptive about which themes to focus on and what the minimum environmental gains should be or anything like that. Let them [project teams] identify the opportunities and based on that, make decisions about where to focus. I think that's the best way for us to collaborate [with the project teams] effectively."*

In the first sentence, she believes that sustainability should never be the critical path in the V&R projects. In the second sentence, she thinks now the voluntariness is off regarding the implementation of sustainability. This does go against CS4's statement in which he mentions that sustainability is still an option. Lastly, the believes that sustainability should not be tightly regulated or have concretely defined boundaries. She thinks that the project team can decide what is best for in each project.

Lastly, CS6's opinion regarding sustainability:

> *"Well, the ultimate goal, of course, is that we from the DULO department would become redundant, because we are not meant to make all those projects in the line as sustainable as possible, but more to drive it. […] So yes, what we are really doing is driving and encouraging that. I do have the feeling that it's going well. Maybe 5 years ago, you had to convince people like 'Hey, wake up, you need to do it sustainably.' And now, everyone is awake in that sense and wants to do it sustainably, and it's more about 'Okay, what does that exactly mean and how do we shape that in our project and when do we do it right?' So, in that sense, we have taken a step compared to a few years ago."*

> *"It should simply be an integral part of the project, and I have the impression that many people I talk to also see it that way. What I do think is that people are looking for bite-sized pieces in such a project."*

> *"We need to do that [implementing sustainability] faster, right? […] It needs to be faster, it should just be like a sort of assembly line work, approximately."*

So, the awareness of doing V&R projects in a sustainable manner according to the respondent has moved in the right direction according to their respective feelings, but there are still lots of questions open to be answered. The dominant notion is that respondents identified a need for more guidance from staff to help implement sustainability in the initiatives.

Considering Mintzberg's framework, this paragraph reflects the "staff" or "support staff" role, emphasizing the need for more guidance in the implementation of sustainability in V&R projects. It suggests a realization that while there has been progress in the awareness of sustainability, there is still a requirement for clearer guidance and answers to unanswered questions, indicating a need for more structured support in the process.

5.9. View on Michelle Blom's statement about sustainability

Interviewees were asked about their opinion on the statement given by the (former) director-general of RWS, Michelle Blom. In a letter she stated that every work what the organisation is carrying out, is being done in a sustainable matter. All interviewees responded favourably to her statement. However, some did have question marks or felt some sort of tension. Especially the implementation part of sustainability and the expectancy how far sustainability should be implemented is being consider unclear by respondents.

CS3 gave the following response:

> *"Yes, you know, of course, it's a good statement. However, what's difficult is, of course, the question 'What does that mean, then?' 'What does the concrete translation into those projects look like?' Because that raises so many questions. I understand it [the statement], but it raises so many questions because it's not easy to make it concrete, and because you keep running into that tension with DGMO and their funding."*

CS4 reacted:

> *"Well, I think it's very good to do that. It's also very good to include that. It creates support for sustainability [within RWS]. It sets the ambition for sustainability. The challenge lies in actually making it happen."*

> *"[…] What you still continue to have, is that what ultimately comes out of it, that is still complicated. It's not automatic that something sustainable comes out of it or that you don't yet know exactly what will come out."*

CS4 identifies the complexity of implementing sustainability and points towards the unpredictability of this in the V&R project.

CS5 gave the following responses:

> *"Well, yes, in that I hear the directive to everyone in the organization to follow up on this [statement of Michelle Blom]. And with that, I find it quite strong. It doesn't differentiate between tasks, disciplines, or anything else."*

> *"Yeah, you know, I think you can criticize a lot about this statement. But I think the intention of the statement was to get everyone moving, and I think that's happening here as well [such as reusing*

coffee cups]. When you ask me if that's the case, well, no, we're not that far yet, but I don't think that was the intention of this statement either."

Lastly, CS6 gave his opinion about the statement by Michelle Blom:

> *"Yes, I find that fantastic, of course, but it's also quite complex. Because in essence, I think it's great that sustainability is no longer something separate. It's not like "We're going to do some sustainable things". No, sustainability should just be a part of the work we do. So, what we already had to do, we should do as sustainably as possible. So, I think what's really good about it is that it ensures sustainability becomes an integral part of what you need to do, essentially as part of asset management. But exactly what it means is still tricky, right? 'What we do, we do sustainably'. Then you're back to the concept of sustainability. 'What is sustainability exactly?', and 'when are we doing it right?' 'When are we doing it sustainably enough?' Yes, that's still a journey we're all on together."*

5.10. Forms of communication

When the interviewees were asked about their division of formal and informal communication forms, most of them answered that their work contains half the time of both formal and informal contacts. This is interesting to know in the light of the framework by Mintzberg. Mintzberg also distinct the five organisational archetypes based by its formal or informal communication. An organisation that uses informal communication tends to be more lenient, less standardised and flexible, and vice versa.

During the observations at the DULO department, I saw that civil servants who work in the same organisational layer mostly used informal communication forms, via online on in real life at the office. However, when civil servants differed from departments or in hierarchies (e.g., one civil servant is a director or team leader and the other is an associate), then a formal communication form was used, because the outcomes of those meetings would be recorded on paper. Sometimes, weeks of preparation was needed to attend these meetings with other departments and higher management.

CS2 gave the following response:

> *"I think 50/50, intuitively, but I find that difficult to determine."*

> *"I'm fine with it, the way it's going now. It has formed somewhat organically. So, in a natural way, we work as we are currently working."*

CS2 gives a rough estimation about his time divided in using formal and informal communication. He also thinks this is the best ratio on how to work within the V&R projects and as project manager.

CS3, from the middle management, gave the following answers:

> *"Yes, I think so. Especially because it's done through the projects and the scope, which are all documented very formally."*

CS3 says that the V&R projects are documented very well. Sustainability is also mentioned in the project scope, but in practice it is not specific enough to monitor the results of this element. Other respondents also struggled to give sustainability a proper framework.

CS4, also from the middle management, said the following:

> *"[…] Recently, we've standardized things quite a bit [such as the four phases of V&R]. So, there's a lot of formal communication in that regard. But everything around it is informal. I'm on a department with*

people working on V&R all day, so that happens very informally. But the things we need to agree on and make decisions about, those are done formally."

"The things we need to do formally, for example, we've just taken a BM2, which is the decision to move from the plan phase to the realization phase. But that's done very formally because then a letter goes to the director, the HID, and the DGMO. Well, that needs to be formal because we need to request an assignment, request a budget, and make agreements."

CS5, which is from the higher management layer, said the following:

"Yes, 40% formal, 60% informal communication"

"We actually alternate between formal and informal moments, and those formal moments are actually the 'steering committee meetings' where [CS4] presents the progress and we also try to reach agreements and decisions relevant to that context."

CS6, which is from the support staff of the RWS WNN organisation, said the following:

"No, it's all informal. It only becomes formal at a certain point when an environmental guide session is conducted. That's the formal part where structured discussions about sustainability take place and opportunities are identified and gathered."

