

# The Delfzijl-Eemshaven innovative coastal dike improvement

Evaluated by the main stakeholders and drawn in comparison to a traditional dike improvement



*(Kwakernaak & Lenselink, 2015).*

Bachelor thesis

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## Abstract

In the field of water management there is an ongoing shift from a safety aspect alone towards a more trade-off solution between safety, spatial development and societal acceptance. This thesis is an evaluation of the main stakeholders regarding the traditional and innovative dike improvement. With a specific focus on the innovative Delfzijl-Eemshaven project. In doing so, the experiences of the project managers, territorial users and external professionals are researched. Based on a review of the available literature, an interview guide was created and semi-structured interviews were conducted. Analysis of the results demonstrated that according to main stakeholders, the Delfzijl-Eemshaven coastal dike improvement reflects both improvements in water safety as well as an increase in spatial quality. Moreover, the results also show that the concept of an innovative dike development is preferred over a traditional dike development. Confirming the theory of a shift in the field of water management that is moving from technical rational towards a more collaborative governance. The results indicate a potential relation between linking-projects and awareness, as the presence of linking-projects creates more awareness. However, this relationship needs further research. Future research should focus on different innovative dike improvement projects and also involve a larger variety of stakeholders.

## Colophon

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## **1 Introduction**

### **1.1 Background**

If it were not for the presence of dunes and dikes, 65% of the Netherlands would be flooded (Ven, 2004). At the same time, sea levels are rising around the world as an effect of global climate change, which is causing modern-day challenges and demands in the Netherlands (Oddo et al., 2017). From both a national and international perspective, flood preventing strategies regarding the Dutch river district are highly valued. Not merely because of the technical advantage but also for their cultural, environmental, recreational and landscape values (Lenders et al., 1999). Traditional flood risk management strategies generally focus on the probability of flooding, and on how to reduce it (Nillesen & Kok, 2015), although there is an ongoing shift to broaden their focus from safety aspects alone. The focus on spatial quality within such projects is of increasing importance (Oddo et al., 2017). Any new development regarding flood risk prevention is a trade-off between flood protection, spatial developments and their societal acceptance (Stijnen et al., 2014). The ‘Room for the River’ program is a well-known example, that demonstrates flood safety in combination with the before mentioned values (Zevenbergen et al., 2015). However, the integration of these values in coastal flood risk management is less common in the field of water management.

After a thoroughly executed safety check in 2014, the Dutch Coastal Risk Management authorities affirmed that the outer dike (primary embankment) between Delfzijl and the Eemshaven was showing signs of weakness and needed to be strengthened (Haan et al., 2016). The dike is located in a Natura 2000 area and adjacent to a protected piece of World Heritage, the Wadden Sea, an area consisting of seawater, mud flats, channels and salt marshes (Hofstede, 2019). Besides taking into account water safety, linking-projects are developed as part of the dike improvement, which aims to increase the ecological and recreational quality of the area. Linking-projects are realised opportunities seen by stakeholders (Buuren et al., 2012), which add value to the region, are linked to the improvement of dikes (Haan et al., 2016), and bring innovative elements into spatial development projects (Kunzmann, 2013). The specific linking-projects within the Delfzijl-Eemshaven dike-improvement project include: the ‘rich dike and bird breeding island’, ‘twin dike’, ‘Marconi city beach’, ‘thanks to the dikes’ and ‘other recreational facilities’ (Loon-Steensma et al., 2014a). As the site is located in two protected natural environments (Natura 2000 & World Heritage site), this makes the case even more unique but not necessarily impossible (Kwakernaak & Lenselink, 2015).

The dike improvement project between the Eemshaven and Delfzijl uses the concept of an innovative dike, which employs a different design profile or flood defence principle than traditional dike concepts. Traditional dikes are designed to meet water safety requirements as efficiently as possible in terms of height, slope and covering (Loon-Steensma et al., 2014a). Innovative dikes on the other hand, fit better into the landscape, offer new opportunities for the Wadden Sea area and are also more robust and thus are better at protecting against the effects of climate change (Haan et al., 2016). Process-wise in the field of water management there has been a shift from the technocratic and state-oriented process towards more collaborative governance (Roo & Voogd, 2013) causing different governmental actors, as well as private companies and societal parties and individuals, to work more extensively together towards an integral solution (Buuren et al., 2012).

However, there is little knowledge about the application of innovative dikes and linking projects regarding coastal dike improvement and thus there are still various questions, including those related to the evaluation of industry professionals and the experience of recreational users. These questions are especially relevant since various studies have shown that not necessarily all stakeholders are content with new developments regarding spatial quality. Bulkens et al. (2015) demonstrates this in Millingerwaard: the difference in opinions of local residents were exposed with regard to the development of new nature. Stating that it is important to involve all stakeholders, since potential projects are not welcomed with open arms by everyone.

