INNOVATING IN THE MARITIME CLUSTER
A qualitative case study on success and failure factors of implementing innovative sustainable technologies in a competitive industry in the region of Rotterdam - Drechtsteden

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Thomas Teijl
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Thomas Teijl
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Summary

The City of Rotterdam is interested in aiding innovation in the port area of Rotterdam so it remains competitive and becomes more sustainable. The City deploys instruments in order to develop a sustainable port economy. One of the clusters in the port of Rotterdam that relies heavily on innovations is the Maritime Cluster.

The local government recently expressed the need for expanding the cluster and increasing sustainability. The City wishes to have more insight in the Maritime Cluster to support innovation implementation. This raises the question what factors are instrumental in implementing innovative sustainable technologies in the Maritime Cluster.

Currently, however, little is known about this particular cluster and how innovations come to be. No specific deep understanding of implementation of innovative sustainable technologies in the Maritime Cluster in the region of Rotterdam is available.

The research problem leads to the following research question:

What success and failure factors of implementing innovative sustainable technologies in the Maritime Cluster in the port area of Stadsregio Rotterdam and Drechtsteden can the City of Rotterdam affect with policy in such a way that more innovative sustainable technologies are implemented?

For providing the City of Rotterdam the requested insight we performed a qualitative case study based in guidelines by Stake and Flyvbjerg. The case study is used to better understand the issues and contexts in a case. This case study focussed on the dynamics in the cluster that are instrumental in the implementation of innovations. By depicting the body of empirically obtained data, a deep understanding is provided of the factors to the reader. This provides awareness that cannot be captured in conceptual maps.

For obtaining the empirical data fourteen relevant stakeholders were interviewed. These interviews were unstructured and one to one-and-a-half hour long in-depth interviews. Stakeholders in the sectors maritime services, marine equipment supply, offshore and shipbuilding were selected. The respondents represent start-ups, small and medium-sized enterprises, leader firms and knowledge institutions.

The qualitative case study has resulted in an empirical body of data, derived from the accounts of interviewees, which is depicted in this report without analysis or comments. This enables the reader to be informed about the various aspects of implementing innovations in the maritime sector in the region of Rotterdam and Drechtsteden. The specifics that are mentioned are important, as it is a case study about a specific cluster in a specific region. No general statements about other cases are therefore possible based on this research, which was not the intention in the first place.

The accounts of the interviewees are grouped in several success and failure factors through holistic data coding. Combining these factors with literature and documents, a list is derived by dividing the factors in
factors that are inside (endogenous) or outside (exogenous) the policy solution space of the City of Rotterdam. Endogenous factors should be regarded as factors where the local government has an role and there might be opportunities for influencing through policy measures. Exogenous factors are factors that either cannot or can only indirectly be influenced. These factors are depicted in the table below.

<table>
<thead>
<tr>
<th>Endogenous factors</th>
<th>Exogenous factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction giving by government</td>
<td>Lack of infrastructure</td>
</tr>
<tr>
<td>Positive innovation climate</td>
<td>Too complex subsidy regulation</td>
</tr>
<tr>
<td>Sharing knowledge</td>
<td>Too conservative sector</td>
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<tr>
<td>Insufficient human capital</td>
<td>Bad market conditions</td>
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<tr>
<td>Unsuitable regulation</td>
<td>Lack of level playing field</td>
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<tr>
<td>Absence of launching customer</td>
<td>Having a competitive advantage</td>
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<tr>
<td>Collaboration</td>
<td>Too many initiatives</td>
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<tr>
<td>Insufficient financing</td>
<td></td>
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<tr>
<td>Difficult to valorise</td>
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However, these factors cannot be regarded by themselves alone. This list is an additional layer of analysis to the main body of this research, which is the complete body of empirical data showing all complexities and intricacies of the case. This is also the reason why summarizing the empirical data here would not do justice to the content, as the content would be represented too simplistically and superficially.

It appears that the endogenous factors of collaboration, financing and regulation are widely shared. Literature underlines the positive benefits of collaborating through open innovation and collaborating in the triple helix. We therefore suggest that the City of Rotterdam should focus policy on enabling and intensifying collaboration in the Maritime Cluster. Cross sector collaboration with other industries may accelerate developments of new technologies. Also, as the industry is heavily regulated, involving classification registers and legislative bodies in the innovation process may quicken and streamline the innovation process. It would be likewise beneficial to involve funders, so that information asymmetry is reduced and funders are more likely to invest in the Maritime Cluster. In order to facilitate new projects and start-ups, thereby effectively acting as a launching customer, the city could establish revolving funds. The requirements for those funds should be simple and straightforward.

As every single factor relates to one or more other factors, these factors can be regarded as a network of factors. This pleads for reading and understanding the merged accounts of the interviewees, which is thus the core of this research. Viewing only one factor by itself is thus pointless. The implications are that policies cannot be developed for only one factor, as the interrelatedness means that other factors are affected as well.

This research is an exploratory research primarily based on the accounts of the interviewees and is concerned with maximizing lessons learned about this particular case. The findings are therefore only applicable to the Maritime Cluster in the region of Rotterdam and Drechtsteden, and cannot be applied to other sectors or regions. All policy recommendations should thus be regarded as guiding statements for this particular cluster.
Since this research is limited in time, a more extensive research may produce some additional insights. The emphasis should be on deepening understanding of innovation implementation. This research focused on the latest phases of innovation, so the findings could also be extended with factors for the earlier phases of innovation through additional research. Quantitative research might render statistical substantiation for the factors, although quantitative research follows a different paradigm than used in this research.

Perhaps more interesting is additional research on the design of policy in order to facilitate collaboration, since only general directions for policy are depicted in this research. Given the relatedness of the factors, an interesting challenge is to develop an adaptive policy that can deal with all the intricacies.
1 Introduction of the knowledge gap in the Dutch Maritime Cluster

The City of Rotterdam is interested in aiding innovation in the port area of Rotterdam so it remains competitive and becomes more sustainable (Port Of Rotterdam, 2012). The City deploys instruments in order to develop a sustainable port economy. One of the clusters in the port of Rotterdam that relies heavily on innovations is the Maritime Cluster. The cluster generates about three percent of the Dutch GDP and two percent of Dutch employment. Employment and production volumes are increasing, despite national trends (Aa et al., 2014).

The local government recently expressed the need for expanding the cluster and increasing sustainability (Rotterdam, 2014). The national government has indicated that the cluster is part of one of the industries where knowledge and innovation have to be strengthened (Topteam Water, 2011). The industry representative, Nederland Maritiem Land, also emphasizes the need for innovation to remain and improve the competitiveness of the cluster (Nederland Maritiem Land, 2014).

The City wishes to have more insight in the Maritime Cluster to support innovation implementation. The innovation deployment seems to be less than the innovation potential (ING Economisch Bureau, 2014). This raises the question what factors are instrumental in implementing innovative sustainable technologies in the Maritime Cluster.

Currently, however, little is known about this particular cluster and how innovations come to be. Some studies were performed on the clustering of the maritime industry and some on generic factors that contribute to innovation implementation (Andrade & Pinto, 2013; Langen, 2002). However, no specific deep understanding
of implementation of innovative sustainable technologies in the Maritime Cluster in the region of Rotterdam is available.

**Research question**

The research problem leads to the following research question:

*What success and failure factors of implementing innovative sustainable technologies in the Maritime Cluster in the port area of Stadsregio Rotterdam and Drechtsteden can the City of Rotterdam affect with policy in such a way that more innovative sustainable technologies are implemented?*

This question is divided into the following sub questions:

a) What are success and failure factors of implementing innovative sustainable technologies in general?
b) What are success and failure factors of implementing innovative sustainable technologies in the Maritime Cluster?
c) What factors can the City of Rotterdam affect to support implementation of innovative sustainable technologies?

For providing the City of Rotterdam the requested insight we performed a qualitative case study. This case study focussed on the dynamics in the cluster that are instrumental in the implementation of innovations. By depicting the body of empirically obtained data, a deep understanding is provided of the factors to the reader. This provides awareness that cannot be captured in conceptual maps (Flyvbjerg, 1998).

The relevance of the outcome of this research is two-fold. The research will produce a scientific as well as a societal contribution. The application of the qualitative case study will contribute to new scientific knowledge. The new insights will enable better instrument allocation by policymakers, which will yield societal benefits. After all, better instrument allocation means that less resources may be used while creating more welfare.

**Structure of report**

First, in Chapter 2 the research strategy of the qualitative single case study is outlined. Then in Chapter three an overview is presented of the context of the Maritime Cluster. Chapter 4 depicts generic success and failure factors found in literature, leading to mental anchors used during the interviews. The empirical data, grouped in success and failure factors, is presented in Chapter 5 without generalizations. Perspectives from literature and documents on the role of local government regarding those factors are added in Chapter 6. All findings are consolidated and reflected upon in Chapter 7, leading to a list of success and failure factors the City of Rotterdam can affect. Finally the main conclusions are presented in Chapter 8, including a discussion regarding the limitations of the research and recommendation for further research.
This chapter depicts the choices made regarding the research strategy of a qualitative single case study and the used methods of using documents, literature and interviews.

2.1 Research strategy
As little is known about how innovative sustainable technologies are implemented in the Maritime Cluster, an exploratory approach seems appropriate. So, given the exploratory and context dependent nature of this research, performing a case study for finding the success and failure factors seems appropriate. Furthermore, since the focus will be on societal processes and insight, a qualitative approach seems fitting. Therefore we performed a case study by adapting guidelines from Stake (1995) and Flyvbjerg (2006). Stake sees a case study as a strategy to better understand the “behavior, issues and contexts” in a case. All choices that we have made regarding definitions and demarcations are aimed to contribute to that understanding.