"No, it's not very hierarchical in that sense. No, it's much more horizontal, just collegial. However, you have to understand that this is how we always work within DULO. Sustainability is not something that happens in one department. Sustainability happens in all departments, and many managers have responsibilities related to it. […] "

Based on the two statement CS6 gave, he says that his communication in the V&R program is mostly done in an informal setting. According to CS6, this is the way de DULO department operates at the RWS WNN. This is also what I observed during the weekly DULO team meetings. In terms of Mintzberg (1979), this department operates on an ad hoc basis.

5.11. Availability of knowledge and skills

The civil servants were asked if they have the availability and opportunity to gain the necessary knowledge and skills to conduct their role regarding the development of sustainability in the V&R. All of them report they feel they can obtain the necessary knowledge and/or skills to function in their role, for example the personal development plan that is given by RWS to its employees. RWS also have ready-to-take courses online at Intranet available for everyone who works at RWS. Besides the ready-to-take courses, one can ask for additional courses via their manager, which is granted if it is reasonable.

CS3 described:

"[…] We have personal development, which follows from your work plan, so your annual personal plan where you indicate what you want to develop in, your personal development, your competencies. You can communicate with the department head, […] and then she'll see if there's a budget available. It's not guaranteed that you'll get it, but it's possible. And besides that, there's an Environmental Management (OM) Academy, and they also organize various knowledge sessions. Each time it can be a different topic for which we, as environmental managers, are invited. So, that's also quite enjoyable."

5.12. Monitoring and coordination mechanisms in the V&R projects

The V&R projects make use of the so called “T-rapportage” (condition report) as a recurring monitoring measure on aspects such as capacity and budget for the projects. Basically, a condition report is a once per month meeting where each project is being monitored and coordinated based on that current state.

CS1 said the following about the monitoring and coordination mechanisms being used:

> *“Yes, progress [of the V&R projects] is monitored through ‘T-rapportage’ (term reports), and there is a collegial assessment (gate review) [of the V&R projects] before deciding [on the status of the V&R project] if you are ready for the next phase.”*

And before and after the plan phase, there is a gate review to check if the project is mature enough to go to the next phase. The gate reviews are a formal process.

CS4 declared in addition:

> *“We maintain a project database. So, we monitor the progress in terms of time and money there. But that's an ongoing process, you know. That's also the T-report, we report twice a year whether we are on schedule. We have set some objectives, yearly goals, so we monitor those objectives.”*

CS5 also mentions the T-report as main monitoring and coordinating mechanism:

> *“Yes, what's great about Rijkswaterstaat is that we have a very effective Monitoring cycle for the projects, in my opinion, with our T-reports. After each term, we hold a discussion based on the T-report itself, where we account for the current status, identify risks, assess the impact on the schedule, and propose potential control measures. As an owner representative, I place a lot of importance on keeping the project databases updated and preparing well for these T-discussions. These discussions are always scheduled, without exception. Ultimately, all projects are summarized in a T-report from our department, and this is how we report on progress. I've announced that sustainability will be a consistent part of these progress discussions [T-reports] as well. This way, you also integrate it into the process.”*

To summarize, the V&R projects utilize the "T-rapportage" (term report) as a regular monitoring tool focusing on aspects like project capacity and budget. This involves monthly meetings to assess and coordinate each project based on its current status. The monitoring and coordination mechanisms involve the "T-rapportage" and collegial assessments (gate reviews) to determine the readiness for the next project phase. Formal gate reviews are conducted both before and after the plan phase to ensure project maturity. Additionally, there is a project database to track progress in terms of time and money. The "T-report" is a crucial monitoring tool, providing a basis for discussions on the project's status, identifying risks, evaluating schedule impact, and proposing control measures. Sustainability is becoming an integral part of these progress discussions, with a commitment to integrating it into the reporting process.

6. Interpretation of the results

In this chapter the results are interpreted to identify recurring themes, patterns, and variations within the responses of the interviewees and in combination to observations I took. The way how this was done is described in chapter 3 of this thesis report. This will allow for the extraction of some key findings related to sustainability in V&R projects and the organizational structure of the V&R program.

6.1. From pioneering and innovation to formalisation and standardisation

Interviewees described the beginning situation when the V&R projects and program started in 2019 as a pioneering exploration. This because the V&R program was a relatively new concept being used in the RWS WNN organisation. As a consequence, civil servants in all layers of the organization had to think in an innovative or out-of-the-box way in order to achieve their V&R project goals (as stated in the project scope by DGMO) in an optimal manner. In the beginning of the V&R program, there was only one phase out of four in the process of V&R projects (see figure 3) and that was the realisation phase. Over three years since the existence, the V&R process has evolved into 4 phases. According to CS4, this is the final form that every V&R project will have to move along the four phases. The additions of these phases give IPM teams structure and overview to operate in, which benefits the V&R process. It also helps to compare other V&R projects with each other.

As all management layers seem to agree upon the final form of the four V&R project phases, there is a shift in work methods. Whereas in the beginning there was more of a pioneering and innovation work process applied, the V&R program is shifting towards uniformising and standardizing work processes. This shift in work process is however still in development. Slowly but surely more work processes on V&R projects are being documented and more work process manuals are being developed and applied and more agreements are being documented. The reason why this transformation shift is taking a long time is mainly due to the unfamiliarity with working on V&R by employees.

One of the IPM team members, CS2, tells his department is still learning, which is a component of a pioneering stage:

> *"Well, we are a learning organization, but I think we are really on the right track. We are still improving in setting up that entire process in a very systematic way."*

The shift happening from pioneering to standardising in the V&R projects was described by CS4:

> *"Yes, sometime last year. It was initiated earlier, but the [V&R] process was officially established in December 2022. Before that, we were doing it already, but I documented it on paper then. That made it traceable, and new [IPM] teams can draw from it. They can follow the V&R process, implement the best practices, exchange experiences."*

By shifting towards a standardised work environment, the expectation is that V&R projects become more predictable in terms of lead times. This is considered important as staff and management at RWS expects to be able to think about how to accelerate the V&R projects and increase output.

CS4 tells:

> *"Well, what standardisation helped with was also gaining insight, namely, what the lead time is. And now we have more or less the idea that if you follow the V&R steps, you'll find that it takes about 7 years to complete. Now that we know this, we can start thinking about how to expedite it. The process outlines the necessary steps, but it doesn't necessarily dictate the sequence in which you must do them;*

> *you can certainly compress it. You're allowed to intentionally skip some steps that you don't need. So, it also offers opportunities for acceleration, but I think the initial insight is about the time required to complete the whole process."*

So, from this point on, the goal of the organization is to scale up the projects, shorten the lead time and increase output. This can also be backed by CS4's statement below:

> *"[…] V&R is still relatively new, and we all feel the need to accelerate, to move through the processes faster, and to tackle more projects. And that's where standardisation helps. Towards the end of last year, a process was established, referred to as a "click-through plate," which incorporates a certain level of standardisation in the approach.[…] Ultimately, the goal is to turn them [infrastructure assets] into standardized objects that can be approached in a standardized manner, but we're not there yet. Thus, I primarily see benefits in standardizing the process and the methodology."*

CS4 mentions examples of methods that helped to standardise the V&R process to meet the demand from DGMO to accelerate the output of V&R projects. However, standardizing infrastructural objects has also its boundaries. In how far could RWS standardize those objects but also respect the object's uniqueness? This is something that could become a dilemma for the V&R department in the future.