## **1.2 Research problem**

In order to gain insight into the experience, evaluation and use of these linking projects by various stakeholders (project developers, industry professionals and recreational users) regarding the coastal innovative dike improvement project between Delfzijl and Eemshaven, the following research question is proposed:

*Does the Delfzijl-Eemshaven coastal dike improvement reflect the improvement of water safety whilst simultaneously increasing spatial quality according to the main stakeholders?*

To answer this research question, the following sub-questions will be examined:

- *Who are the main stakeholders?*
- *How do the main stakeholders evaluate and experience the development of a traditional dike improvement?*
- *How do the main stakeholders evaluate the development of an innovative dike improvement?*
- *What are the main differences perceived by the main stakeholders between a traditional and innovative dike?*
- *What are the lessons to learn for future innovative dike developments?*

## **1.3 Structure of the thesis**

Chapter 1 gave a short introduction into the topic as well as introducing the research question. Additionally chapter 2 discusses both theories and concept in the theoretical framework. It touches upon two types of dike improvement as well as linking-projects and the main stakeholders. The chapter closes with the hypotheses and the conceptual model. In chapter 3 the thesis continues with the methodology used during the research. Chapter 4 is an overview of the results which are presented and divided in various subheadings, also the link to the literature is made. Finally chapter 5 is the conclusion answering all research questions followed by future research recommendation and a reflection on the research.

## **2 Theoretical Framework**

### **2.1 Two types of dike improvement**

Coastal flood risk prevention focusses on risks, potential impacts of flooding and the chance of being affected by a flood as an individual (Pötzt et al., 2014). The basic flood protection level is, regardless of where an individual lives, the same in the whole of the Netherlands. The probability of dying because of an inundation should be less than 1 in 100,000 yr<sup>-1</sup> (10<sup>-5</sup>). To compare: the probability of dying as a result of a traffic accident is three times higher (Ritzema & Loon-Steensma, 2018). There are two types of coastal dike improvement, an older more traditional one (traditional dike improvement) and a newer more innovative one (innovative dike improvement). Traditional dike improvement is a concept focussed on directly and merely increasing water safety, measured by several requirements such as height, slope and covering (Loon-Steensma et al., 2014a). Traditional dike processes approach concerns regarding safety and risk in a probabilistic way. This approach is focussed towards employing the skills of civil engineers rather than the incorporation of nature (Enserink, 2004).

Innovative dikes are a strategy in order to create both a safe and appealing area (Haan et al., 2016; Oddo et al., 2017) which makes them:

- i. Safer, due to the employment of different design profiles or flood defence principles.
- ii. Able to create positive effects or opportunities for regional business, spatial quality, recreation and tourism, nature, energy and raw materials, or combining nature and landscape quality with socio-economic tasks.
- iii. Boost in terms of feasibility, offer opportunities for linking-projects and increased adaptability.
- iv. Able to create fewer investment costs and additional opportunities for co-financing.

The alternative design of an innovative dike concept meets like a traditional dike all the criteria in order to withstand extreme weather conditions (Loon-Steensma et al., 2012). However, these dikes might be more robust in order to cope with extreme conditions in the future, since they employ different flood defence principles. Examples are a multifunctional dike, a sand-engine or multiple lines of defence (Loon-Steensma et al., 2014b). Also, they may incorporate nature and landscape values, offer new opportunities to combining functions like linking-projects (Haan et al., 2016) and may be cheaper than a traditional dike improvement project (Loon-Steensma et al., 2012).

### **2.2 Linking projects**

Lower investment costs are mainly realised by the implementation of various linking projects. Consequently more stakeholders will be involved to invest in projects and share the costs. Linking projects themselves are a collaboration between different stakeholders (Buuren et al., 2012) to realise the implementation of projects which are 'linked' to the dike improvement process (Haan et al., 2016). Therefore linking-projects creates new windows of opportunity s to increase the spatial quality and add innovative elements into the dike improvement process (Kunzmann, 2013). However, the communication and collaboration between several stakeholders can be challenging (POV-Waddenzeedijken, 2020).

Spatial quality is a definition which is mostly subjective and can differ per research (Rijke et al., 2012). However in this thesis, spatial quality will be interpreted as the successful development and integration of strategies, policies or designs to create an effective and valued use of space with elements regarding recreation and tourism, nature, landscape, ecology and infrastructure. A strategy could be the implementation of various linking projects in combination with a main intervention in order to increase the spatial quality. Also the creation of positive effects and opportunities for a specific area can have a direct influence on better spatial quality (Haan et al., 2016). An example of a linking-project or the creation of opportunities is the twin dike. The twin dike fulfils three objectives: innovation in agriculture, increase in nature and increase in water safety.