The boundaries of this case are on a rather high level, which are detailed in paragraph 2.1.3. One could also focus on one specific aspect of implementing innovative sustainable technologies in the Dutch maritime cluster. However, there is currently no available knowledge indicating which aspects are relevant or directing how to focus on an known aspect. Focusing on one small aspect would obviously require too much assumptions and too much choices. Therefore the set scope is relatively broad. The basic methodological choices and demarcations that are made are thus based on the principle of increasing broad understanding.
2.1.1 Definition of innovative sustainable technology

So what is an innovative sustainable technology exactly? This concept actually consists of several concepts. It is relevant to define these beforehand in order to focus the research and clearly communicate with others about these concepts during the research. After all, without defining these concepts will determine what is an innovative sustainable technology and what not. However, one must be aware that it is impossible and undesirable that the interviewees use these exact definitions. Every single person has his or her own mental constructs, views and definitions. The researcher cannot and should not influence these.

2.1.2 Technology

Technology is usually seen as the practical application of scientific knowledge. Technology is however not solely based on scientific knowledge, but results from a creative combination of various resources (Sismondo, 2011). One can also view technology as interacting with artefacts (Aunger, 2010). For now, technology is regarded as the practical application of research for the practical purposes of constructing or altering artefacts.

2.1.3 Innovation

Many definitions of the term innovation exist. In this research we use the following definition by Baregheh, Rowley, & Sambrook (2009) as basis: “innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace”. This definition draws upon various definitions of other scholars, resulting in a more comprehensive definition. From an innovation typology perspective, the innovations are mainly concerning product innovations (Rowley, Baregheh, & Sambrook, 2011).

Garcia & Calantone (2002) operationalize innovativeness of a product as newness to the customer, newness to industry and newness to firm. They argue that, given the consensus among various scholars, the degree of product innovativeness can be labelled in three categories as “radical”, “really new”, and “incremental”. Radical innovations might be more visible but incremental innovations might be more common. In our case study, we will regard any of the degrees of innovativeness.

2.1.4 Innovations and transitions

So far the focus in this proposal has been on supporting innovations. However, in literature more and more works are written on transitions (Markard, Raven, & Truffer, 2012). The definition of transition remains ambiguous, but most agree that it is about structural system change (Oei, 2014). According to Alkemade, Hekkert, & Negro (2011), transition policy “is the effort to guide or facilitate sustainability transitions, that is, to influence the speed and direction of the evolution of a socio-technical system”. Transitions are in practice more supported by national instead of local government (Verbong & Geels, 2007).

Alkemade et al. (2011) argue that innovation and transition policies can co-exist, but have to be aligned. In order to align the two types of policies, both policies have to support economic growth and sustainable development. Innovation policies may – like transition policies – be aimed to create societal beneficial changes, but often primarily support economic growth. In other words, innovation policies need to be aimed better at sustainability. So in this case, it is more interesting to consider innovations instead of transitions. These innovations nevertheless support transitions, like the transition to renewable energy. While the distinction may not always be very clear or useful, this research will focus on innovations using innovation theory. The focus...
on innovations also suits the local level of government better, and the innovations themselves can contribute
to increasing the desired sustainability.

### 2.1.1.4. Innovation phases
Innovations can be classified as being in different phases (Godin, 2006). For a long time a linear innovation
development model was used, and various variations exist. The basic phases are basic research, followed by
applied research, followed by development followed by production and diffusion. For this research, the focus is
on the shift from the development phase to production and diffusion phase.

Technologies can also be classified using Technology Readiness Levels as developed by NASA (Mankins,
1995). This classification is used in The Netherlands by for instance the research institute TNO (M. Huisman,
personal communication, 18 August, 2014). These levels range from observing basic principles to system
operational deployment. This research will focus on the higher Technology Readiness Levels (TRL 6 or higher),
as it is concerned about success and failure factors of implementing technologies (Mankins, 2009).

### 2.1.1.5. Sustainability
The term sustainability can encompass several meanings. One commonly used interpretation of this concept
is that sustainability consists of three pillars: economic, social and environmental (Adams, 2006). Other
varieties include concentric circles or overlapping circles of those three aspects. The International Union
for Conservation of Nature (IUCN) shows that these three aspects are not in alignment, since at this time
economic sustainability is overpowering social and environmental sustainability. Environmental sustainability
however supports social and economic sustainability, and should therefore be improved to balance all three
types of sustainability. Therefore we focus in this research on innovations that improve environmental
sustainability.

### 2.1.1.6. Innovative sustainable technology
In conclusion, implementing an innovative sustainable technology is understood during this research as
introducing a new or improved product, that is intended to positively impact environmental sustainability,
regardless of dimensions or innovativeness. The terms innovative sustainable technology and innovation are
henceforth used interchangeably.

### 2.1.3 Application of a constructivist approach
This research will adopt a rather constructivist paradigm, as opposed to the positivist take on case study
research by Yin (2014). This means that reality is viewed as existing in the form of mental constructions based
on person’s experiences (Guba, 1990). To date, fierce debates exist on which paradigm is suitable or even
legitimate. This debate will unlikely end anytime soon, as it has as much to do with personal backgrounds and
beliefs as it has with objective argumentation. Furthermore, there exist a lot of stances in between, and both
paradigms are unlikely to ever be completely unified (Lincoln, Lynham, & Guba, 2011). For this research any
further detailing and arguing of the paradigms would be pedantic. Acknowledging the rather constructivist
paradigm is sufficient in understanding the used approach. It underlines the choice for the qualitative case
study. After all, Stake argues that the constructivist approach “encourages providing readers with good raw
material for their own generalizing”.

2.1.4 Defining the case

There are a lot of ways to define a case, and there exists no consensus in literature. The term case is used very different ways, so there is no sole right answer (Ragin & Becker, 1992). The proposed research will use a qualitative single case research strategy. This choice, made in consultation with the client, seems best given the resource constraints and the nature of the case. The case is the implementation of innovative sustainable technologies in the Maritime Cluster, where the Maritime Cluster is delineated as described in the section before.

Though one could view specific innovations within the cluster as small sub cases or as samples, this research remains a single case study. One can compare this to a case study of a school improvement program. The school improvement is the overarching case study, where the various schools are the physical objects under study. Of course, not every school will be visited, but a selection will be made. In the Maritime Cluster, the companies can be analogous to the schools, of which a selection will be made for in-depth study. It is about understanding why innovative sustainable technologies are implemented or not for specifically the Maritime Cluster in the regions of Rotterdam and Drechtsteden.

2.1.5 Success and failure factors

In literature research into success and failure factors in various fields can be found. Studies reveal that there are a lot of factors that can lead to success or failure in innovation introduction (Balachandra & Friar, 1997). Alternative terms to success and failure factors that are used in literature are drivers and barriers respectively.

2.2 Research methods

As discussed before, a case study research is proposed. This will be the overarching research strategy. Case study as research strategy is still very broad and is used in answering the main research question. Several research methods are used to answer the research questions. These methods relate to the sub questions that were defined in the previous paragraph. The methods and data usage are inspired by Hujs (2011). In this paragraph the research methods and required data are established for each sub question.

a) What are success and failure factors of implementing innovative sustainable technologies in general?

As a start an overview is sought of general success and failure factors of implementing innovative sustainable technologies in literature. This research question is answered by performing a literature study, so the required data is retrieved from scientific publications. The study will be carried out by consulting scientific search engines such as Scopus and Web of Science, as well as the search engines of libraries.

This research thus starts out with a general overview of generic factors, as to form an initial view. These initial factors form mental anchors for performing interviews. This research question is thus aimed as an initial orientation. The success and failure factors that are sought after are derived from the empirical data obtained through the next research question, namely accounts from respondents. After all, in this research we are looking for specific factors for a specific cluster in a specific region.
b) What are success and failure factors of implementing innovative sustainable technologies in the Maritime Cluster?

For gathering the success and failure factors for this specific case, interviews were performed. The interview consisted of a one to one-and-a-half hour in-depth interview. Fourteen relevant stakeholders, which are listed in Appendix A, were interviewed. Each interview has been summarized after the interview. The summary was sent to the interviewee for approval, after which it could be used as empirical data input. The summaries can be requested from the author.

Each interview is recorded through note-taking and summarized within twenty-four hours after the interview. Interviews can be recorded using recording devices or through note-taking (or a combination of both of course). Both approaches have arguments for or against each approach. Recording the interview with a device has the advantage that the exact wording of the respondent is available as hard evidence. Respondents however may not talk freely, as they are aware of the fact that they are being recorded. Note-taking forces the interviewer to engage actively in the conversation and focus more on what the interviewee is saying, so any vagueness or indistinctness is detected sooner during the interview. Another benefit of note-taking is that interviewees have some time to collect their thoughts while the interviewer is writing down some notes. The downside is that note-taking is very intense for the interviewer and transcribing is more difficult, since the account of the interviewee is not written down in his or her own words. The approval of the interviewee of the summary indicates that the summary represents the interviewee’s account.

Considering the exploratory nature of this research, the interview is primarily unstructured, to get insight in the perceptions of those involved (Alvesson, 2003; Bauer, 1996; DiCicco-Bloom & Crabtree, 2006). The unstructured approach lets the respondents relate the issues that are on their mind and that they are facing. These issues are after all the ones that are most relevant and important to them. An unstructured interview diminishes steering of the respondent by the researcher as much as possible. After all, the research strategy is about learning as much as possible.

Performing unstructured interviews means that there was no list of questions used. The interview started out with a brief outline of the research, followed by a broad question about the involvement of the respondent concerning innovations to start the interview. Further questions by the interviewer were limited to “what else” or “can you give an example” questions. However, if the interview yielded too little information or seems to strand, the interview changed into a semi-structured interview. Therefore an interview guide was constructed, containing some general topics. The interviews were not held without any prior knowledge though, as relevant documents were reviewed in order to have some preliminary understanding about the Maritime Cluster. The body of empirical data is formed however by the accounts of the interviewees.

The interviewees were gathered by using contacts of the City of Rotterdam and contacts of those first tier contacts. The amount of interviews that could be performed was limited by the restricted timespan of the research. In studies on average after twelve interviews saturation can be achieved (Guest, Bunce, & Johnson, 2006). In total fourteen interviews were performed that resulted in approved summaries.