When we consider the organisational structure of RWS considering Mintzberg (1979), we can conclude that RWS uses a Divisionalized Form configuration to develop the V&R program. The conclusion that the V&R program is a divisionalized form configuration is based on several observations. Firstly, in a divisionalized form configuration described by Mintzberg (1979), the middle management (in this case formed by CS3 and CS4) are the key part of the organisation. We see in the V&R program, that CS4 describes his role metaphorically as the captain of a team and spider in a web. This indicates that his role is quite important in the V&R program and this is backed up by the amount of information and knowledge that has been obtained from this respondent and observations. I noticed his importance to the V&R when questions I had regarding V&R. Most times the civil servants mentioned CS4's name to get clarification from when they did not know the answer to my questions. Secondly, there is a limited vertical decentralization in the V&R program. All important decisions from the operational core (formed by CS1 and CS2) in the IPM project teams are discussed via CS4. On top of that, there is also a higher power present, which is DGMO. Lastly, the prime coordinating mechanisms for the management of V&R projects are T-reports. The reports provide information on achieved output and the ongoing process, offering an overview of the project's advancement compared to its planned objectives and milestones. While this type of coordinating mechanism could fit in both a machine bureaucracy as well as a divisonalized form, the main focus for the V&R is to achieve consistency in output – a minimum level of quality. Standardisation of the process is used by the organization to accelerate the output in terms of the number of V&R projects than can be performed. Therefore, we could say that while the main configuration being adopted has elements which point towards a divisionalized form, we can also distinguishelements of a machine bureaucracy because of the type of coordination mechanism being used. On top of that, the V&R also holds elements of a professional bureaucracy, due to its highly skilled workforce. The civil servants I spoke during the interviews and observations all had a university degree background. Also, the focus on training and development (such as the personal development plan) is an aspect where RWS is focussed on. During my observations, I noticed that right after I started doing my research, I was asked to finish several obligatory online courses on RWS's work procedures, general sustainability goals and specific courses related to the DULO and V&R department.

So now we established what the main organization type RWS gave to the V&R program, we can visualise it. In figure 5, the civil servants are positioned based on their roles at RWS and the divisionalized configuration by Mintzberg (1979).

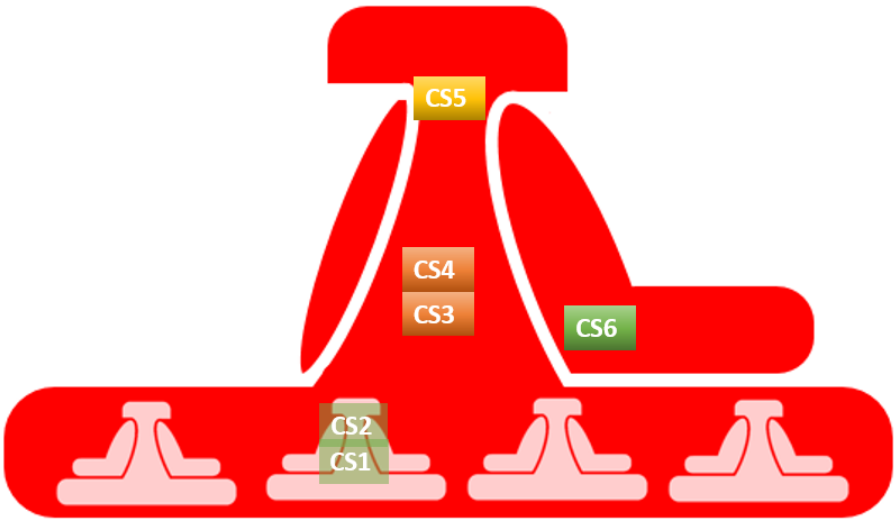

Figure 5: divisionalised form and the places of the civil servants

CS1 and CS2 form the operational core and are part of individual V&R project teams, or divisions form the theory. CS3 and CS4 are the middle management and (especially CS4) are the core of the organisation structure. CS5 is placed slightly below the top of the organization. The actual director rely mostly on the input of CS5 and therefore it makes more sense to place CS5 just on the border of the strategic apex. CS6 is part of the support staff and have mostly (informal) contact with the project groups and middle management. In light of Mintzberg (1979), this department is important because it gives knowledge and support to the middle management and operating core. As depicted in the figure above, the technostructure (left part of the figure) appears relatively small. This can be attributed to two key factors. Firstly, RWS can be regarded as a technocratic institution where technocracy inherently permeates all levels of management (Berkers, 2002). Secondly, the technical (asset) managers primarily operate within the project teams (divisions) themselves.

Mintzberg (1979) applied the divisionalised form mostly to private companies, but some archetypes could also apply to the public sector. In this case, we deal with a public organisation.

The divisionalised form is not a straight forward configuration to be applied in a starting setup like the V&R organisation, where the main work components were pioneering and innovation. It is rather difficult to develop work manuals and work processes, which did not exist at the beginning, in a divisionalised form configuration. Also, pioneering in a bureaucratic environment like RWS is difficult or almost impossible because of the limited space of freedom where civil servants can operate in. Based on pioneering and innovation, it would make more sense to apply an adhocracy structure. The reason why an adhocracy would make more sense at the starting phase is because there is a lack of formalisation and standardisation. This makes sense because you want to stimulate innovation, and having a high degree of formalisation and standardisation would actually work against innovation. On top of that, there is large amount of freedom for the IPM project teams in order to explore different innovative ideas in the V&R. But in practice, the project teams were left with questions open from the middle and higher management on how to tackle the V&R projects, which still gives frustration to the IPM teams on how to implement sustainability in the V&R.

A divisionalised form works best when there is a high degree of formalisation and standardisation (Mintzberg, 1979) This was logically lacking for a long time during the beginning of the V&R program since V&R was a new innovative program which sought to explore novel ways of managing assets. In the early years tools were developed to identify……

Only recently, the middle management has started the shift more towards formalizing and standardising. This means that the more formalising and standardizing is taking place, the more the current V&R organisation structure will operate in a better environment. However, because of this mismatch at the start of the V&R program with its divisional form configuration, the middle management (CS4) was forced into taking wider estimations in budget and time:

> *"You can notice that I've become a bit more cautious about providing estimates upfront, because now I have the experience that costs tend to escalate. However, these estimates are often needed to allocate funds in the budget. Throughout the experience we now got with V&R, you can see that we've become more cautious about costs, setting wider cost ranges and broader timeframes? Nowadays, we often say 'under promise, over deliver,' meaning we're cautious in our planning, and if things go well, we deliver ahead of expectations. So, through experience, we've learned that we need to allocate more budget, provide more generous margins, and reserve more time until we have a more stable understanding of the task, until we have more experience of what challenges might arise. This has meant that we often had to go back to request additional time or funds [from DGMO], which are always difficult conversations because you're not meeting your targets."*

As the V&R program is further being formalised and standardised, the focus is shifting towards acceleration and scaling up the projects. However, the sustainability aspect in the V&R projects still lacks behind when it comes to standardisation and formalisation. This gap only becomes bigger the more the V&R project team's work processes get formalised and standardised. From the data collected and observations, the civil servants struggle with a lack of directions and manuals for implementing sustainability in the V&R projects. Sustainability is not yet made concrete enough to implement it in the projects. Therefore, this leads into uncertainty and tensions in the project teams. On the one hand the project teams are expected to explicitly show the higher management what kind of sustainable elements are added in the V&R projects, but on the other hand it is expected to finish the projects within the prearranged time as the focus will be on acceleration.