In theory, an innovative dike causes an interaction between water safety and spatial quality, certain measurements to increase the spatial quality can also improve the water safety and vice versa (Loon-Steensma et al., 2014a). A key example of good integration between water safety and spatial quality is one from the field of river flood protection, and is named: ‘Room for the River’. Room for the River is a Spatial Planning Key Decision (SPKD) in which is conceptually based on an integrated (holistic) approach of creating a more multifunctional river region (Zevenbergen et al., 2015).

**2.3 Conceptual model**

Nowadays, a trade-off between flood protection, societal acceptance and spatial development is critical in order to establish a successful flood protection strategy (Stijnen et al., 2014). Addressing the preferences of multiple stakeholders and avoiding extreme perspectives can be attained in seeking compromised solutions due to satisficing an optimal performance in order to create more stability (Oddo et al., 2017). Figure 1 is a framework for planning-oriented action. In the field of water management a shift has occurred which is moving away from a state-oriented process towards a more collaborative governance (Buuren et al., 2012). A shift from the generic ‘technical rational’ towards a more specific ‘communicative rational’ (Roo & Voogd, 2013).

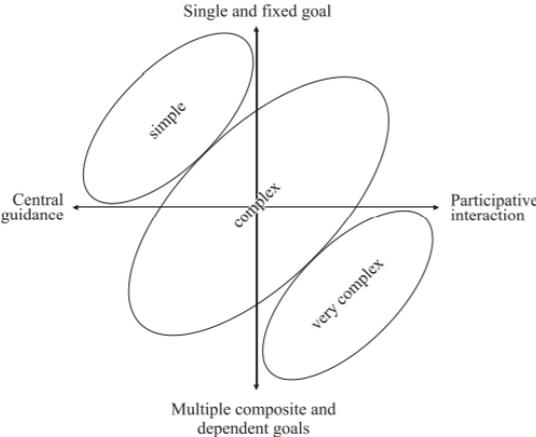


Figure 1: Framework for planning-oriented action (Roo & Voogd, 2013)

A more specific approach is, for example, the implementation of linking projects or by creating positive effects which will in itself lead towards spatial quality (Haan et al., 2016). Such a strategy is part of the innovative dike improvement, however little know experience from the main stakeholders is collected. The conceptual model is visualised in figure 2.

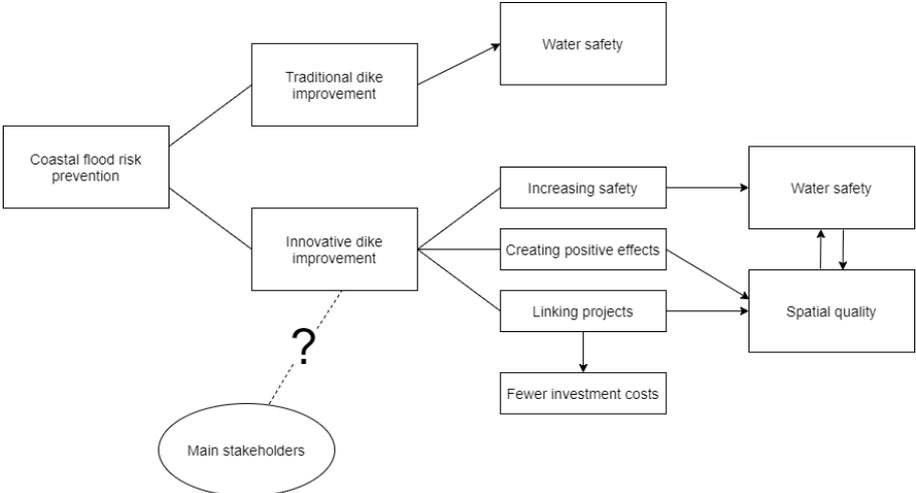


Figure 2: Conceptual model (Author, 2020)

### **3 Methodology**

#### **3.1 Research method**

##### **3.1.1 Data collection instrument**

This thesis will be based on a combination of primary data (semi-structured interviews) and secondary data. The interviewer will prepare a list of questions, however there will be the possibility to address any issue which the participant feels is important (Clifford et al. 2016). This combination of data collection will be carefully applied by firstly using the secondary data to give a sufficient and clear overview about all general knowledge regarding the field of water management. The pre and post-policy documents of the Delfzijl-Eemshaven project provide detailed insight into this specific project. Secondly, the primary data will be collected since there is little information available regarding the opinions of project developers, industry professionals and recreational users respecting innovative dike improvement. A semi-structured interview will provide a relevant framework addressing key terms but it also will help the respondent to address whatever they feel is meaningful (Longhurst, 2016). Also, open interviews are not used since the researcher needs to narrow down to questions to guide the interview (Clifford et al. 2016).