After collecting the empirical data, combining the very different accounts into success and failure factors is probably the most difficult and timeconsuming task. The data was managed by using the software program
ATLAS.ti, which is Computer Assisted Qualitative Data Analysis Software (CAQDAS) (Friese, 2012). The data has been coded by using a holistic coding strategy as described by Saldaña (2009). Coding is used to capture the essence of data, and to link similar or complimentary data. (Richards & Morse, 2007) Holistic coding requires several coding rounds and is performed by absorbing the data as a whole instead of coding line by line. In the first cycles we analysed the data to find general topics, which became the success and failure factors. In later cycles the factors, which were treated as code families in ATLAS.ti, were more detailed, by assigning more detailed codes to parts of data. Obviously the process was very much iterative, even or maybe especially while writing down the accounts for this report. This resulted in 18 code families and 176 codes. This coding strategy is used to group the data.

The result of the body of empirical data is depicted in Chapter 5 without any generalizations. One of the main tasks, as argued by Stake (1995), of the qualitative researcher is that of interpreter. Presenting the data will allow the reader to generalize the findings using one’s own mental frameworks and knowledge. Different individuals with different backgrounds will interpret the data differently. This demonstrates the complexities and intricacies of the case, which would be lost if only analysis or generic statements were reported. After all, according to Stake (1995) the researcher should facilitate “reader understandings that exceed the comprehension of the researcher”.

c) What factors can the City of Rotterdam affect to support implementation of innovative sustainable technologies?

Now that the success and failure factors are identified by performing a case study, those factors can be mapped to policy instruments of the City of Rotterdam. The City has a limited number of instruments, as the role of the government is changing to a more supportive one. Using literature and documents the role local government has regarding the factors is reviewed. These findings are consolidated with the factors, resulting in a list of factors that the City of Rotterdam can affect. This outcome can be used to give direction to policymaking. As this is an exploratory research, no policies will be constructed as that requires a different research approach than we used.

Developing a more sustainable port economy will require efforts from several parties. The City of Rotterdam disposes of various instruments that can be deployed. Here, instruments are defined as resources the government has to intervene. Resources are obviously limited, so choices have to be made about where, when and which instruments are going to be deployed. The City of Rotterdam has identified it has three roles, namely to set boundaries, facilitate and initiate (Gemeente Rotterdam, 2013). These three roles are used to show the role of the local government.
3 The Maritime Cluster

So what is the Maritime Cluster? Here we will give a brief overview of the cluster and its context, resulting in a schematic demarcation.

3.1 Maritime Cluster

The concept of clusters was introduced by Porter (1990). He defines a cluster as a “geographic concentration of interconnected companies and institutions in a particular field”. Clusters increase the production of firms in the area, drive the speed and direction of innovation and stimulate new businesses (Porter, 1998). The importance of regional economics is also underlined by Krugman (1991).

In The Netherlands the concept of clustering can be applied to the maritime sector (Langen, 2002). The concept of a maritime cluster is now used in government policies and by sector associations (Aa et al., 2014).

The geographical boundary of this research is the region consisting of Stadsregio Rotterdam and Drechtsteden. The object under study will therefore be firms in the maritime cluster located in Stadsregio Rotterdam and Drechtsteden. These two entities are, in this research, considered for both geographical as well as governmental attributes. While the implementation of innovations in other ports or infrastructures is very interesting as well, and findings in other areas can definitely be used in reflections, the focus of the study is to develop deep understanding in this geographic region.

The Maritime Cluster consists of quite a large group of stakeholders. The cluster can be divided into several sectors (Webers, Djoan, Hese, Thienpoint, & Peeters, 2013). Not all sectors are relevant for study, given the focus on innovative technologies and the limited research resources. The research is, in consultation with the client, limited to four strongly related sectors: maritime services, marine equipment supply and shipbuilding.

The maritime services are regarded as glue in the sector, because of the supportive role they play. Some important organizations include financial institutions and research institutions such as TNO. The marine equipment supply sector can be characterized by some leader firms, but also consists of many small and
Medium enterprises. It is strongly connected with production activities, such as shipbuilding. Some important organizations include Alewijnse and Imtech Marine. The shipbuilding sector consists of approximately 75 shipyards in the year 2012. The significant leader firms are Damen Shipyards and Royal IHC. (Webers et al., 2013)

The Maritime Monitor, a study commissioned by the Ministry of Infrastructure and Environment in cooperation with Maritime by Holland, gives a brief overview of the current state of the sector. Current focus of research are “improving the environmental performance of the fleet, developing alternative sustainable energy and improving the integration of the maritime sector in the logistic chain”. The offshore sector has become increasingly important. Therefore, shipbuilders are more focused on building maintenance and support ships for offshore activities. The maritime equipment suppliers also produce more equipment for the offshore sector. The study furthermore states that “offshore activities, including the development, production and distribution of wind energy will be important” (Aa et al., 2014)

In 2012 the maritime cluster generated approximately 3% of the total GDP of the Netherlands. The employment in the sector accounted for approximately 2% of the total employment in the Netherlands. That year the number of employees and the total production value increased. Compared to the year 2006, in 2012 the sectors dredging, offshore, ports, maritime services and maritime equipment industry provided for an increase in employment. The cluster is a whole performed better on average than other sectors in the Dutch economy. (Aa et al., 2014)

What role the stakeholders play is an important part of the case study. Innovations are developed and implemented by those stakeholders, and are merely supported by the City of Rotterdam. There are several ways to categorize stakeholders or firms. One party can develop an innovation while another one implements it, or both activities are done by one and the same party. Innovative ideas may arise due to demand or due to supply (Dearing, 2000; Teece, 1986). Therefore, innovation is triggered by a pushing or pulling party. However, given the nature of a cluster this is not a straightforward distinction. A stakeholder or group of stakeholders may take on either role or both roles. This is therefore .

The stakeholders are therefore categorized after an initial documents analysis and orienting talks with stakeholders. We discern start-ups, SMEs, large or leader firms, knowledge institutions and government bodies. These are distinguished in the Maritime Monitor, except for start-ups. We discern them as they have other needs and recent experiences, such as getting start-up financing. From each category, except government body, relevant persons were selected and interviewed using contacts of the City of Rotterdam. The case study should therefore depict a fairly representative view. It is of course not a statistical sample, but since we are interested in learning as much as possible interviewing stakeholders from the various groups (not just one group) may yield the most different views and experiences.
3.2 Schematic demarcation

Given all basic concept definitions and delineations, a simple conceptual model is constructed (see below). It is by no means a well-supported model, but it is meant to visualize the schematic view that we have of the system. It pictures four demarcations.

The geographical demarcation as discussed is the region of Rotterdam and Drechtsteden. We defined the innovative sustainable technology concept, where local governments are partially involved in. The stakeholders are categorized as discussed, and respondents from each stakeholder group, except local government, are interviewed. It also shows the interfaces. Earlier these were labelled as the relations within the cluster (as is more traditionally done in literature (Reed et al., 2009)). We prefer the term ‘interface’ to illustrate the focus on interaction between stakeholders. The term is intentionally vague, as these interfaces between parties may be formal or informal, and may take on several forms.
4 Factors from literature

Before conducting the interviews for gathering empirical data, an overview is compiled of success and failure factors of innovation implementation in literature. A selection has been made of literature that resulted in success or failure factors. The latest literature review found was published in 2003. Therefore individual studies were sought after that date. The studies were selected when the factors were derived from data from the maritime sector or from manufacturing sectors. This results in a generic overview of success and failure factors, giving a first indication of what those factors in the maritime cluster that is studied in this research might be. The factors are not explained in detail, as it is only intended as initial sense of direction. The actual factors are based on the empirical data. Below an overview is giving of the generic sets of factors per scientific work.

Panne, Van Beers, & Kleinknecht (2003) performed a literature review to determine success and failure factors of innovation. To that end they studied 43 different studies, dated between 1972 and 1999. They found consistency regarding the ten highest-ranking factors, but not so among the lower-ranking factors. They divided the factors in firm, project, product and market related factors.

Some factors are relevant as they were supported by many studies, so there exists consensus on their relevance (Panne et al., 2003). Firm related factors are firm culture, experience with innovation, characteristics of the R&D team and firm strategy towards innovation. Project related factors are complementarity and innovation management style. Product related factors are relative price and quality. Market related factors are concentration of targeted market and timing of market introduction. Other factors were found, however there seemed no consensus on their relevance. These factors include organizational structure, R&D intensity, top management support, innovativeness, technologically advanced products and marketing.

González, Jaumandreu, & Pazó (2005) studied barriers, or failure factors, of innovation in Spanish manufacturing firms. Based on a questionnaire they interviewed 294 managers of manufacturing companies.
The factors that were used were based on literature. These are - in order of importance from high to low, based on the questionnaire results - high costs, innovation cost difficult to control, insufficient government support, economic turbulence, lack of qualified personnel, difficult access to financial resources, lack of market information, excessive risk, lacks of regional infrastructure, lack of information about technologies, problems keeping qualified employees, lack of internal employee training, lack of external partners opportunities, employees resistance to change and manager resistance to change.

Rese & Baier (2011) conducted a study on success and failure factors on innovation in a network setting. They performed a statistical analysis based on 271 returned questionnaires. The factors they found are product advantage, compatibility, project team organization, dependency, ability, proficiency of marketing activities, commitment, proficiency of predevelopment activities, technological synergy, proficiency of technological activities, protocol (product and project definition), trust, market potential and marketing synergy. These factors appeared to be in line with the before mentioned literature, with the addition of some network related factors.

Andrade & Pinto (2013) researched whether three maritime clusters shared the same drivers of innovation. The factors they identified are infrastructure, firm’s rivalry, buyer sophistication, codified knowledge, tacit knowledge, barriers to small companies to entry, domestic R&D, firm’s heterogeneity, firm’s quantity, interfirms relationship, representative associations, private investments and government incentives.