6.2. Financial constraints

As for the financial component in the V&R projects, it becomes clear from the data of the case study that finance is, besides time, the most important factor in realising and implementing sustainable development. According to the operating core (the IPM team members), implementing sustainability in a renovation or replacement project does not necessarily mean that the funds of the project increases. Moreover, the IPM team members feels that the focus of the projects relies too much on realising the projects as cheap as possible, and as soon as possible. On the other hand, it is also expected by DGMO to integrate sustainable elements in the V&R projects too, which costs additional time and money. This is based on the following statement given by CS1:

> *"[…] decisions [from DGMO] are made from a very different perspective, so they are more often taken from a financial point of view. And sometimes, it becomes quite challenging to explain why you want to do something if only the financial aspect is considered."*

> *"My feeling is that we often emphasize that sustainability, safety, technical solutions, and all those kinds of things should have priority. While ultimately, with the decision-maker [DGMO], I sometimes have the sense that the focus mainly lies on being as cheap as possible, in the shortest possible time."*

So, what DGMO say about focussing on doing projects in a sustainable way, yet the project teams do not think it is facilitated in the V&R project teams. Instead, the focus lies on cost reduction and time management, according to middle management and the IPM teams.

From the middle management, it becomes clear that there is a budget for sustainability reserved. However, it is unclear how much the fundings for sustainable development is on top of the total contract sum of the V&R project.

> *"Well, I'm not very well-versed in this, but I believe we have included 7% for sustainability measures in all our estimates. So, if it fits within that range, you naturally need to justify what those measures are, but in principle, you can claim that additional 7% budget for sustainability."*

CS4 notes the availability of an additional 7% funding allocation for sustainable development within the V&R projects. Nonetheless, the IPM teams are required to justify supplementary funding. This situation underscores the inherent tension between the imperative to avoid project delays and the need to strategize and implement concrete and innovative sustainability measures within V&R assets, which naturally consumes time. It is precisely this tension that makes it challenging to fully integrate sustainability, as it demands a delicate balance between efficiency and sustainability considerations.

The support staff, however, gave some interesting statements about the availability of fundings for sustainability.

> *"Well, that's a tension, especially between a V&R project and DGMO. Money is always a limiting factor."*
>
> *"[…], it's about 2%, […]. But that needs to be calculated first.*
>
> *"It depends, you don't just get an extra 2% automatically. You need to justify it with your estimated calculations of what you're going to do. And if you have a higher ambition level, you'll have a higher plan and estimated calculation costs, which will also affect your budget. If you're at ambition level 1, that basically means you're just doing the minimum, and that's essentially what's in the standard contracts, so you won't receive any extra budget for that."*
>
> *"Well, in addition to that, there are also various, I don't know all the details, but it's a maze of funds and subsidies, like climate envelopes and CO2 budgets. So apart from that 2%, there are also other financing options that a project can tap into."*

Based on the statements from CS6, the total funding for sustainable development in V&R projects is 2% and not 7% as was mentioned in the interviews with middle management. Another interesting part is that project teams are not expected to get extra fundings when they opt to aim for ambition level 1. So, this would mean that even if you do not explicitly state sustainable elements within the project, it would still be counted as having an ambition level of 1. In other words, having no ambition to implement sustainable elements in the project does still counts as having ambition. Budget wise, it only matters when you apply ambition level 2 or 3 in the projects.

CS6 states that besides the 2%, there are more subsidies and fundings available where IPM teams could apply for. However, from the collected data and observations it remains difficult to keep up with the various funds and subsidies that are available within the RWS organisation. This shows the complexity of the environment in which the IPM team is operating regarding implementing sustainability. The IPM teams do have intrinsic motivation to implement sustainability into the V&R projects, but the lack of standardisation, frameworks and guidelines/manuals from higher management makes it uncertain and time consuming to delve into it themselves. Even if project teams would hypothetically apply for all possible fundings, the question remains whether the

application for extra fundings gets accepted or denied, which takes time and creates uncertainty. At RWS, it is expected from a good project manager to keep projects simple, within time and budget. As a possible consequence, the risk is that V&R projects will apply superficial sustainable elements in the projects or in the worst-case scenario, none. Taking in mind, sustainability is only one of the various aspects that a V&R project must deal with, such as safety and accessibility. These aspects are still reckoned higher than sustainability and therefore also takes a lot of time and money.

Lastly, when the project manager was asked about the budgets for sustainability in the V&R, he stated:

> *"[…] In principle, I have to work with my budget and stay within it. As long as I stay within my budget, that's fine."*
>
> *"Undoubtedly, there are likely to be subsidy opportunities you can tap into, but I'm not fully aware of them."*

His task is to just carry out the project and stay within the budget. He is not aware of various budgets and about the 2% sustainability funding.

It seems that the lack of knowledge about financial funds for sustainability might be a bottle neck for the implementation of sustainability in V&R projects.

6.3. Composition of integral project teams in the plan phase

Since the start of the V&R program in 2019, there has only been 1 V&R project that has run through all four phases of the program. At the end of the year, another 4 projects will have reached this state. So, it is quite interesting to see that one project seems to be enough learning experience to the organisation to quadruple the scale. Scaling up projects too quickly can introduce various risks and challenges, which may impact the overall success of V&R projects and the organization.

The first potential risk associated with scaling up too fast are resource constraints. Rapid project scaling can strain resources like finances, skilled personnel, and equipment. This can lead to delays or project failure if not managed properly. Ensuring adequate resource allocation is vital for successful scaling (Amiri et al., 2018).

The second risk of scaling up V&R projects too fast is quality control. Maintaining consistent quality standards becomes challenging during rapid scaling. There's a risk of compromising quality, damaging reputation, and eroding client's trust (Frick & Laugen, 2012).

The third risks are operational Inefficiencies. Scaling without proper planning can disrupt workflows and coordination, causing bottlenecks and operational inefficiencies. Addressing these challenges is crucial to maintain efficiency, especially in a divisionalised form configuration (Vanderfeesten & Reijers, 2014).

The last risk that is identified with quickly scaling up the V&R projects is employee burnout. Rapid scaling often means overburdening existing staff or hiring quickly. This can lead to employee burnout, decreased productivity, and high turnover rates if not managed well. Prioritizing civil servant's well-being is essential during scaling efforts (Mokoena et al., 2022).

The case study data shows that from 2019 until now, there were capacity issues in the IPM teams during the plan phase. This has only been solved recently, but the main challenge is to maintain the size and roles of these IPM teams. CS4 said the following:

> *"We finally got it on track this year, but we did face significant capacity issues in the past few years. We've now filled all the teams, and as a result, we're meeting our goals more smoothly. However, it*

took a lot of hard work and dedication to staff those teams adequately. Now, the key focus is on ensuring continuity. We had quite a few roles open, especially in technical management and contract management. If you don't have roles like contract management or technical expertise within an IPM team, it can hinder the team's progress. So, we've got that sorted out now, but it's an ongoing effort to keep it that way."

