Fostering wind in foreign waters

Governmental roles stimulating export of the Dutch offshore wind sector

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Governmental roles stimulating export of the Dutch offshore wind sector

by

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Youri Nijsse
Delft, 27/11/2017

Executive summary

Following recent large cost reductions and global sustainability trends, the global offshore wind market is rapidly expanding. While offshore wind developments so far have primarily taken place in Europe, offshore wind markets are also starting to develop in Asia Pacific and the Americas. Offshore wind's installed capacity is expected to increase to at least five times its current capacity by 2030, attracting tens of billions (of euros) in investments and offering large opportunities for countries involved in the sector to export their goods and services.

Opportunities in offshore wind markets

Offshore wind technology's costs have gone down substantially due to technological developments, scale advantages of new wind turbines and farms, regulatory certainty, the application of competitive tender systems and current low interest rates, oil and steel prices. Costs are expected to further decrease, decreasing the industry's reliance on subsidies. The main offshore wind markets in Europe are currently the United Kingdom, Germany, the Netherlands, Denmark and Belgium. Additional strong growth is expected in France and Poland. Outside of Europe, the main growth markets in the coming 10 years are expected to be China, Taiwan, Japan, South-Korea and the USA.

Particularly Denmark, Germany, the Netherlands and the UK currently host industries with companies which are considered to be the global technological leaders in the sector and are in a prime position to take advantage of this market's growth. Increased exports of domestic companies in the offshore wind sector can be beneficial for the countries hosting these companies, as these exports can boost domestic economic development and employment and lead to local cost reductions. Therefore, the governments of European countries involved in offshore wind are actively implementing policies to support their domestic industry in its ability to take advantage of international opportunities.

As the Netherlands is hosting one of the largest industries in the offshore wind market, the Dutch government also realizes that it should look into means of effectively supporting its offshore wind sector. The Dutch Ministry of Foreign Affairs is therefore interested to learn *where and how it can effectively support its domestic companies in their ability to take advantage of these opportunities in the offshore wind industry*.

Research approach

Four governmental roles are identified, based on literature in the fields of international trade and economics, international developments, and governance processes and instruments. Each of these roles shows a different hierarchical character in its instrumentation. In the executive role, a government uses its own internal sources to deliver a good or a service. In the regulative role, a government steers its sector with rules and laws. In the networking role, a government utilizes informal processes to affect the organization of and coordination between stakeholders in a sector. Lastly, in the financing role, a government uses financial incentives to steer a sector. Governments are expected to use a mix of instruments from these respective roles to stimulate the exports of their sector.

Considering the importance of innovation and domestic development in the promotion of export for the offshore wind sector, governmental support to parts of the sector developing the technology which can be exported is considered within the scope of this study. Governmental support to the commercialization of a technology however differs from governmental support stimulating its diffusion to foreign markets. To enable a systematic analysis of the export domain, a novel representation of the export process is constructed. This export process consists of six consecutive stages which require different forms of governmental support. These stages are the research and development stage, the testing stage, the domestic market development stage, the foreign market exploration stage, the market entry preparation stage and the export stages.

The four governmental roles and the six export stages are combined to a framework which can be used to analyse where and how a government supports its offshore wind sector. With this framework, a comparative case study is performed on methods that the Dutch, Danish and German government utilize to promote the export of their domestic offshore wind sector. For each case, the instruments utilized by a government are identified per export stage by gathering data using a combination of expert

interviews and desk study. Based on the presence of these instruments, the prevalences of these respective governmental roles are rated on a four-point scale.

By analysing and comparing the utilized instruments and prevalences of the governmental roles, patterns of prevalences are identified across the case countries. Additionally, the comparative analysis assesses differences between the Dutch and Danish and German approach which can lead to recommendations for the Dutch government on the promotion of its offshore wind sector's export. The cases are first compared per export stage, and afterwards general findings are distilled and discussed.

Analysis per export stage

In the research and development stage, high governmental involvement in research programs as found in the Dutch case's Topsector program could lead to better cooperation between universities, governments and the industry. Quantitative data to confirm this finding is however missing. Regulative steering of research and development in tender procedures is currently rare. This could become more viable in future tenders in the light of large cost reductions, opening up possibilities to steer research and development more strongly towards exportable technologies.

In the testing stage, governments implement different regulatory frameworks to develop offshore test farms. The Danish system offers room for industry-led development of test locations next to governmentally-planned demonstration farms. The Danish government also uniquely offers a subsidy focused specifically on the development of technology with high export potential.

In the domestic development stage, the governments of each country are found to strictly regulate the deployment of domestic offshore wind farms. Time-horizons on domestic development plans vary, which in the Danish case leads to uncertainty in the market. The Dutch government actively promotes intra-sectoral financing between large and small- to medium-sized enterprises, but its portfolio of financial instruments is lacking in risk-, seed- and venture capital compared to the Danish and German government. The German Chambers of Commerce play a more central role in the German sector than that they do in the in the Dutch and Danish sector.