These generic sets of success and failure factors from literature are used as mental anchor points during the interviews. Though the relevant body we seek are the factors determined from the accounts of the interviewees, a mental framework aids the researcher in interpreting what the respondents are telling.
5 The innovation process according to Dutch maritime professionals

Earlier on, an generic sets of success and failure factors from literature were depicted. These sets acted as mental anchors during the interviews. The respondents, or interviewees, were interviewed using a mainly unstructured approach. Their narratives are merged and grouped under several success and failure factors, which became apparent after a qualitative data analysis using CAQDAS. The used method is described in Chapter 2. The respondents were not directed towards specific answers. So not all respondents may have said something about a topic, though they very well may have knowledge or thoughts on that topic.

In this chapter their explicit stated accounts are depicted exclusively. This allows for readers to generalize the data themselves. Interviewees may discuss the same topics, so their unique contributions are presented and referred to. Figures mentioned by the interviewees are indicative. The factors are ordered according to the number of times different interviewees say something about that factor. Here the factors are shown from most mentioned to least mentioned. This has no statistical value, however it gives an indication of whether topics are more or less commonly shared. For further analysis of these accounts, the reader is referred to the following chapters.
Details of the interviews and interviewees can be found in Appendix A. We have attached an alphabetical code to each interviewee, so the detailed referencing is compactly shown.

<table>
<thead>
<tr>
<th>Code</th>
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<tr>
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<td>Peter van Terwisga</td>
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<td>Felix Moonen</td>
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Collaboration

Collaboration is an important aspect of innovating in the Dutch maritime sector, as is described by twelve out of fourteen interviewees. There are a few reasons why companies collaborate in the maritime sector. The supply chain that comprises shipbuilders and suppliers is not linear, but it is a network. In the sector a few large companies exist, while a lot of parts, components and services are supplied by small and medium sized enterprises. Innovations introduced by a firm can have an impact on a supplier or vice versa. Furthermore, vessels are becoming increasingly complex making it too expensive and laborious to be completely designed and manufactured by a single firm. Additionally, developing a technology may be too expensive for tight markets, such as robotics for deep sea mining. Finally, clients no longer order vessels that are completely detailed by those clients. This requires suppliers now to develop pre-contractual liaisons.

The maritime sector is regarded as a sector that can benefit from operating as a regional cluster and collaborate, as is demonstrated in other clusters. In order to improve chain cooperation the program ‘Integraal Samenwerken’ was launched. This demonstrated that collaborating and sharing knowledge (demarcated as a separate factor) is something firms are not readily doing yet. Another example that stimulates and enables collaboration is the RDM Campus.

Bringing different parties together in a more casual (pre-contractual) setting can increase collaboration and the success of innovation, as is mentioned by interviewees. An example of a project where firms started to collaborate is Shore Support, where suppliers and ship-owners pre-contractually discussed possibilities for improved support services for vessels. A safe setting is needed to exchange ideas and knowledge, as different
parties have different agendas. A lot of firms are not structured to support that kind of collaboration. The networks of stakeholders in the sector can be regarded as living networks, and those stakeholders can be brought together through events. This is done for example in the cluster Food Valley by organising a special excursion for all stakeholders. Currently Innovation Quarter is facilitating the connecting of parties. One of the present opportunities is connecting the sector with business service providers. Local governments can help bringing stakeholders together by signalling needs and using the overview they have. An example of initiative doing that is Rotterdam Maritime Services Community (RMSC).

One of the programs that stimulates collaboration between firms, research institutes and government is the Joint Industry Project (JIP). In these projects identified knowledge gaps are tackled collaboratively. Subsidies are available for these projects through TKI Maritime. Subsidies or fiscal incentives stimulate and facilitate collaboration. An example of a JIP is Hybrid 111, where firms such as Imtech Marine and Alewijnse are collaborating on designing.

Once parties have been brought together, the collaboration can become progressively more concrete. The collaboration should not be completely detailed in advance, as this is difficult and limits creativity. Parties can set main goals and then start small projects to approach the targets. An example a company doing this is Imtech Marine, which is starting projects with other parties using concrete goals derived from long-term goal. This long-term goal is emission free and unmanned navigation. The evolving research agenda is shared with other parties. Innovating through collaboration can be regarded as open innovation, where each party contributes cash or in-kind. This later phase seems to be more difficult for collaborating parties though then setting agreements for collaboration.

In order to enable collaboration within the sector, (research) agendas are shared through the Innovation Council of Maritime by Holland. In this council, composed of firms, knowledge institutes and business associations, the research focus and appropriate research areas for government funding is determined. This is advised to the government, so the subsidies from NOW can be deployed effectively. The Dutch government can also assist in advising the European Union in setting research priorities, while the sector knows which knowledge gaps are current.

In collaborating parties must share risks and take responsibility. If for example something unexpected happens, all stakeholders involved must solve this together and not become in a legal battle. Trust plays an important role there. A pitfall might be when too many parties are involved that no one will take the initiative.

Insufficient financing

One of the main causes of hindering the implementation of new technologies is financing, as eleven out of fourteen interviewees indicate. Currently a lot of companies are experiencing a lack of financing. Businesses need financing to develop new technologies, to create prototypes and to scale prototypes to usable final products. Companies are having trouble getting financing from both the public and private sector.

In the public sector several investment programs, such as the ‘Maritiem Innovatie Programma’ through which subsidies were adjusted to topical issues, have been cancelled and subsidy budgets have been cut. Earlier,
the ‘Sleutelgebieden’ policy provided eight million euro worth of subsidies each year, which was instrumental for the development of innovations. The current ‘Topsectoren’ policy partly replaced the subsidy with fiscal instruments and a collaboration platform. The availability of and need for subsidies is not matching, as was demonstrated by the fact that on the first day the ‘Subsidieregeling Innovatieve Scheepsbouw’ was in effect, the available subsidy amount times three was requested.5

Subsidy programs stimulate innovation as finance is more readily available and risks are partly transferred.2 Subsidies also accelerate the scaling and subsequent implementation of new technologies. An example is a subsidy issued by the province of Zuid-Holland, together with Stadsregio Rotterdam and Gemeente Rotterdam, for the installation of a SCR catalyst in order to lower NOX emissions.6

Programs that offer subsidies that are currently used by companies and research institutes are the ‘Research en Development Aftrek’ (RDA), the ‘Wet Bevordering Speur- en Ontwikkelingswerk’ (WBSO), the ‘MKB-innovatiestimulerings Topsectoren’ (MIT), the ‘Joint Industry Program’ (JIP), the ‘Europees Fonds voor Regionale Ontwikkeling’ (EFRO) and ‘Horizon 2020’. For export oriented companies, credit insurance from the government is a very important form of financial support.5 K M L A new form of subsidy are research vouchers, which companies can exchange for research time from knowledge institutes.H

Cutting back subsidies is thus a hindrance to innovation implementation. Innovation Quarter is therefore financially supporting companies by cofinancing through stock investments. Currently, 28 million euro as investment capital is available and this will likely be increased.6 Though this only negates part of the cutbacks, it seems to be meeting market demands.6

In the private sector funders are very reticent of financing innovations in the maritime sector. Investments that are required due to changing regulation for example is therefore difficult, as banks are only scarcely giving out loans.6 Because of the past economic crisis there is less money available for investments. Furthermore, investors are unfamiliar with the market in the maritime sector. It is impossible for investor to be thoroughly familiar with all markets. It requires much less resources for an investor to, for example, invest in ten ICT companies in the same market, than to invest in one maritime company. There are also no safety nets available, which is an additional barrier for banks and investors.6

This lack of financing is especially true for start-ups and small and medium enterprises (SMEs).6 Since there are limited funds available due to the economic crisis, investments by investors and businesses have become scarcer and smaller. Therefore the available budget for new technologies is often too small, because of which compromises have to be reached. For example, computer simulations are very expensive and time-consuming, so sometimes only testing scale models is feasible. SMEs need cash flow to survive, and any delay can therefore be disastrous.6

One start-up company introducing a new propulsion system is an example of a SME that is struggling with getting the right finance. When installing the product the company has to assume and guarantee some risks. This is a problem as the company has problems with getting financing, because it is currently trapped in the “valley of death”. The company is too big for financing by informals and too early for financing by venture capital. Banks do not give loans as the company does not have a stable turnover yet. Subsidies require financial guarantees for the advance payments. This seems odd because the reason most subsidies exist is to cover
risks of new technology. As the company has trouble getting financing, giving those guarantees is not possible because it signifies additional finance needs. A possible solution to this would be to simplify the access to revolving funds.¹

Unsuitable regulation

Regulation in the maritime sector is a topical issue, as ten out of fourteen interviewees indicate. The sector is heavily regulated, which significantly limits new developments.⁶ Due to the complex regulations new developments have to pass through procedures that can easily take six to seven months, which is very costly. For instance, the company Hatenboer-Water alone is subject to 76 different environmental regulations. A special agency (DCMR) verifies the compliance with the regulations, but generally does not assist by issuing advisories.⁴

The regulations are primarily introduced by the International Maritime Organization (IMO) and European Union (EU). However, local rules (regarding for example noise and smell) and permit requirements also place heavy burdens on companies. While some companies are “reshoring” (bringing back outsourced activities), a lot of companies are relocating activities to foreign countries. Current topical regulations are ballast water regulation and emission regulation. ²³

Increasingly stringent regulation is raising costs for parties in the sector.¹ There exists one benefit though, as new innovations will be developed to comply with new regulations.⁷ These can subsequently be sold worldwide, since they deliver improved performance.⁸ An example is PSPC proof equipment developed by a Dutch company, which is currently successfully being sold in Asia.⁸ Other examples are innovations regarding efficient propulsion, sustainability and automation.⁶⁰