From this, it becomes clear that the V&R program have dealt with capacity issues from the start in 2019. In terms of innovation, this meant that reaching the highest ambition level (ambition level 3) is almost made impossible due to the lack of civil servants. Therefore, it is important to find out how many civil servants is needed for an IPM team, to divide tasks among the civil servants (working on a V&R project) more efficiently. So, by this way a higher ambition level could be reached. This can be done by experimenting different roles and sizes of an IPM team during the plan phase. Once that has been find out, the roles should become formalised and secured by the higher and middle management.

Another issue is that the role of the support staff. During my observations, the engagement of the DULO department is infrequent, informal and noncommittal when it comes to achieving sustainable development in the V&R project and IPM teams. However, this department could help the IPM teams with implementing sustainability in the V&R. The DULO department have more knowledge on sustainability than the average IPM team member from what I have seen during the team meetings of DULO regarding V&R.

6.4. Abstract vs. concrete/standardized definitions for sustainability in V&R

Having analysed the different organisational layers in the V&R program, the image emerges that different views on the definition of what a sustainable measure is in V&R projects exist in the organisation. The operating core is seeking applicable frameworks and definitions for sustainability to operate with in the projects. The middle management agrees that this is an issue that IPM teams struggle with. CS2 and CS4 both indicated that the teams need concrete and predefined frameworks for sustainability:

"I think we need more concrete sustainability aspects that you can include in your request specification and the questions you ask the market during the plan phase."

"It's still very abstract at this point. The ideal scenario, and I keep coming back to this, would be if it becomes very tangible and part of the options we have. […] So, how do you make that tangible again?"

"The need for concrete sustainability manuals/guidelines is a logical phenomenon when we look at the organizational structure, the divisionalized form of RWS and the place of the V&R program in this organization. The divisionalized form operates best in a standardized, concrete, and formalized work environment (Mintzberg, 1979). However, sustainability has not reached that stage yet within RWS.

Higher management sees sustainability in different, more broad and abstract terms. CS5 thinks sustainability.

"[…] I noticed that at the national level, there was quite a bit available in terms of frameworks and guidelines, but it wasn't very applicable, concrete, or detailed at all. So, I think the project teams are the ones responsible for this. They are the ones with the scopes and projects and objects in their wheelbarrows that they can work with in this regard. [...] I also believe that project teams should have some room to manoeuvre in this [sustainability aspects]. So, I don't mind that everything isn't tightly regulated. That's why I'm quite... well, I want to keep that space open and not be too prescriptive

> *about which themes to focus on and what the minimum environmental gains should be, or anything like that. Let them [IPM teams] identify the opportunities and make decisions based on that."*

> *"Yes, indeed, and I think it's interesting due to the fact that they [DGMO] have been given the mandate to speed things up. The assignment letter also states that we won't overhaul the scopes and milestones with this task, so it's really about tailoring what you can still do in your projects. That's why I mentioned that for the projects heading towards a decision point this year, the four we expect, we won't suddenly introduce all sorts of new things. Partly because there is already a basic level of sustainability in them. But the challenge lies mainly in the projects with longer durations, so they can adapt in that regard. What I find interesting, is that I believe that sustainability is normally a very integral part of your project, and I think that, without it being prominently displayed right now, it's already the case."*

CS5 had a different view compared to other respondents on defining sustainability. She thinks being too prescriptive will only cause burden to the IPM teams. This creates tension with the scaling-up phase; therefore, it fits better with the pioneering and experimentation phase. However, as mentioned in the statements of several respondents, DGMO also gave a signal towards the V&R program to speed up the process and output. Speeding up the V&R projects and not have concrete definitions on when sustainability is being implemented correctly, could lead to sustainability taking a back seat in terms of importance for project teams. Ultimately, speed or acceleration in ensuring the project is completed within the set timeframe takes precedence. In this situation, higher management could provide more guidance on what they expect as minimum and as maximum sustainability requirements. This to give directions and some expectancy to the IPM teams that are working on V&R projects. Ultimately, it is also not clear from DGMO how far they want to go in terms of sustainability in the V&R projects, according to the middle management.

If the V&R program wants to continue with the current organisational configuration, clear manuals and targets on sustainability for V&R need to be adopted by the higher management. This way, sustainability can keep pace with other important aspects in V&R projects, such as safety and accessibility, in terms of formalisation and standardisation in the divisionalized form configuration.

In the statement given by CS6, it confirms that IPM teams do want to operate in more prescribed and concretely predefined sustainability goals, which is not available now. CS6 also confess that higher management is in favour of prescribing abstract definition on sustainability in the V&R.

> *"[...] What you do see is that the further you get in practice, towards the IPM team that has to shape it, the more it becomes a quest for how exactly we're going to do it. You have to make it concrete, and then you see that sustainability is a complex and broad concept that you have to break down, and we did that with the KCI [klimaatneutrale en circulaire rijksinfrastructuurprojecten strategy]. Then we say it has to be climate-neutral and circular, but then it's still quite a search in a plan phase like, 'Okay, what does research exactly involve, and how do I shape it?' I think that's the difference, and less attention is paid to it from an HID or a director. Then it's all a bit more abstract, and that's logical too."*

In this quote, the respondent is highlighting a distinction between the strategic or high-level perspective (represented by terms like "climate-neutral and circular" at the HID or director level) and the practical, implementation-focused perspective, especially within the IPM (Integrated Project Management) team. The respondent suggests that as you move closer to the teams responsible for shaping and implementing sustainability measures, the focus becomes more about the practicalities and details of how to achieve these high-level goals. There's a shift from abstract strategic goals to the concrete challenges of making sustainability a reality in projects, such as defining what research involves and how to implement it. This reflects a disconnect between the more abstract, strategic

discussions at higher levels and the detailed, hands-on considerations of implementation faced by the IPM team.

6.5. The function of ambition levels in V&R projects

Every V&R project that is being started, has an ambition level for sustainability. The higher the ambition level in projects, the more innovative sustainable elements are added in the V&R project. The case study data points out that no one seems to know how and by whom the ambition level is determined for V&R projects. CS6 states:

> *"[…] Who determines the ambition level? I don't really know how that works either. Because, in a way, as a project team, you have the freedom to choose an ambition level. But sometimes, as a project team, you also just want to get the job assignment [from DGMO], so it needs to come from somewhere else. […] so, I find these ambition levels sometimes difficult, and what we actually concluded yesterday is, yes, maybe you should just say that as a standard, we choose the highest ambition level, namely ambition level 3. That's just our default. And if, for some reason, it needs to be scaled back, then we do that. I found that interesting."*

Moreover, due to the absence of concrete frameworks and standardised outputs for sustainability, it remains unclear what kind of sustainable elements used in V&R projects fit in ambition level 1, 2 or 3.

CS4 assumes ambition levels are pointing in a particular direction rather than setting a concrete goal at the start of the plan phase.

> *"I think the ambition level is the effort you put into doing something innovative. That doesn't necessarily mean that the measure is completely specified, so the innovative aspect definitely happens, but you still don't know which measures it will lead to by definition."*

The essential question revolves around the importance and necessity of articulating ambition levels in projects. Specifically, it prompts consideration regarding the primary audience for this information – is it crucial for the project teams or more pertinent to the higher management at DGMO? Despite this, there remains an expectation for project teams to clearly outline the sustainable measures they intend to implement to DGMO.