All the interviews will be recorded, transcribed, coded and analysed in Atlas.Ti. When the interview is completed the interviewer will transcribe the interviews into a concise document after which all interviews will be uploaded in Atlas.Ti. The codes, as portrayed in the codebook and tree (appendix A & B) are a combination between deductive and inductive codes. On the first hand the code tree consists of deductive codes, complemented by inductive codes derived from the interviews (Clifford et al. 2016). The codes bundle all relevant information together after which they can be compared. The interview guides can be found in appendix C.

##### **3.1.2. The interviewees**

The main stakeholders consist of three groups: project developers, external industry professionals and territorial users. Throughout the research two different dike improvement projects are analysed, a traditional dike and an innovative dike. The two types of dikes are analysed in order to draw comparison. The first main stakeholder (project developer) will be interviewed concerning both situations. Two external industry professionals are also interviewed about a traditional and an innovative dike. The last main stakeholder is a territorial user, who is a resident or recreational user of the area. The territorial user initially would be split into two separate groups during the interview. One group living in an area where traditional dike improvement has taken place while the other group living in an region where the concept of an innovative dike has been implemented. Due to unforeseen circumstances of the COVID-19 pandemic, the interviewer was only able to interview a territorial user living in an innovative dike area.

<i>Topic of interview</i>	
<b>Traditional dike improvement</b>	<b>Innovative dike improvement</b>
Project developer	Project developer
External industry professionals	External industry professional
	Territorial user

*Table 1: Topic of the interview (Author, 2020)*

For this research, interviewees were recruited via the network of Noorderzijlvest. The external industry professionals would initially be interviewed on the ‘dag van de dijkwerkers’, however, due to the COVID-19 pandemic, they have also been approached through contacts from Noorderzijlvest. The pandemic also changed the way of interviewing, instead of a meeting in person, the interviews were conducted through a Skype call. The way of selecting the participants may have caused a bias of their attitude towards the project which should be taken into consideration. Mostly because they have been recruited through the same set of individuals. The set of participants can be found in table 2.



Date	Participant
26-03-2020	<b>Silvia</b> <i>Project manager</i> Environment manager at Noorderzijlvest.
26-03-2020	<b>Marco</b> <i>Project manager</i> Water safety consultant at Arcadis, hired by Noorderzijlvest (and other water boards).
02-04-2020	<b>Sander</b> <i>External industry professional</i> Environment manager at Hunze en Aa's.
02-04-2020	<b>Cor</b> <i>Territorial user</i> Inhabitant of Delfzijl.
07-04-2020	<b>Peter</b> <i>External industry professional</i> Environment manager at Wetterskip Fryslân.

Table 2: Overview of the interviewees (Author, 2020)

### 3.2 Research location

The dike improvement project is located in the province of Groningen in the Netherlands. More specifically between the city of Delfzijl and the transshipment port of the Eemshaven, as can be seen in figure 2. An 11.7 kilometres wide range is part of the local primary flood defence system (Haan et al., 2016). As is shown on the map, the outer dike area is established as a Natura 2000 area. Furthermore, part of the waterbody is international World Heritage, the Wadden Sea (Kwakernaak & Lenselink, 2015). The Wadden Sea region consist among other things of seawater, channels, mud flats and salt marches. Within this specific region various linking-projects have been implemented. However, since the geographical location of the linking-projects is not vital to the research, they have not been implemented in the map (figure 3). The linking-project are the Rich dike and bird breeding island, Marconi city beach, thanks to the dikes, the double dike and other recreational facilities.