For new technologies it is often difficult to get approval. Because of the heavy regulations, all vessels, equipment and parts have to be approved by various authorities. Garage start-ups, which are found for instance in the IT sector, are therefore not possible.⁸ Certification is usually done through classification registers. For new technologies however current standards are generally inadequate, which means that the innovation does not get certified. An example is the standard for anchoring for scaffolding, which is not suitable to certify the magnets developed by McNetiq. Consequently, those magnets will not get certified. Starting a certification process costs initially thousands of euros, while no guarantees are given.¹ It is difficult and expensive to get permits for new technologies. This makes lacking regulation more problematic to deal with than changing regulation.⁶ There are hence serious opportunities for connecting classification registers and businesses in the maritime sector.⁰

In addition to overregulation and incomplete regulation, indistinct regulation is detrimental for innovation. An example of such legislation is the ‘Hinderwet’ (a Dutch law on hindrance, currently succeeded by ‘Wet Milieubeheer’). People might appeal to this law if they find to be hindered by for example new fast ships that generate different wake patterns. The outcome of that appeal is unclear, which impedes innovation implementation.⁷ Another development that is surrounded by uncertainty is the regulation regarding LNG. Currently the use of LNG as fuel on vessels is only permitted through special exemptions under specific conditions. As it is unclear what the final regulations will be, any dissimilarities with the present exemption conditions can lead to large adjustment costs for ships that are currently fitted with LNG fuel tanks.¹
Regulations in the water transport sector impose stricter rules than in the road transport sector. Due to those regulations retrofitting a LNG fuel tank on a truck (that is allowed to enter city centres) for example costs roughly thirty thousand euro, while the retrofitting on a ship will cost roughly one-and-a-half million euro.

Too conservative sector

The maritime sector can be characterized as (somewhat) conservative, as is mentioned by seven interviewees. People in the sector tend to stay with proven technologies. New business concepts, like renting out capacity instead of selling a ship, are therefore more difficult to implement. Incremental innovations are also much more likely to be implemented than radical innovations. Innovations that are implemented are purposeful, such as the automation of a crane due to excessive g-forces. Next to the somewhat conservative attitude in the sector is the large scale nature of the growth markets. For instance, tapping a new mine for deep sea mining may require an investment of maybe one billion euro. This obviously severely limits the possibilities of trying out new prototypes. Trying out new prototypes on large offshore vessels is therefore also not rewarding, as it is very costly when such a vessel is not operating. Individual owners of smaller ships are therefore not as conservative, however they lack the resources to implement unproven technologies.

Sharing knowledge

Knowledge sharing is an integral part of collaboration. Seven interviewees underline the importance of sharing knowledge, but there are some difficulties. At the moment, few companies are sharing knowledge in the maritime sector. Companies are therefore having trouble finding knowledge. An example is a company searching years for answers to a knowledge question, which was in-house knowledge of another company situated only ten kilometres away. As the sector is conservative, it is difficult to support knowledge sharing. A platform that may help with this is the Maritieme Delta. Participants can share innovations through this platform in order to support the cluster as a whole.

In the maritime cluster, companies seem reticent in sharing knowledge, which became apparent during the collaboration support program Integraal Samenwerken. Sharing knowledge is always difficult, because knowledge has value. Therefore, it is important but challenging to clearly determine and fairly assign intellectual property rights between parties when collaborating on an innovation. It is also difficult for companies to determine what knowledge is critical to the company and what knowledge can be shared. Subsidy programs lead to ambiguous situations regarding intellectual property rights. Companies wish to keep their new knowledge generated by their own research for competitive reasons, but that is not always possible when that research is (partly) financed with public money.

According to two interviewees, a solution to these difficulties would be to make part of the knowledge open source. An example is the company Tesla, which nowadays is known for their electric cars. This company decided to make many patents freely available, in order to fuel innovation. Knowledge that is critical to the company should be kept private of course. However, sharing knowledge on basic systems can be complemented with additional research, leading to a higher quality technology. This prevents the re-invention of the wheel. An example could be to share the basic functionalities of a phone, so each company can focus on the distinctive attributes of their product such as design or applications.
Direction giving by government

Six interviewees indicate that government ambitions and policy are instrumental in determining the direction research has to take. Government policy steers innovation. For example, automation might be the solution to comply with increasingly stringent regulation. The sector therefore needs clearly stated goals, demand and policy from governments in time, in order to adapt research investments. The required research might not be currently part of the core business of the companies or sector, but will lead to more knowledge creation.

Furthermore, not everything can be important, as then no specific research will be done. This can be achieved by appointing specific themes, like the current themes of “Winnen op zee” (Explore at sea) and “Schone schepen” (Clean ships). Germany has set an example by announcing the closure of all nuclear power plants, thereby fuelling sustainability research and innovations. The production of offshore wind energy is becoming increasingly important, as The Netherlands and the EU are spending billions on research. The local government could for instance try to become one of the main centres of expertise, by supporting parties and emphasizing the importance.

Having a competitive advantage

Currently, the maritime sector in The Netherlands has globally speaking several competitive advantages, as mentioned by five interviewees. Companies in The Netherlands are able to construct vessels and equipment that are more complex and of higher quality than foreign competitors. Clients are prepared to pay more for that complexity and quality. Foreign companies also tend to be more open to innovation.

Dutch companies are very proficient at installing equipment and integrating systems, so they focus on those two aspects. The building costs of a ship comprise roughly one third for the hull, one third for equipment and one third for services like installing and integrating. Competing on price for half-finished products is for example hardly possible. Therefore, innovating is important in keeping the competitive advantages regarding complexity and quality. Companies are however taking action to lower costs to compete with foreign companies, while trying to maintain the reliability and quality of their products. A salient detail is that the preference for quality or price by a client depends very much on the client type. For example, shipbuilders may be keen on lowering costs, while ship-owners may be more focused on reliability.

Too complex subsidy regulation

An important issue that is underlined by five interviewees is the very complex rules and obligations associated with subsidies. The conditions concerning subsidies are very complex. Most subsidies require too much and too precise justification, while those justification rules are usually opaque. Sometimes expenses that fall within the scope of the subsidy cannot be declared due to the opaqueness of the rules. One interviewee even noted that not obtaining subsidies might be a success factor due to the required cumbersome administrative work.

For SMEs, about thirty percent of the subsidy regulations are not helpful due to the pressure of rules. This means that it will cost more to comply with the rules than what is gained by the subsidy. As bigger companies tend to have a more comprehensive administration, more subsidies will be relevant for them.
The conditions for applying for a subsidy are generally woolly and abstract. A start-up company, McNetiq, requested funding from Agentschap NL (former agency of the Ministry of Economic Affairs) which was replied with six attachments containing each 300 pages of text. This illustrates the complexity of the regulations which is far too complex for SMEs, as they have to focus on day-to-day business.

Insufficient human capital

Human capital is a factor that is becoming increasingly important in the maritime sector. Four interviewees mention that companies are having more and more issues finding talent. It is deemed important to pay attention to the move from education to labour market. One of the reasons for IHC to be located on the RDM Campus is to attract new talent. Although education should be adjusted more to the needs of companies, they favour that education is not completely tailored to the company, so that students bring in a critical and fresh look. Regarding vocational education, a lot of companies previously disposed of in-house schools, but those schools merged into public schools. Now, the training of new workers is not well adjusted to the needs of companies. Investments in the quality of education are needed to maintain a high level of knowledge and skills of students for the sector to remain competitive.

Additional employees are needed because of aging of the population and growth in the sector. Several activities are already being organised to attract new labour, such as career events and workshops. Some companies also struggle attracting workers due to their image or location. A solution to this could be matchmaking as is done by Deltametaal. Another option would be the retraining of unemployed workers, which is currently being tried as a first test. Another initiative is setup by Jules Dock, by establishing a physical platform to attract human capital, for instance by encouraging pupils and students.

Positive innovation climate

As mentioned by five interviewees, the innovation climate within companies and the sector affects the implementation of innovations. An innovation climate can be improved by setting up competitions or by nourishing new technologies through initiatives like RDM Campus and the Rotterdam Science Tower. The positive impact of competitions is also underwritten by two other interviewees. Furthermore, parties in the sector must have a positive basic attitude. One must be willing to try and enable innovations, even though some innovations will fail. Also when an innovation fails an entrepreneur should not immediately be viewed as loser. Sony is an example of a company that introduced many innovations, of which only a few were very successful.

Next to the climate in the sector, the innovation climate within a company must be beneficial. Innovations are not a panacea when an organization functions treacly. Innovating within a company requires a special structure, as innovating is done on a different pace. One could think of this as personnel being on the high way, while the innovator is placed in a meadow. Innovating requires a change in thinking within a company. One of the ways to achieve this is to adapt the decision-making.
Absence of launching customer

Five interviewees indicated that the market introduction of an innovation depends heavily on attracting a launching customer. The earlier a company can attract a launching customer, the swifter the market introduction will be. An example of a swift market introduction of an innovation due to an early contracted launching customer is the axe bow introduced by Damen. To stimulate innovations governments can act as launching customer. When issuing public tenders, governments could regard the entire life cycle instead of only the initial construction costs. This may enable new technologies and reduce the need for subsidies. One of the fields the government can act as launching customer is the removal of plastic pollution from seas. In this particular case governments could act as problem owner, because no one is directly accountable but from a societal viewpoint it is a very relevant issue.

Lack of level playing field

A level playing field indicates that all parties have to play by the same rules in a specific sector in some region. Three interviewees mention that in some international areas there is no level playing field. There are three causes that harm this principle.

First of all, subsidies distort the market. Worldwide the shipbuilding industry is a heavily subsidized market. This is even within Europe so, where Spain was subsidizing their industry more than other countries. An example of a subsidy regulation is the Subsidierregeling Innovatieve Scheepsbouw or SIS. This subsidy was introduced on a European level, but the subsidies were given out by the national governments. The national governments were free in determining the subsidy amount. This resulted in unequal support for companies within Europe.