To guarantee that a significant level of sustainability is implemented in the V&R projects, project teams can choose to always opt for ambition level 3 and during the project, the IPM teams could switch to other ambition levels if needed. However, a pitfall with this approach is that project teams might encounter uncertainties regarding the implementation of sustainability throughout the V&R project. For instance, when would a project team switch from ambition levels? This doesn't foster the clarity and stability desired in for project team members. Furthermore, it could lead to project teams not feeling obliged to achieve ambition level 3, as the option to switch to a lower ambition level always exists. Lastly, it could also pose financing problems. Suppose you received extra funding at the beginning because the intention was to apply ambition level 3, but over time, it becomes clear that this isn't achievable. How can you still justify that additional budget?

7. Discussion

The findings of this master thesis study suggest that there are several key areas of tension within the V&R program of Rijkswaterstaat WNN that may impact the implementation of sustainable approaches in infrastructure redevelopment. One of the main challenges identified in this study is the conflicting priorities between sustainability and economic considerations. While there is a growing recognition of the importance of sustainability in infrastructure development, economic considerations such as cost and efficiency often take precedence over sustainability concerns. On top of that, higher management is also more and more focussing on speeding up the output and process of the V&R project. This can lead to a situation where sustainability is seen as an optional add-on rather than an integral part of the infrastructure development process.

Another key challenge identified in this study is a lack of clear standards of what sustainability mean in the projects. The question in the IPM teams remain what sustainability means in practice. Infrastructure redevelopment is a complex and multi-faceted process that involves a wide range of stakeholders, including various RWS departments as well as the private markets. However, these stakeholders often have different priorities and perspectives on sustainability, which can lead to misunderstandings and conflicts. To overcome these challenges, it is important to establish sustainability frameworks and standards. These in turns need to be established in the RWS organization to ensure that sustainability considerations are integrated into the V&R process.

Based on the framework of Mintzberg (1979) on organisation structures and configurations, it became quite clear that RWS has organized the V&R program as a divisionalised form structure. On top of that, the organization also showed elements of professional bureaucracy as well as machine bureaucracy.

Based on the case study, it becomes clear that the V&R projects shifts from pioneering towards formalisation and standardisation. However, the sustainability part lags this transformation to the standardisation phase and still operates as a pioneering phase.

8. Conclusion

The main research question is *"How can sustainability be implemented in the redevelopment of existing infrastructural assets?"* We see that the V&R organization is in the middle of a transformation, from pioneering and innovating towards standardisation and uniformizing the work processes. This process involves various challenges that the V&R organization is dealing with and is discussed in this master thesis.

There are several ways RWS WNN could successfully implement sustainability in the V&R projects. Firstly, based on the divisionalised form structure of RWS and the specific form of the V&R program, sustainability is expected to become more precisely defined. This can be done by developing concrete frameworks, standardisations and formalisations processes for integrating sustainability into the V&R assets. At this stage, sustainability lags other important aspects, such as safety, where concrete frameworks and formalisations do exist. This divergence in prioritization and formalisation may lead to several possible consequences such as inconsistent sustainability practices and the risk of falling behind on sustainability goals of RWS.

Secondly, the research shows that capacity issues have created a significant role in the V&R projects. The V&R organization had several unmanned staff in the V&R projects, while the V&R projects were still expected to achieve their goals and deadlines without exceeding their budget. However, the possibility exists that staff working on V&R could be asked to shift to other non-V&R related work, so a robust plan to keep personnel continuously working on V&R is not yet established. This is needed so that IPM project groups become maintained during the plan phase to prevent staff loss due to capacity issues. On top of that, higher management does not give enough direction to the lower management to what they think is needed in order integrate sustainability into the V&R successfully. Now, the goals for sustainability in the V&R projects remains quite vague and ambiguous. Also, the role of the DULO department as the support staff is now informal and non-committal. They have a significant knowledge on sustainability that would be beneficial for to the V&R organization. However, at this moment their knowledge and commitment are not fully integrated in the V&R projects, but rather on a non-committal basis.

Thirdly, it is unclear how much financial budget is reserved for sustainability in V&R. Civil servants gave contradicting answers and were also no aware of other financial budgets related to sustainability. During the observations, it was difficult to grasp upon this. IPM team members are not delving into these various budgets as it takes significant time and effort to get an overview on this matter. Considering Mintzberg's (1979) divisionalised form, this makes sense as team members are expected to operate in an organization with standardized output of the financial means.

Lastly, currently the role of the ambition levels regarding sustainability in the V&R projects remain unclear. The formulated ambition level does not directly benefit the total budget of the V&R project. Therefore, the selection of a higher ambition level within V&R projects and the grounds on which level are chosen, are unclear. The ambition levels seem to be selected largely based on the motivation of IPM team members. On top of that, having a higher ambition level does not guarantee that the V&R projects will receive extra budget, which also demotivates opting for a higher ambition level.

8.1. Recommendation

For the V&R program, it is essential that civil servants working closely on the V&R program will focus on how to create concrete frameworks for sustainability to help the IPM teams fulfil their role in the realization of V&R projects. The aim of these clarifications is to help practitioners make trade-offs and concretise sustainability in projects like other key values such as safety and availability. In addition, the financial component (subsidies, budgets) could be made more transparent so that the options for the budget for the development of sustainability in V&R projects is clarified for IPM teams. A possible solution could be to add financial project controllers to V&R projects. The project controllers could identify the different funds and subsidies for the project team. This provides current IPM team members breathing space to focus on other tasks in V&R projects.

In the current divisional form configuration, the DULO team should be more committed to help informing and coordinating the IPM teams when it comes to achieving sustainability goals. This can be done by developing and updating sustainability policies and guidelines for the V&R program and by monitoring and reporting on the sustainability performance of the different IPM teams, tracking progress towards sustainability goals and targets.

For future studies, it would be recommended to continue researching the integration of sustainability into V&R assets by interviewing DGMO regarding their stance on sustainability in the V&R projects. During this research the scope was limited to RWS WNN branch, to whom DGMO is not part of. Also, it became apparent that the organization has multiple goals. As part of an executive agency, RWS is struggling to cope with the implementation of a new aspect in its long-standing processes. Concrete ways to implement sustainability in V&R projects do not exist yet in the RWS WNN organisation. However, the requirement to cope with infrastructure renewal forces the organization to speed up and expand the V&R project portfolio. Higher management should develop a more predefined, concrete and prescribed goals on what is expected for sustainability in the V&R projects. Ultimately, these goals should also be able to measure, so that monitoring could take place in an objective manner. On top of that, the IPM teams should continue to experiment with what the optimum number of staff would be in the plan phase to keep up with the pace of the scale up of the V&R projects. Once the optimum composition of an IPM team is established, it is essential to keep the team members working dedicated to the V&R project, and not shift from roles to other non-V&R related jobs. This can be done by setting up (long-term) contracts with the staff members.