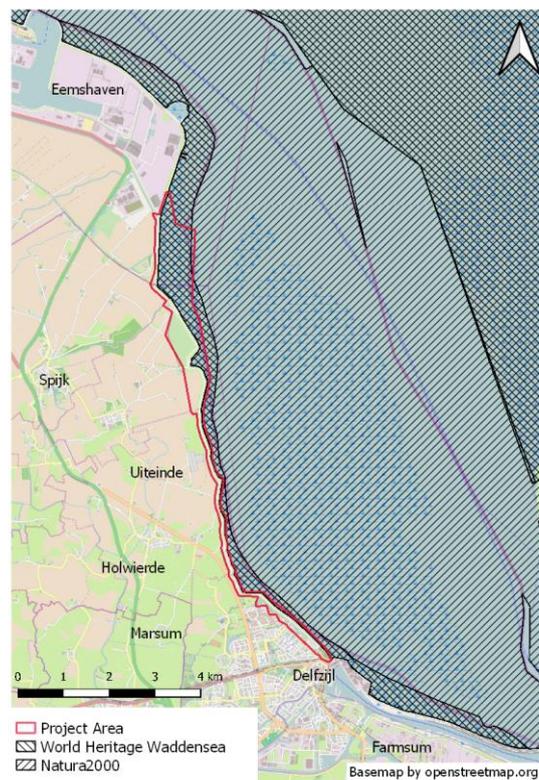


Figure 3: Map of the Delfzijl-Eemshaven project area (Author, 2020)



Figure 4: Bird's eye view of the multifunctional twin dike from the Eemshaven southwards (Kwakernaak & Lenselink, 2015).

### 3.3 Reliability and validity

One thing to note is that only a limited number of individuals are interviewed, and those interviewees cannot accurately represent the whole population. The way of selecting the interviewees can be seen as a bias, as the project developers reached out to their own personal contacts instead of the researcher being involved in the selection process. On the other hand, there were not many main stakeholders involved in the project. Consequently there were not many individuals to approach which increases the reliability. Additionally, no individual territorial user living in a traditional dike improvement situation is interviewed which reduces the validity.

Moreover, one has to be aware of the fact that the sample is really small. Which is due to the fact that this thesis is a case study and aims to compare and analyse the opinions of the stakeholders. Therefore, the results will not provide one hundred percent certainty concerning all individuals involved. It rather will establish a specific insight (Adams, 2015). Further, the results will not show broad generalizations, but rather an if-then relationship (specific observation).

However, since this project is a case study, the analyses will be in depth and therefore specific. Furthermore, the outcomes of the research can give an indication to similar projects and the evaluation of the project itself will be more accurate, since one does not have to take into account different projects. Therefore, a clear in depth analyses can be made about the Delfzijl-Eemshaven innovative dike project. The COVID-19 pandemic did not decrease the reliability and validity since the sample size did not become smaller due to the pandemic.

### **3.4 Ethical considerations**

Before the official part of the interview, the interviewer asked for informed consent to use the interviewees first name in the report and record the conversation. Also, the aim and educational purpose of the research was explained. Secondly the interviewer explained that the participant can withdraw from the research at any point. Furthermore, the transcribed data is stored on one computer including a password. Lastly, the interviewees only participated voluntarily and it was clear that the research did not have any commercial or political interest and that therefore the researches is seen as objective.

### **3.5 Reflection on data collection process**

During the data collection process, the interviews have not encountered many obstacles. All participants gave clear and concise answers and short questions were replied with long answers. Showing that the participants were feeling comfortable. Therefore many side stories were brought onto the table, however, they did not influence the interview in a negative way. Rather than distracting the interviewer from the main concepts they were supported by many examples. As a response, the interviewer showed understanding and portrayed a positive attitude towards the interviewees. As a result, some participants asked whether the interviewer could send the final report.

## **4 Results**

### **4.1 Main stakeholders**

The first significant stakeholder is the project developer, and within the specific project of the dike improvement between Delfzijl and the Eemshaven, the project developer is Noorderzijlvest (Loon-Steensma et al., 2014a). The second main stakeholder is the territorial user, a combination of local residents and recreational users who make use of the area. For this specific thesis the territorial user is a resident of Delfzijl. Lastly, the evaluation of the project will be reflected by external industry professionals, experts in the field of water safety and spatial quality. For this thesis, the external industry professionals are environment managers from Wetterskip Fryslân and Hunze en Aa's.

The project developers from Noorderzijlvest were intensively involved in the Delfzijl-Eemshaven project. The territorial user was part of a sounding board. Lastly, the external industry professionals were not involved in the Delfzijl-Eemshaven project. For an innovative dike improvement process, many stakeholders are involved, varying from the project managers or local municipalities to nature conservancy. This paper is aware of the fact that there are more main stakeholders, although due to the scope of this research they are not taken into account.

### **4.2 Safety**

Safety is of grave importance to both traditional and innovative dike improvements (Enserink, 2004; Haan et al., 2016). In this chapter, the technical safety will be analysed by the main stakeholders for both dike improvements. In addition, the awareness of being safe is discussed.