Second, some markets are shielded from competition through regulations enacted by national governments. An example is the Jones Act in the United States, which significantly limits the opportunities for foreign companies in order to protect the national interests of the United States. A third cause is the varying legal requirements regarding emission standards and materials. Worldwide only some (group of) countries are introducing more stringent emission standards, such as the European Union. This is also true for forbidden materials, meaning that some foreign companies can still use hazardous but cheaper materials.

Lack of infrastructure

The region of Rotterdam and Drechtsteden is favourably situated. To sustain growth in the maritime sector, the accessibility by road, train and water must be strengthened. The current port infrastructure can be better utilised, which is one of the current research topics.

One of the current growth markets is LNG. At the moment this market is experiencing a chicken-and-egg problem. Shipping companies are not converting their ships to use LNG as fuel, since there is not a sufficient LNG infrastructure available. At the same, there are no companies that are investing in bunker facilities, since only a few ships are fuelled by LNG. As infrastructure is very expensive, a trade-off has to be made whether
to invest in infrastructure or new technologies.¹

Too many initiatives

Four interviewees mentioned the large number of initiatives, even though those initiatives are started and carried out with the best intentions. It requires too much resources for the industry. A research initiated by Drechtsteden showed that companies desired for a bundling of activities regarding innovation, knowledge development and collaboration. G For parties involved it requires too much coordination. It also makes it unclear who point of contact is for companies.¹ One of the solutions is to bundle these activities under one program or platform. The Maritieme Delta is set up to do just that. For example, meeting dates are coordinated and activities are bundled. New activities are initiated based on desires from the industry.¹³

Bad market conditions

As in any market, market conditions determine the investment opportunities. Three interviewees explicitly mention these conditions. The markets in which all transport sectors operate are cyclical markets. During the latest economic crisis boat owners were unable to make (substantial) profits due to low freight rates, which led to bad debts.¹¹ Due to the scaling up of ships in years before the crisis, there exists an overcapacity now.¹²

Difficult to valorise

Innovating starts with fundamental research, followed by applied research which is then scaled to usable innovations (known in Dutch as "kennis, kunde, kassa"). In the Innovation Council of Maritime by Holland the direction research will take is discussed and advisories are issued to the NWO in order to better distribute subsidies.¹º The innovations that are developed within the maritime sector are very much practical and purposeful. Applied research can act as a link between fundamental researchers and companies. However, applied research can also help in making development or utilization smarter.¹¹

Companies struggle with participating in fundamental research, as scientific researchers are usually more aimed at publishing than at developing practical implementations. This was one of the reasons some companies like Hatenboer-Water stopped participating in fundamental research.¹³ Researchers can no longer act as "Gyro Gearloose", or "men kan niet langer Willie Wortelen" as Hoegee calls it. The past eighty years funding for fundamental research has been cut back by approximately one percent every year. Companies do not have the resources to participate in fundamental research without a concrete outlook in the foreseeable future.¹¹

All the codes and factors are mapped and depicted per respondent in the tables below. The codes represent unique focussed topics that the respondent talks about. Since the research strategy emphasises learning as much as possible about a case, the codes have no numerical or statistical value. For more on the research strategy and the coding strategy the reader is referred to Chapter 2.
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Valley of death | Buying shares  
Complex rules |
| Anneke Van Haegenbergh    |                                             | Adopting to regulations         | WBSO  
Lack of financing |
| Jan Hoegge                | Higher costs  
More knowledge                             | Conservative sector              | EFRO  
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Horizon 2020  
JIF  
Lack of financing |
| Jan Arie de Ruijter       | Higher costs  
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6 Additional insights from literature and policy documents

The question rises what the implications are for government involvement in the innovation process. Several success and failure factors have been found, but the role the local government can play is not always clear. In this chapter the involvement of the local city government regarding the factors is explored based on literature and policy documents. Since the research is exploratory and concerned with the current state of innovation implementation in the Dutch maritime cluster, only recent literature is taken into account.

It is difficult to assign findings from literature and documents to each individual factor. The factors are heavily related and determined based on respondent data. The terminology used in literature does not always correspond with the found factors. The empirical data, which is formed by the accounts of the interviewees, is the core of this research. Therefore, the factors are not adjusted to the literature, but rather elements from literature are taken in order to indicate the role of the city government.

6.1 Collaboration

One of the most important characteristics the interviewees talked about was the cluster forming and collaboration in the Dutch maritime sector. Currently in literature a lot of attention is paid to open innovation. Open innovation is a term that was introduced by Chesbrough (2003). Open innovation is defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively”. (Chesbrough, Vanhaverbeke, & West, 2006) Based on a literature review, Lichtenthaler (2011) defined open innovation as “systematically performing knowledge exploration,
retention, and exploitation inside and outside an organization’s boundaries throughout the innovation process”. According to Huizingh (2011) open innovation has since become one of the most researched topics in innovation management and also receives attention from a wide range of research disciplines.

A distinction can be made between inbound open innovation and outbound open innovation. Inbound open innovation is the internal use of external knowledge. Outbound open innovation is the external exploitation of internal knowledge. Empirical studies showed that much more inbound than outbound open innovation takes place. (Huizingh, 2011) There are several streams of research regarding open innovation, which are technology transactions, user innovation, business models and innovation markets. (Lichtenthaler, 2011)

The main disadvantage of open innovation is that a firm needs to open up to competitors, so the firm stands the risk of losing competitive advantages. Lichtenthaler (2011) argues that an integrated approach can be used in managing the open innovation process. As this approach is more complex, a competitor can only benefit if it copies all the innovation processes. The implementation of open innovation depends however on the innovation requirements of the firm, the timing of the implementation and their organizational culture (Mortara & Minshall, 2011).

This open innovation concept however is geared towards private collaboration. It is very interesting for private stakeholders, which is also revealed by the accounts of the interviewees. Most interviewees see collaborative innovation as important, and some even mention open innovation. However, the literature on open innovation does not adequately indicate what the role is of government.

Feitelson & Salomon (2004) view the adoption process as “an outcome of societal processes”. They argue that innovation adoption depends on technical, economic, social and political feasibility. The economic feasibility is usually met, as the innovation has to pass a benefit-cost analysis. Of course it also has to be technical feasible. From the perspective of the City of Rotterdam, these two feasibilities have to be met by market players. The city intends to have a merely supportive role. Therefore, the social and political feasibility could be of main interest for the city.

Another concept that is currently used is the Triple Helix, which was introduced by Etzkowitz & Leydesdorff (2000). This Triple Helix is a model representing university–industry–government relations in a knowledge based economy. They characterize the three as systems that can change over time, and the boundaries of these systems are dependent on the established definitions in a research. Innovation research will therefore require taking at least three dimensions into account. One may even extend this to an “N-tuple of helices” (Leydesdorff, 2012). The term Triple Helix is currently frequently used in Dutch policy, and also the City of Rotterdam uses the concept (Gemeente Rotterdam, 2011).

A distinction can be made between a national system of innovation and a regional innovation system. This division is primarily due to functional and historic reasons, such as the public governance system and taxation powers (Cooke, 2001). Moreover, the differences between the two may not be as substantial in a smaller country as The Netherlands as in larger countries (Leydesdorff, 2006). Cooke (2001) identified that regional governments have a role in innovation by facilitating the interactions of parties and influencing investments in hard infrastructure. This seems in line with the suggestions of interviewees. After all, most have indicated that the government is well suited for a facilitating role.
Asheim, Boschma, & Cooke (2011) introduce a regional innovation policy model that is based on the principle of constructing regional advantage. They argue that innovation policies on the national level may lead to an unwanted “pick-the-winner” outcome, while regional innovation policy is aimed at bringing different activities together without emphasizing a particular sector or region. As each region varies from another due to various reasons, such as institutional and cognitive differences, there is no one best solution. One of the regional policy aims could be facilitating knowledge spill overs, or sharing knowledge, not only within one sector but also between related sectors. Another policy may be to enable the exchange of labour, or human capital, between related sectors. Tödtling & Tripl (2005) also acknowledge that there is no one best solution and argues that policies differ between rural and metropolitan regions. However, the authors thus indicate the relevance of regional policy.

Belussi, Sammarra, & Sedita (2010) present an open regional innovation system model, that supports the notion that greater firm innovation openness indeed leads to more innovation. They describe openness as the amount of external knowledge that is being applied. Governments could aim to facilitate an innovation climate which enables the openness of firms to be increased.

The motivation to innovate can either be intrinsic or extrinsic. Intrinsic motivation is receiving satisfaction from doing the activity. People can for instance be motivated by problem-solving or overcoming challenges. Extrinsic motivation comes from external incentives, such as recognition or a reward. Governments can increase extrinsic motivation by introducing advantages, such as an innovation award. There are both advantages and disadvantages, which are not supported by data in literature yet. (Rosenblatt, 2011)

One can conclude that in literature there seems a rising consensus that successful innovation requires collaboration, as is established through the concept of open innovation. Various disciplines are picking up on this notion and add insights from their perspectives. For instance, in addition to the generic concept of open innovation, geography studies add the importance of regional innovation. For the region of Rotterdam and Drechtsteden the focus on regional innovation policies could be more beneficial than national policies, as for example local knowledge spill overs are easier to accomplish. The Triple Helix concept outlines that in a knowledge based economy collaboration is required between firms, knowledge institutions and government. In order to do this, all stakeholders must be adapted to this relatively new way of innovating.

6.2 More factors

The competitive advantage of the Dutch maritime cluster is, as five interviewees mentioned, the fact that the sector delivers high quality and knowledge intensive products and services. In order to maintain that advantage, firms need to innovate to stay ahead of competition. This is an extrinsic motivation that leads to a loop. Product innovation leads to a better competitive advantage, and maintaining that advantage requires innovation (Weerawardena & Mavondo, 2011). This factor is therefore both a resulting outcome and an incentive, and there is no direct government involvement.