To prevent complacency in terms of striving for certain levels of sustainability in V&R projects, the current ambition levels could be increased. In other words, what is currently ambition level 2 could become ambition level 1. This way, V&R project teams are stimulated to strive for innovative levels of sustainable developments in the V&R projects. A possible solution to achieve a higher ambition level in each V&R project is to apply the “Minimax” method, which is usually applied in ecological economic realm aimed at minimizing the potential negative impacts or risks while maximizing the benefits or positive outcomes for the environment and society (Haddad & Solomon, 2023). In this case, the lowest ambition level should have higher standards than what is currently expected. What is now ambition level 2 becomes ambition level 1, and what is ambition level 3 becomes ambition level 2. This ensures that a sufficient level of sustainability is always incorporated in the projects. The adjustment of the ambition levels should also come from DGMO as they are the main clients of the V&R projects and therefore have decision power over the V&R projects.

A recommendation for the financial element of the V&R projects; it remains unclear how much budget and financial initiatives are reserved in total for sustainability in the V&R projects. A financial

project controller could be introduced in the IPM teams to focus on all possible forms of subsidies and budgets for sustainability.

Future studies could explore the potential of emerging technologies and innovations in promoting sustainable infrastructure development. This could involve exploring the potential of new materials, construction techniques, and energy systems to reduce the environmental impact of V&R projects.

Regarding the methodology used in this study, it is important to note that the explorative and qualitative research methods employed were effective in providing a comprehensive overview of the research topic. However, future studies could benefit from the inclusion of more quantitative data and analysis to complement the qualitative findings. The use of in depth semi-structured interviews with civil servants within the V&R program of RWS WNN was a valuable approach to gathering data and insights. However, future studies could consider incorporating other data collection methods, such as surveys or focus groups, to gather a more diverse range of perspectives and experiences from a broader public within RWS.

References:

Amiri, M. J. T., Haghighi, F., Eshtehardian, E., & Abessi, O. (2018). Multi-project time-cost optimization in critical chain with resource constraints. *Ksce Journal of Civil Engineering*, *22*(10), 3738–3752. https://doi.org/10.1007/s12205-017-0691-x

Bergek, A., Hekkert, M. P., Jacobsson, S., Markard, J., Sandén, B. A., & Truffer, B. (2015). Technological Innovation Systems in Contexts: Conceptualizing contextual structures and interaction dynamics. *Environmental Innovation and Societal Transitions*, *16*, 51–64. https://doi.org/10.1016/j.eist.2015.07.003

Berkers, E. A. M. (2002). *Technocraten en bureaucraten : ontwikkeling van organisatie en personeel van de Rijkswaterstaat, 1848-1930*. [Phd Thesis 4 Research NOT TU/e / Graduation NOT TU/e), Delft University of Technology]. Europese Bibliotheek.

Bossink, Bart. (2009). Assessment of a national system of sustainable innovation in residential construction: a case study from The Netherlands. *International Journal of Environmental Technology and Managemen*t. 10. 371-381. 10.1504/IJETM.2009.023740.

Exter, P. van, S. Bosch, B. Schipper. (2018) *Metal demand for renewable electricity generation in the Netherlands: navigating a complex supply chain*. Metabolic, Copper8 en Universiteit Leiden. Rapport te vinden op copper8.com.

Frick, J., & Laugen, B. T. (2012). Advances in production management systems. Value Networks: Innovation, Technologies, and management. In *IFIP advances in information and communication technology*. https://doi.org/10.1007/978-3-642-33980-6

Gauvreau, P. (2018). Sustainable education for bridge engineers. *Journal of Traffic and Transportation Engineering, 5*(6), 510–519. https://doi.org/10.1016/j.jtte.2018.10.001

Gilmour, D. J., Blackwood, D. J., Falconer, R. E., Isaacs, J. P., & Taylor, A. (2014). A knowledge map of sustainability for urban redevelopment projects. *Researchgate*. https://dissem.in/p/42716934/a-knowledge-map-of-sustainability-for-urban-redevelopment-projects

Haddad, B. M., & Solomon, B. D. (2023). *Dictionary of Ecological Economics: Terms for the New Millennium.* Edward Elgar Publishing.

Harvard University School of Public Health. (2020, July 6). *Coronavirus and Climate Change*. C-CHANGE | Harvard T.H. Chan School of Public Health. https://www.hsph.harvard.edu/c-change/subtopics/coronavirus-and-climate-change/

Hekkert, M. P., Suurs, R. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological forecasting and social change*, *74*(4), 413-432.

Heurman, B. (2022). Dit zijn de 10 populairste werkgevers in Nederland. *Business Insider Nederland*. https://www.businessinsider.nl/populairste-werkgevers-nederland-2021/

Ken Peffers, Tuure Tuunanen, Marcus A. Rothenberger & Samir Chatterjee (2007) A Design Science Research Methodology for Information Systems Research, *Journal of Management Information Systems*, 24:3, 45-77, DOI: 10.2753/MIS0742-1222240302

Kuhlman, T., & Farrington, J. (2010). What is sustainability? *Sustainability, 2*(11), 3436–3448. https://doi.org/10.3390/su2113436

Levinson, L. (2021). Introduction To Qualitative Research Methods: Look At Field Research From Field Fires: The Past Of Qualitative Research. Independently Published.

Loorbach, D. (2010). Transition management for sustainable development: a prescriptive, complexity-based governance framework. *Governance*, *23*(1), 161-183.

Martens, M. L., & De Carvalho, M. M. (2017). Key Factors of Sustainability in Project Management Context: A survey exploring the project managers' perspective. *International Journal of Project Management*, *35*(6), 1084–1102. https://doi.org/10.1016/j.ijproman.2016.04.004

Mazzucato, M. (2018). Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change*, *27*(5), 803–815. https://doi.org/10.1093/icc/dty034

Ministerie van Economische Zaken en Klimaat. (2020, January 22). *Maatregelen Klimaatakkoord per sector*. Klimaatverandering | Rijksoverheid.nl. https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatakkoord/maatregelen-klimaatakkoord-per-sector

Ministerie van Economische Zaken en Klimaat. (2021, March 18). *Het Akkoord*. Klimaatakkoord. https://www.klimaatakkoord.nl/klimaatakkoord

Ministerie van Infrastructuur en Waterstaat. (2021a, March 24). *Circulaire economie essentieel voor behalen van klimaatdoelen van Parijs*. Nieuwsbericht | Rijksoverheid.nl. https://www.rijksoverheid.nl/actueel/nieuws/2021/03/24/circulaire-economie-essentieel-voor-behalen-van-klimaatdoelen-van-parijs

Ministerie van Infrastructuur en Waterstaat. (2021b, 19 maart). *Energie en klimaat*. Rijkswaterstaat. Geraadpleegd op 11 november 2021, van https://www.rijkswaterstaat.nl/zakelijk/duurzame-leefomgeving/energie-en-klimaat

Ministerie van Infrastructuur en Waterstaat. (2020, April 21). 'Het roer moet om.' Plan Van Aanpak Transitie Infrasector: Interview Michèle Blom | Rijkswaterstaat &. https://www.magazinesrijkswaterstaat.nl/zakelijkeninnovatie/2020/01/het-roer-moet-om

Mintzberg, H. (1979). *The structuring of organizations: A Synthesis of the Research.* Prentice Hall.