#### **4.2.1 Technical safety**

The innovative dike concept and more specifically the Delfzijl Eemshaven project is in technical terms a very safe dike according to the main stakeholders. This is in line with the literature since 'safety' is one of the four main pillars of the principal aims of the project (Haan et al., 2016). The main stakeholders also confirm that a traditional dike improvement creates safety, which is in line with the literature (Enserink, 2004). This was expected since the concept of traditional dike improvement is merely focussed on increasing water safety (Loon-Steensma et al., 2014a). One of the interviewees declared that both traditional and innovative dikes will enhance safety as the end result. This summarizes once more the first and foremost goal of a dike improvement: safety:

*The moment when you start with a dike improvement, traditional or innovative, the end result must be that the dike has been improved, that the safety has improved. (Marco)*

All stakeholders agreed that water safety is the number one priority and the innovative dike improvement between Delfzijl and the Eemshaven is successful in terms of safety.

#### **4.2.2 Awareness**

Besides technical water safety, another important aspect of safety is the awareness of individuals living in the area behind the dike. The awareness of the residents is present throughout the research. The concept of awareness is very relevant, however, it is not found in the discussed literature. There might be a potential relationship between the linking-projects and the extent to which people are aware of why the dike must be strengthened. Although not all participants mention this phenomenon (perhaps because such a question was not included in the interview guide), some are strongly convinced that the linking-projects influence the awareness of individuals in a positive way. According to the literature, linking-projects should add value to an area (increase spatial quality), since they are a collaboration between different stakeholders and the project managers (Haan et al., 2016). Hence one might suspect that linking-projects create support, and therefore increase the extent of awareness. The participant believes that taking into account spatial quality will lead to an increasing feeling of safety. Another interviewee said that everyone in the surrounding area between Delfzijl and Eemshaven is fully aware of why the dike improvement process is extremely important.

Another interesting statement was brought upon the table by an inhabitant from Delfzijl. According to an interviewee, people who are aware of why the dike is built have fewer problems with the additional nuisance:

*Share on Facebook, share a story there, what you are doing. What is coming. And if there are issues, you can share those problems there. If people know what is happening, then people have no problem with it. (Cor)*

The participants state that if inhabitants are aware of why the dike improvement is necessary, fewer complaints or protests will arise to the project team. Which is in line with the literature which said that by seeking a compromised solution and satisficing optimal performance (of which awareness is part), increased stability is created (Oddo et al., 2017). Creating awareness of why the dike is important is linked to the accessibility and distribution of information regarding the project, which will be further analysed in section 4.4.1. Hence, awareness is related to the feeling of being safe and is present at the researched project. Perhaps it is created to a larger extent at an innovative dike improvement project. Also if the project team makes the inhabitants aware of the reasons why a dike improvement is necessary fewer issues will be found during the process.

### **4.3 Spatial quality**

The concepts of a traditional and innovative dike improvement are discussed by the main stakeholders. Moreover, the linking-projects which are part of an innovative dike improvement are analysed.

#### **4.3.1 Traditional dike improvement**

The main stakeholders agree that traditional dike improvements take into account spatial quality and it is easier to apply since it takes into account fewer actors. The consideration of spatial quality within traditional dike improvement projects is not in line with the literature (Loon-Steensma et al., 2014a). Which states that traditional dike improvement is merely focussed on improving water safety. All external professionals and project managers agreed that even within a traditional dike improvement process there is a focus on spatial quality or an integration plan as is explained by one of the project managers:

*Even within a traditional approach, some sort of a spatial integration plan or spatial framework is outlined, and the dike improvement has to find a place within that outline. (Marco)*

The results also show that traditional dike improvement is mostly chosen because it is easier to apply in a broader spectrum. Some interviewees consider this to be the case since it is technically easier to apply and because it might be easier for the local residents, while others think it is linked to financial resources. Lastly, most participants agree that a traditional dike improvement is less focussed on the interests of other stakeholders and applies less concise strategic environmental management. Traditional dike improvement is mostly focussed on the technical aspects while innovative dike improvement is eyeing more towards extensive contact with the stakeholders (Enserink, 2004). However, the interviewees also agreed that the interests of stakeholders are taken into account, simply to a different (less) extent.

Moreover, nowadays it is more difficult to distinguish the concepts of traditional and innovative dike improvement since they occasionally overlap and change throughout time (Ven, 2004). To summarise, the concept of a traditional dike is not as fixed as the literature claims it to be since spatial quality is taken into account but to a different extent. The motivation why the traditional process is preferred in some situations is because the concept itself is more accessible and a traditional dike dismisses other aspects.