The conservatism in the sector exists because of large sunk costs with some projects, a conservative attitude and the bad market conditions. Local government involvement regarding sunk costs and market conditions
seems hardly possible and may lead to a diminished level playing field. According to marketing literature, market knowledge or market orientation are important in successfully innovating (Dibrell, Craig, & Hansen, 2011; Luca & Atuahene-Gima, 2007). This is a concern for firms, and also for government if public co-funding is initiated. So conservatism and market conditions can be regarded as external factors to local governments.

Porter (1996) stated that environmental regulation can lead to more innovation. This has become known as the “Porter Hypothesis” and is now supported in literature. So well designed environmental regulation may contribute to increased innovations (Ambec, Cohen, Elgie, & Lanoie, 2013). Most regulation concerning maritime sectors however are introduced by international bodies, such as the European Union and the International Maritime Organization (Corbett, 2014; OECD, 2001).

An aspect that was mentioned by a number of interviewees related to financing. A recent study found positive effects of public venture capital. Firms receiving venture capital from both public as well as private venture capitalists receive much more funding than firms receiving only private (or public) venture capital. This means that public venture capital augments the venture capital a firm receives (Brander, Du, & Hellmann, 2014). The Australian national government has proven that a national government can aid in the development of venture capital and private equity for start-ups (Cumming, 2007). The Dutch national government can thus incentivize the use of private capital in the maritime sector. This should also be possible for regional governments (Meer, 2013). Especially since – according to the discussed literature on regional innovation – these governments are supposed to be better at anticipating local dynamics. This requires budget though, which is problematic considering the current budget cuts (Vereniging Nederlandse Gemeenten, 2013).

This is, however, not a solution for firms stuck in the valley of death. These firms are unable to get financing from venture capitalists. There could be a few reasons, but this seems predominantly so because they are too early or because there exists information asymmetry so investors are unfamiliar with the market. In order to attract financing for these firms, government could internalize pollution costs through for example taxes, so that new technologies become more interesting to invest in (Wong, 2014). This will however obviously negatively impact the level playing field and competitive advantage. Weyant (2011) has however shown that, in pursuing the reduction of greenhouse gases, putting programs in place for overcoming the valley of death can be very beneficial, as it can lead to high payoffs with relatively few costs. This is therefore a mostly political deliberation. According to Wong (2014) other options include favourable taxation and regulation to attract investors.

International programs such as Horizon 2020 seek to improve innovation by providing financing and encourage collaboration (Rijksoverheid, 2013). The number of initiatives are being reduced and consolidated by the introduction of Maritime Delta (Ondernemersvereniging Zuid-Holland, 2013).

All findings stated above are combined with the empirical data of success and failure factors in the next chapter.
In this chapter, all findings stated before are consolidated to form a single list of success and failure factors. All statements are based on previous findings. Considering the accounts of the interviewees and the findings from literature and documents, we split the list of factors in two. The distinction will be made between factors which are endogenous and which are exogenous to the direct solution space of the City of Rotterdam. Obviously, this distinction is grey at best, however it should give an indication where the local government can focus policymaking on based on the three roles of the City of Rotterdam (see also Chapter 2). Endogenous factors should be regarded as factors where the local government has an role and there might be opportunities for influencing through policy measures. Exogenous factors are factors that either cannot or can only indirectly be influenced. The results are depicted in the table below.
### 7.1 Exogenous factors

The exogenous factors are success and failure factors that the local government cannot directly influence, because that is either hardly possible or because a higher level of government is required. The conservatism in the sector as well as the market conditions are difficult to influence at all, and the interviewees have made no recommendations for government involvement. The competitive advantage is a resulting factor, rather than one that can be directly affected.

The complex subsidy regulation and level playing field are two areas of concern. The first makes that a lot of subsidies are not usable by firms (especially for SMEs). The second concerns varying subsidies, emission standards and protective policies. However, we consider both to be an international issue. Therefore involvement from national government and the European Union is required. Local government can of course voice specific concerns from firms, if articulated, to the national government.

The infrastructure that is sometimes required to deploy new innovations, such as infrastructure so that vessel can bunker LNG, we regard it is an national or international issue. Local government does not dispose of the financial resources to set up new infrastructure. However, infrastructure can be facilitated by assisting with regulation, for example by issuing permits and adjusting development plans.

The high number of initiatives is something the local government cannot directly influence, as the initiatives are foremost set up by other parties. It would be more efficient to bundle activities in the sector, however well intended they might have been.

Various of these exogenous factors that are relevant to the sector, such as the level playing field that is adversely affected by subsidies and emission standards, are regulated (inter)nationally. If acting as a facilitator and collaborating in the triple helix, the local government will be better aware of issues and opportunities in the sector. Consequently, the City of Rotterdam can better advise national and international governmental bodies in order to foster growth in the Maritime Cluster, thus fostering employment and economic growth.
7.2 Endogenous factors and considerations for policy

The City of Rotterdam has stated that her role is to set boundaries, facilitate and initiate (Gemeente Rotterdam, 2013). Of course, one should wonder if there should be any additional government involvement at all. The Maritime Cluster is currently one of the most successful industries in The Netherlands. However, this success is primarily caused by the technologically advancement of the industry compared to other international competitors. The Dutch industry can hardly compete on price, but instead delivers higher quality and more complex products and services. So in order to keep that competitive advantage, innovation is required. This notion seems to be shared by both the sector and government. The Maritime Cluster should thus be supported in order to keep the competitive advantage.

As the Maritime Cluster is already an innovative sector, governments should aid in increasing the innovation capabilities of the sector. Though there seem to be no extreme failures, there is potential for improvement. Furthermore, stable policy ensures that little to no readjustments, something which temporarily decimates innovation, are required from firms. Local government seems pre-eminently suited for taking on the role of facilitator. Of course, some of the tasks that are mentioned can also be executed by a specially authorized agency.

From the accounts of the interviewees it appears that the endogenous factors of collaboration, financing and regulation are widely shared. In literature emphasis is put on collaborating through open innovation and collaborating in the triple helix. We therefore suggest that the City of Rotterdam should focus policy on enabling and intensifying collaboration. Cross sector collaboration with other industries may accelerate developments of new technologies. Also, since the industry is heavily regulated, it would be beneficial to increasingly involve classification registers and legislative bodies in the innovation process, thereby quickening and streamlining the innovation process. It would be likewise beneficial to increasingly involve (potential) funders, so that information asymmetry is reduced. After all, it is unfortunate when new technologies, for which demand exists, fail due to a lack of initial financing.

For each of the endogenous factors, thus those the local government can directly affect, the role of the city is explored.

Direction giving

According to the accounts of the interviewees the sector seems apparently willing to collaborate and share knowledge. However, too much meddling or interference is unwanted. If local government is going to focus on facilitating collaboration and knowledge spill overs, the government should set an example by transparently communicating goals, vision and future policy. Through this direction giving firms can adjust and prepare their own research.

This seems to fall within the self-described role of the City of Rotterdam to set boundaries. The local government sets rules for development and sets goals. As this is already being done, we recommend to maintain fulfilling this role. However, the question is whether these goals are set timely and communicated well. The longing for clear goals by some interviewees indicate either that no goals are set in their area of
expertise or that the goals are not reaching those interviewees. Further research could point this out.

Innovation climate

The innovation climate within the sector and companies is also an interesting factor. Particularly SMEs are primarily concerned with day to day operations. An innovative climate is needed within a company, where money and time is set aside to innovate and people are aware that that is required in order to innovate. Local government could offer trainings to companies or other activities to enhance the innovation climate.

Sharing knowledge and collaboration

What interviewees mentioned and is supported by literature, showed by the literature body regarding the open innovation and triple helix concepts, is government involvement in collaboration and sharing knowledge. Local governments should be able to this better than national government for regional clusters. Both interviewees and literature mention that local government should act as a facilitator, given her helicopter overview.

Human capital

The human capital is of importance in maintaining and expanding a skilled workforce. Education may be tailored better to the needs of maritime firms. Though this is partly dependent on other parties, such as educational institutions, local government can also invest in attracting skilled workers and highly trained professionals.

Regulation

As mentioned earlier regulation affects the innovation implementation by either being too strict, being indistinct or being absent. The regulation that maritime firms face are primarily introduced by the European Union or IMO. However, local government still has some regulatory competences, primarily regarding permits and development plans. For this the role of setting boundaries seems applicable. The specific tool of setting regulatory frameworks could be utilized to enable for instance the construction of LNG supply infrastructure.

Launching customer

In the triple helix context, government can act as a facilitator. In order to assist valorisation, local government could act as a launching customer, which is important in proving and showcasing new technologies. The city already has undertaken various efforts to facilitate this by supporting projects as the RDM Campus and Living Labs (Stadsregio Rotterdam & Stadsgewest Haaglanden, 2012). As an initiator, revolving funds can be used to finance new projects or start-ups.

Financing

A difficult factor to categorize is financing, as local governments hardly have any funds available anymore for interventions. Literature has shown however that public funding augments rather than replaces private
funding. As with subsidies, public funding redistributes risks. Furthermore, co-funding relieves part of the investigative activities investors need to undertake. So by utilizing the financial tools the government could emphasize on revolving funds. The regulations regarding these funds must be kept straightforward and simple to avoid a disproportionately administrative burden, as currently is the case regarding many subsidies.

**Valorisation**

Valorisation is one of the things firms are having trouble with, partly because of a lack of financing, or stringent regulation and partly because of difficulties with participating in fundamental research. However, this can be overcome by acting as a launching customer, using for example revolving funds.

**Network of factors**

While viewing the factors one can hardly relate one factor independent of other factors. As one can see, every factor is related to at least another factor. For instance, having financing available positively influences collaboration and the sharing of knowledge. The factors can therefore be regarded as a network of factors, as every single factor is related to one or more other factors.
8 Conclusions and discussion

In this chapter conclusions from answering the main research question of this research are presented. This is followed by a discussion of the research limitations and recommendations for further research.