Mokoena, W., Schultz, C., & Dachapalli, L. P. (2022). A talent management, organisational commitment and employee turnover intention framework for a government department in South Africa. *SA journal of human resource management*, *20*. https://doi.org/10.4102/sajhrm.v20i0.1920

OED. (2012, March). *sustainability, n. : Oxford English Dictionary*. Oxford English Dictionary. Retrieved December 7, 2022, from https://www.oed.com/view/Entry/299890

Rathenau Instituut. (2020). Missiegedreven innovatiebeleid vraagt samenwerking tussen lokaal en nationaal niveau. In *Rathenau Instituut*. https://www.rathenau.nl/sites/default/files/2020-02/BAP%20Missiegedreven%20innovatiebeleid%20vraagt%20om%20samenwerking.pdf

Rijkswaterstaat. (2017, January). *Klimaatneutraal werken in 2030*. https://www.rijkswaterstaat.nl/leefomgeving/duurzaam-werken/klimaatneutraal-werken-in-2030

Rijkswaterstaat. (2018, January). *Taken en verantwoordelijkheden Rijkswaterstaat*. https://www.rijkswaterstaat.nl/leefomgeving/wetten-regels-en-vergunningen/geluidwetgeving/taken-en-verantwoordelijkheden-rijkswaterstaat

Rijkswaterstaat. (2019). Programmaplan planfase Vervanging en Renovatie WNN. In *RWS Bedrijfsinformatie*.

Rijkswaterstaat. (2020, January). *Vernieuwen van bruggen, tunnels, sluizen en viaducten*. https://www.rijkswaterstaat.nl/over-ons/onze-organisatie/vervanging-en-renovatie

Rijkswaterstaat. (2021). *Handreiking duurzaamheid in de planfase van VenR*.

Roo, G. de, & Porter, G. (Eds.). (2012). Fuzzy planning: The role of actors in a fuzzy *governance environment*. Ashgate Publishing, Ltd.

Rotmans, J., Kemp, R., & Van Asselt, M. (2001). More evolution than revolution: transition management in public policy. *foresight*, 3(1), 15-31.

Tang, Man-Chung (2015). *Sustainability - A bridge engineer's viewpoint.* International Conference on Performance-based and Life-cycle Structural Engineering, Brisbane, QLD, Australia, 9-11 December 2015. Brisbane, QLD, Australia: School of Civil Engineering, The University of Queensland. https://doi.org/10.14264/uql.2016.931

Termeer, C.J.A.M., et al., 2018. A diagnostic framework for food system governance arrangements: *The case of South Africa.* NJAS: Wageningen J. Life Sci. 84 (1), 85–93. https://doi.org/10.1016/j.njas.2017.08.001.

Thomas, E. (2020, September 25). *How does sustainability shape bridge construction?* World Cement. https://www.worldcement.com/special-reports/25092020/how-does-sustainability-shape-bridge-construction/

TNO. (2021). Literatuuronderzoek integrale benadering van maatschappelijke opgaven en transities. In *TNO*.

Vanderfeesten, I., & Reijers, H. H. (2006). How to increase work autonomy in workflow management Systems? *Management research news*, *29*(10), 652–665. https://doi.org/10.1108/1409170610712344

Yılmaz, M. K., & Bakış, A. (2015). Sustainability in construction sector. *Procedia - Social and Behavioral Sciences*, *195*, 2253–2262. https://doi.org/10.1016/j.sbspro.2015.06.312

Appendix I: Interview questions

Introductie:

1. Kunt u mij iets over uzelf vertellen? Hoe heet u? Wat is uw rol binnen RWS WNN? Hoelang al werkzaam?

Deel 1: organisatiestructuur:

2. *Kunt u de organisatiestructuur van V&P beschrijven*?
3. Geldt dit ook voor de V&R opgave?
4. Hoe neemt V&P beslissingen? Is de besluitvorming gecentraliseerd of gedecentraliseerd? Wie heeft de beslissingsbevoegdheid?
5. Vindt u dit ook efficiënt voor de V&R opgaves?
6. Kunt u de communicatiekanalen van Rijkswaterstaat beschrijven? Is de communicatie formeel of informeel? Is de communicatie vooral verticaal of horizontaal?
7. Heeft V&P en/of uzelf ook te maken met andere afdelingen buiten V&P om? Hoe zijn deze gestructureerd en hoe werken ze samen met de rest van de organisatie?
8. Ervaart u dit meer als een last of juist als een toegevoegde waarde voor uw werkzaamheden?
9. Merkt u dat de aandacht van andere afdelingen op u, uw werkzaamheden belemmeren?
10. *Hoe coördineert V&P zijn activiteiten en zorgt hij ervoor dat het werk efficiënt en effectief wordt uitgevoerd?*
11. Past deze type mechanisme bij jouw huidige rol en werkzaamheden? Of ziet u efficiëntere mechanismen?
12. Kunt u beschrijven hoe V&P/uzelf omgaat met standaardisatie? Zijn er gestandaardiseerde procedures of processen die medewerkers volgen? Zijn er specifieke doelen of targets die medewerkers geacht worden te bereiken?
13. En hoe wordt er omgegaan met de V&R vraagstukken?
14. Hoe reageert V&P/Uzelf op veranderingen in de omgeving? Is de afdeling aanpasbaar en flexibel? Hoe worden veranderingen in de externe omgeving gecommuniceerd en opgepakt binnen de organisatie?
15. Merkt u dit ook op bij de V&R opgaves?

16. Kunt u de cultuur van Rijkswaterstaat beschrijven? Hoe beïnvloedt de cultuur van de organisatie de structuur en de coördinatiemechanismen?

17. Hoe zorgt V&P ervoor dat u over de nodige vaardigheden en kennis beschikken om hun werk goed uit te voeren? Bestaan er opleidings- of ontwikkelingsprogramma's?

18. Hoe meet en evalueert V&P/uw afdeling zijn prestaties? Zijn er specifieke maatstaven of indicatoren om de effectiviteit van de structuur en de coördinatiemechanismen van de organisatie te beoordelen?

Appendix II: Interview transcriptions

A: CS1

A: CS2

A: CS3

A: CS4

A: CS5

A: CS6

Appendix III: Interview concepts

A: CS1:

B: CS2:


werk
plan
manier
kost
ipm
naam
ding
link
tijd
opgave
team
geld
project
deel
mirt
hek
beetje
vraag
huis
dak
idee
brug
mens
rol
jaar
afdeling
blok
planfase

C: CS3


keer
week
geld
beleid
ding
doelen
zin
contact
rol
plein
dulo
organisatie
idee
project
ambitieniveau
om
programma
soort
jaar
proces
vraag
doel

D: CS4


type
overleg
soort
jaar
tijd
project
stap
norm
object
keer
issue
kost
planfase
brug
sluis
team
ding
rol
opgave
fase

E: CS5


bregje
tijd
lijn
object
kant
slag
dienst
stap
duurzaam
opgave
lid
vraag
planfase
jaar
brug
soort
fase
kennis

F: CS6


staal
keer
kans
zee
team
planfase
dulo
opdracht
doel
fase
geld
mens
rol
zin
pot
project
deel
vraag
soort
budget
lijn
regio
tijd
beetje
ding
super
richting
jaar
subsidie
onderdeel
beleid