#### **4.3.2 Linking-projects**

Linking-projects seem to create awareness, support and spatial quality, however they are not flawless. According to some main stakeholders, linking-projects potentially increase awareness as is explained in part 4.2.2. Besides awareness, most stakeholders agree that the linking project increases support of the inhabitants. Because of the linking-projects, individuals see an added value in spatial quality to their

surroundings and therefore cope better with the negative temporary impacts. As of yet, both the literature and partakers proves that linking-project create a boost in terms of feasibility, increased adaptability and create positive effects such as a collaboration between various stakeholders resulting in spatial quality (Haan et al., 2016). Also, the findings of Oddo et al., (2017) are in line with this, as there is a focus on linking-projects, so one can say that there is a focus on spatial quality.

On the other hand, most participants agree that the implementation of the linking-projects in general are still not optimal. Firstly because of a lack of relation between the linking-projects and water safety. Meaning that increasing spatial quality does not automatically lead to an increase of water safety (and the other way around). In this project, the linking-projects did not necessarily increase water safety. Therefore the findings from Loon-Steensma et al., (2014a) differ from the results of the interviews, since they claim that an interaction between water safety and spatial quality can improve each other. Secondly, cooperation and communication between various stakeholders can improve, since it seems hard for different parties with diverse backgrounds and working methods to efficiently cooperate. One of the project managers summarises the effects in the following quote:

*We did not really investigate a relation at the beginning, so we very quickly concluded that we may have a few linking-opportunities, so elements have been added without increasing water safety. They do have ensured that there is much more support. (Marco)*

Therefore these linking-projects are a useful tool in order to increase the spatial quality, developing more awareness and gain more support, but can definitely be improved according to the main stakeholders.

#### **4.3.3 Innovative dike improvement**

Innovative dike improvement is desired, creates more spatial quality but has to be feasible. All participants seem to acknowledge the shift from a technocratic towards a more process-oriented collaborative governance with more stakeholders working collectively to formulate an integral solution (Buuren et al., 2012). As is explained in section 4.3.2, linking-projects aim to reach an integral solution. Furthermore the interviewees also acknowledge that there is an increasing trade-off between spatial quality, societal acceptance and flood protection (Stijnen et al., 2014), which is in essence, the core concept of an innovative dike improvement process (Haan et al., 2016):

*If you merely apply a new gadget with an innovative dike, you will not have it, but if you listen to the stakeholders and apply and access it, fit in more elements and look broader than just the dike itself, you will almost automatically see that the spatial quality gets higher. Because you take more interests into account. (Sander)*

As was expected (Loon-Steensma et al., 2012), the interviewees also confirm that the innovative dike improvement increases safety. What the interviewees also recognise is that the term ‘innovative dike’ is shifting. The term is not fixed since the development regarding dike improvements is dynamic. What for one project developer may be innovative may be outdated by another. They all believe that an innovative dike is desired under the condition of feasibility. Examples given are time or financial restraints, but also the suitability of a dike in its surroundings. Peter explained that a dike build closely to a village may not benefit from an innovative dike since there is not enough available space. To conclude, an innovative dike improvement is desired where possible and creates more spatial quality.

#### **4.4 Process oriented dike improvement**

During the research the participants emphasized the importance of process-oriented dike improvement. Throughout the discussed literature this segment has not been addressed thoroughly, which these results aim to compensate.

##### **4.4.1 Accessibility and stakeholders**

Accessibility has been identified as a key concept throughout the interviews, communication to the residents as well as the degree of openness. The main stakeholders agree that first of all it is very important to communicate during the process, which will lead to less complaints or protests. This is in

line with ‘awareness’, discussed in section 4.2.2. Secondly, transparency and openness to residents is important, such as being able to visit a specific communication centre. The main stakeholders did not specify that the degree of accessibility is higher at either a traditional or an innovative dike:

*So I have always experienced, that at the beginning you should communicate well with the surroundings and also keep communicating, keep the people updated regularly. Nowadays you have very solid options with an email, just another update, send an email again, how are you, I don't have much news but we are busy. (Peter)*

From this, the main lesson for future projects is to integrate communication and openness to the stakeholders. Since all main stakeholders agreed that communication and openness are key, and will result in a smoother process with more support. Thus, regardless whether or not the development is traditional or innovative, one should always aim for the highest form of communication and transparency.

#### **4.4.2 Duration of dike improvement projects**

The Delfzijl-Eemshaven project was executed more rapidly than a traditional dike improvement, however some external industry professionals believe that innovative dike improvements will take longer. According to the project manager this dike improvement process is executed in five years instead of eight. On the other hand an industry professional considers that normally an innovative dike improvement process should take longer:

*If you come up with an alternative, with maybe a twin-dike or whatever, I just mention some, which has different shapes that on the one hand take more time to get support of the environment and how it will impact on the view of the environment. On the other hand, usually alternative (not always) also needs more space so you will also need to acquire more land. That is 9 out of 10 cases an inner dike and that takes much more time. And a third is that it will most likely be more expensive. It is going to cost more money, I think an alternative is generally more expensive, not always, but I think it is. (Peter)*

The project developer who stated that the realisation of the dike improvement is finished three years earlier, also admitted that a few details have been missed out on. Therefore, the participant states that perhaps one should not try to build an innovative dike too fast. Further, one of the major lessons is that one should not try to finalise a project too fast since important details can be missed out on. To conclude, although the Delfzijl-Eemshaven project was finished earlier than a traditional dike improvement, future innovative dike improvements should not be executed too fast.