8.1 Conclusions

The main research question read: “what success and failure factors of implementing innovative sustainable technologies in the Maritime Cluster in the port area of Stadsregio Rotterdam and Drechtsteden can the City of Rotterdam affect with her instruments in such a way that more innovative sustainable technologies are implemented?”. We answer this question by answering the sub questions.

a) What are success and failure factors of implementing innovative sustainable technologies in general?

An initial research lead to a broad list of factors, which was used as mental anchors when starting the interviews. This sub question required significantly less research time than the other two sub questions. We still posed this though to illustrate that although the interviews were unstructured, we did have some mental construction going into the interviews.

b) What are success and failure factors of implementing innovative sustainable technologies in the Maritime Cluster?

The qualitative case study has resulted in an empirical body of data, derived from the accounts of interviewees, which is depicted in this report without generalizations. This enables the reader to be informed about the various aspects of implementing innovations in the maritime sector in the region of Rotterdam and
Drechtsteden. The specifics that are mentioned are important, as it is a case study about a specific cluster in a specific region. No general statements about other cases are therefore possible based on this research, which was not the intention in the first place.

The accounts of the interviewees are grouped in several success and failure factors through holistic data coding. These factors are depicted in the table below.

<table>
<thead>
<tr>
<th>Endogenous factors</th>
<th>Exogenous factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction giving by government</td>
<td>Lack of infrastructure</td>
</tr>
<tr>
<td>Positive innovation climate</td>
<td>Too complex subsidy regulation</td>
</tr>
<tr>
<td>Sharing knowledge</td>
<td>Too conservative sector</td>
</tr>
<tr>
<td>Insufficient human capital</td>
<td>Bad market conditions</td>
</tr>
<tr>
<td>Unsuitable regulation</td>
<td>Lack of level playing field</td>
</tr>
<tr>
<td>Absence of launching customer</td>
<td>Having a competitive advantage</td>
</tr>
<tr>
<td>Collaboration</td>
<td></td>
</tr>
<tr>
<td>Insufficient financing</td>
<td>Too many initiatives</td>
</tr>
<tr>
<td>Difficult to valorise</td>
<td></td>
</tr>
</tbody>
</table>

However, these factors cannot be regarded by themselves alone. This list is an additional layer of analysis to the main body of this research, which is the complete body of empirical data showing all complexities and intricacies of the case.

c) What factors can the City of Rotterdam affect to support implementation of innovative sustainable technologies?

The factors mentioned in Table 2 are split in endogenous and exogenous factors. This is done to determine which factors can be directly affected by the City of Rotterdam. Combining the list of factors with literature and documents, the list is derived with factors that are inside (endogenous) or outside (exogenous) the policy solution space of the local government. The endogenous factors can thus be affected by the City of Rotterdam.

It appears that the endogenous factors of collaboration, financing and regulation are widely shared. Literature underlines the positive benefits of collaborating through open innovation and collaborating in the triple helix. We therefore suggest that the City of Rotterdam should focus policy on enabling and intensifying collaboration in the Maritime Cluster. Cross sector collaboration with other industries may accelerate developments of new technologies. Also, as the industry is heavily regulated, involving classification registers and legislative bodies in the innovation process may quicken and streamline the innovation process. It would be likewise beneficial to involve funders, so that information asymmetry is reduced and funders are more likely to invest in the Maritime Cluster. In order to facilitate new projects and start-ups, thereby effectively acting as a launching customer, the city could establish revolving funds. The requirements for those funds should be simple and straightforward.

As every single factor relates to one or more other factors, these factors can be regarded as a network of
factors. This pleads for reading and understanding the merged accounts of the interviewees, which is thus the core of this research. Viewing only one factor by itself is thus pointless. The implications are that policies cannot be developed for only one factor, as the interrelatedness means that other factors are affected as well.

8.2 Discussion

This research is an exploratory research primarily based on the accounts of the interviewees. Therefore the findings are only applicable to the Maritime Cluster in the region of Rotterdam and Drechtsteden, and cannot be applied to other sectors or regions. This is intentional, as the chosen research strategy is concerned with maximizing lessons learned about a particular case, not developing generically applicable statements. All policy recommendations should thus be regarded as guiding statements for this particular cluster.

Classifying the accounts of interviewees under factors is difficult, and perhaps even troublesome. The accounts are presented without comments, so readers can see and interpret the complexities of the case themselves. The neutrality of one’s own (subjective) interpretation may be altered by showing the assigned factors. However, since the accounts are presented while any interpretation is absent, that effect should be minimal.

The limited available time makes that the number of interviewees is relatively small. A more extensive research interviewing more stakeholders may produce some additional insights. However, this is primarily expected for the group of start-ups or small and medium sized enterprises, as the groups of leader firms and knowledge institutions are relatively small. Furthermore, during the research already saturation was detected.

The empirical body consists of the accounts of respondents. Obviously their views may be slightly skewed or biased, which may be caused by many reasons. However, we feel that the respondents tried to honestly tell what they experience when implementing innovations. Nonetheless, the research is thus based on mental constructions of others, but for a public body as local government this is useful knowledge in order to appropriately adjust policies.

One of the characteristics of this type of research is that it presents a fairly steep learning curve for the researcher. It relies heavily on the skills and interpretations (and thus credibility) of the researcher. Therefore, later performed interviews may have yielded more information than earlier performed interviews. Obviously this is true since other respondents may provide new insights, but also the interview technique and observation skills of the researcher is improved. As these are skills that are not trained in the curriculum associated with this thesis, a difficult learning curve was definitely present. Furthermore, Not tape recording the interviews also may have led to some loss of data, but nonetheless we chose for this approach because of the perceived benefits. This added though to the learning curve.

We would like to emphasize that we, through this research, are not trying to make normative statements. We tried to establish an overview of success and failure factors in innovation implementation in the Dutch Maritime Cluster and point out possible directions for policymaking. Further research can detail what the policies might be. The research strategy emphasized learning over normative statements. Any normative statements are obtained from the respondents or from documents, so those statements are statements from others.
8.3 Further research

As mentioned above, this research renders a couple of new starting points for additional research, especially because this research is an exploratory one. Since this research is limited in time, a more extensive research may produce some additional insights. A larger study can incorporate a larger pool of respondents, although the number of leader firms and knowledge institutions is small. The emphasis should be on deepening understanding of innovation implementation. This research focused on the latest phases of innovation, so the findings could also be extended with factors for the earlier phases of innovation through additional research.

Quantitative research could render statistical substantiation for the factors, by issuing large amounts of questionnaires. However, quantitative research follows a different paradigm than used in this research. That research has to be designed carefully to do justice to the complexities of the case. This means that only one or few factors can be substantiated at a time.

Perhaps more interesting is additional research on the design of policy in order to facilitate collaboration, since only general directions for policy are depicted in this research. Given the relatedness of the factors, an interesting challenge is to develop an adaptive policy that can deal with all the intricacies.

One of the main issues that is suitable for further research is the discrepancy that is observed between what the City of Rotterdam is doing and what the respondents are experiencing. For example, though the city is setting boundaries and goals, still some respondents longed to a certain extent for more (long-term) goals. So either the policy is misaligned with what the respondents seek, or the policy outcomes are not reaching the respondents. This is true for most factors, as multiple interviewees mention the city is suited for a facilitating role, which is one of the three main self-described roles of the City of Rotterdam.
References


Gemeente Rotterdam. (2013). Kader Stedelijke Ontwikkeling


## Appendix A – List of interviewees

<table>
<thead>
<tr>
<th>Interview date</th>
<th>Name</th>
<th>Organization</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-07-2014</td>
<td>Maarten Ruysseienaers</td>
<td>RDM Campus</td>
<td>Program manager Innovation teams</td>
</tr>
<tr>
<td>12-08-2014</td>
<td>Peter van Terwisga</td>
<td>Damen Shipyards Group</td>
<td>Research Coordinator</td>
</tr>
<tr>
<td>14-08-2014</td>
<td>Mart Hurkmans</td>
<td>Imtech Marine</td>
<td>Coordinator R&amp;D</td>
</tr>
<tr>
<td>15-08-2014</td>
<td>Mark van de Zande</td>
<td>Royal IHC</td>
<td>Program Manager IHC Innovation Lab</td>
</tr>
<tr>
<td>20-08-2014</td>
<td>Sanne de Vleschhouver and Sieger Sakko</td>
<td>Netherlands Maritime Technology (NMT)</td>
<td>Innovation and project manager and Sector manager respectively</td>
</tr>
<tr>
<td>20-08-2014</td>
<td>Bart Kuipers</td>
<td>Erasmus Smart Port Rotterdam (ESPR)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Regionale Economie, Haven- en Vervoerseconomie (RHV)</strong></td>
<td>Director Business Development at ESPR</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Researcher and advisor at RHV</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-08-2014</td>
<td>Edward Gilding</td>
<td>Innovation Quarter</td>
<td>Project Developer</td>
</tr>
<tr>
<td>27-08-2014</td>
<td>Arjen Uytendaal</td>
<td>Stichting Nederland Maritiem Land (NML)</td>
<td>Director</td>
</tr>
<tr>
<td>05-09-2014</td>
<td>Patrick Heuts</td>
<td>O-foil</td>
<td>Business Director</td>
</tr>
<tr>
<td>09-09-2014</td>
<td>Edwin van der Heide</td>
<td>McNetiq</td>
<td>Entrepreneur</td>
</tr>
<tr>
<td>19-09-2014</td>
<td>Anneke Van Haegenbergh</td>
<td>Alewijnse Marine Technology</td>
<td>Coordinator Technology and Innovation</td>
</tr>
<tr>
<td>22-09-2014</td>
<td>Jan Hoegee</td>
<td>TNO</td>
<td>Director Maritime and Offshore</td>
</tr>
<tr>
<td>29-09-2014</td>
<td>Jan Arie de Ruijter</td>
<td>Hatenboer-Water</td>
<td>Process Engineer</td>
</tr>
<tr>
<td>03-10-2014</td>
<td>Felix Moonen</td>
<td>Jules Dock</td>
<td>Founder and Director</td>
</tr>
</tbody>
</table>