#### **4.5 Comparison between a traditional and innovative dike improvement**

A traditional dike takes less account of the interests of other stakeholders but does include spatial quality to a certain extent. Nevertheless, in some situations a traditional dike is easier to apply. In terms of safety, an innovative dike does increase the required water safety and the research has shown that it is more desirable. It focusses more on the integration of stakeholders within the process and therefore creates more awareness and support. Additionally, an innovative dike concept creates more spatial quality because of linking-projects.

After reviewing a traditional dike and an innovative dike, one can compare the two concepts. Safety-wise there are not many contrasts, although an innovative dike concept uses different design profiles and flood defence principles (Loon-Steensma et al., 2014b). Therefore this type of dike might be more robust to extreme weather conditions in the future. Linking-projects, present at an innovative dike, create increased awareness, support and an improvement in spatial quality. Due to these factors, the innovative dike is more desirable than a traditional dike improvement.

## **5 Conclusion**

The goal of this research is to explore the extent to which water safety and spatial quality were simultaneously improved according to the main stakeholders in the Delfzijl-Eemshaven project. To gain a deeper understanding the research also aimed to compare a traditional dike improvement with an innovative dike improvement. This paper aims to answer the following research question: *Does the Delfzijl-Eemshaven coastal dike improvement reflect the improvement of water safety whilst simultaneously increasing spatial quality according to the main stakeholders?*

The Delfzijl-Eemshaven coastal dike improvement reflects improvements of water safety whilst simultaneously increase spatial quality according to all main stakeholders. The improvement of water safety is in line with the discussed literature (Loon-Steensma et al., 2012; Loon-Steensma et al., 2014b; Haan et al., 2016). According to the main stakeholders the Delfzijl-Eemshaven project simultaneously improves spatial quality, which further reflects the arguments made in the literature (Kunzmann, 2013; Haan et al., 2016). Nonetheless, this research also demonstrated that there is not a clear relationship between an increase in water safety leading to an improvement of spatial quality and vice versa, in the Delfzijl-Eemshaven project. This result does not agree with Haan et al., 2016, who suggested a relationship between water safety and spatial quality. What is expected is that traditional dike improvements would mostly focus on increasing the water safety (Enserink, 2004). The main stakeholders and therefore the thesis confirms this. The research has shown that a traditional dike can still have a significant focus on spatial quality. To conclude, this innovative dike improvement reflects both water safety and spatial quality, but the two concepts do not necessarily influence each other.

Furthermore, this research has shown that linking-projects create more support and increase spatial quality. Additionally, There might be a link with the individual awareness of residents, but further research is needed. Moreover, according to all stakeholders, linking-projects and the innovative dike concept are preferred over a traditional dike development, if feasible. This is in line with the literature (Stijnen et al., 2014) since a trade-off between flood protection, spatial development and societal acceptance is gaining more importance. An innovative dike development gains more support due to the linking-projects and is therefore closer to a specific ‘communicative rational’ (Roo & Voogd, 2013). The main stakeholders confirm the theory that there is a shift towards a more collaborative governance (Buuren et al., 2012) by addressing the preferences of multiple stakeholders (Oddo et al., 2017). However, this research showed that the communication and cooperation between the various stakeholders is not optimal.

Future research could focus on the difference between the duration of a traditional and innovative dike improvement process. Furthermore, one can also compare different case studies or choose to research various international cases. This would enable a comparison between projects within and outside the Netherlands. One could compare these results in order to give advice for future (inter)national projects. Lastly, one can research the potential link between linking-projects and the creation of individual awareness of residents. This research could explore to what extent the linking-projects influence awareness and create another incentive to use such linking-projects.

To reflect, the qualitative data collection was successful. All participants were willing to answer the questions and did so in a clear, varied and rich way. The COVID-19 pandemic did not influence the data collection in a negative way, however, the interviews were held online instead of in person. However, it was difficult to establish a concrete definition for spatial quality. Nevertheless, the research tried to use a clear distinction. The outcomes of this research are derived from a case study and can therefore not be generalised to a larger or entire population. This research can function as an explorative study and inspire other research to continue the study on this particular matter.



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