In the foreign market exploration stage, services offered by embassies of the Dutch and Danish government are in the German case partially covered by its non-governmental network of Chambers of Commerce Abroad. Whereas the Dutch embassies focus on offering free and general services for their domestic companies, the Danish embassies and German Chambers offer additional company-specific services. These are often offered in collaboration with local consultants and paid for by the companies using these services.

In the market entry preparation stage, similar differences as in the foreign market exploration stage between the services between the embassies and Chambers are found. Each of the case countries organizes and partially finances trade missions. The Danish government puts a higher emphasis on government-to-government cooperation and the formation of memorandums of understanding compared to the Dutch and German cases, utilizing its knowledge and experience of its executive agencies. Lastly, the Danish government is very active in the branding of its offshore wind sector.

In the export stage, little governmental intervention is found, with the exception of export credit guarantees and similar financial products. The Danish and German sector utilize these products far more often than the Dutch sector, but this is likely to be a result of the nature of the companies operating in these respective sectors. The possibility of offering companies export credit subsidies for domestic projects has been identified outside of the case studies.

General findings

The study finds that in general, financial instruments are commonly utilized in almost each export stage across the case studies. Larger variations in the utilization of financial instruments in the later part of the export process could indicate a widely varying opinion of a government's role in the support of domestic companies to explore and enter foreign markets.

Differences in ownership structure of transmission system operators and research organizations seem to have little effect on a sector's ability to export its goods and services. The role of governments in the organization and steering of national research programs and organization promoting intra-sectoral cooperation varies widely. The networking function these governments perform in their sector does not necessarily correlate with its utilization of financial incentives, and examples of the networking role being used in place of the financing role have been found.

Instruments in the earlier stages of the export process are more technology-specific whereas in the later stages of the export process these are more general. This could indicate that the pattern of prevalences of the governmental roles in the later stages is more likely to be inherent to export processes, and the earlier stages should be re-assessed for each specific sector. Developments in cost-reductions and economic importance of the sector could reduce the prevalence of the executive and financing role and increase the prevalence of the regulative role in the earlier stages of the export process.

Conclusions and recommendations

The study finds that while the current approach of the Dutch government is largely appropriate for the effective stimulation of its offshore wind sector's export, some changes to its policy mix are recommended.

- The Dutch Ministry of Economic Affairs should consider the implementation of subsidy schemes and tender criteria for its upcoming demonstration parcel prioritizing the development of technologies with high export potential.
- The Dutch Ministry of Economic Affairs should continue the inclusion of co-location parcels for testing in its upcoming tender procedures and should consider implementing an open-door policy similar to the Danish sector, opening up possibilities for industry-led development of additional test farms.
- The Dutch Ministry of Economic Affairs and Foreign Affairs should, in cooperation with the Dutch trade organizations, initiate a Dutch offshore wind branding initiative similar to the Danish State of Green initiative.
- The Dutch government should ensure that the knowledge of TenneT on offshore wind grid connections and its agencies' experience on tender design are utilized to strengthen government-to-government cooperation with upcoming offshore wind markets.
- The Dutch trade and export promotion organizations in the offshore wind sector are advised to further integrate their activities on offshore wind and consider mergers to increase the sector's transparency and decrease redundant use of resources.
- The Dutch Ministry of Foreign Affairs is advised to launch a study on the revenues, added value and employment in the offshore wind sector, which can be utilized to measure the efficiency of its subsidy- and Topsector policy.

Meetings with key-stakeholders have been organized to discuss and validate these findings and to further encourage their implementation.

Scientific contribution

The four governmental roles identified in this study allow for the evaluation of a government's role in systems where the government fulfils primarily a facilitative function for its private sector, but due to the public nature of some of the activities in the sector chooses to execute parts of the provision of these goods or services itself. The representation of the export process offers a novel methodological approach to assess governmental support in the export domain, which is especially useful in sectors where governmental support to innovation plays a vital role in the development of the sector.

Combining these governmental roles and export process to a framework allows for an evaluation of a government's utilized roles and instruments in an export process of a specific sector. However, due to the context-dependency of each government's approach, the transferability of the findings across the cases is difficult and the framework therefore does have a prescriptive character.

Future research

An interesting topic for future research could be to determine the link between context-variables and the effectiveness of governmental roles. If links between context-variables and the application or the prevalence of certain governmental roles could be established, such a study could offer a prescriptive method to determine which roles a government should utilize.

This study has assessed and compared each export stage separately. A systemic approach to the export process, focused on the relations between the export stages could lead to more insights into the export domain.

Further topics for future research could be a method to determine where and how a country should apply instruments for the developments of technologies with export-potential, quantitative studies measuring and benchmarking the efficiency of national research programs, and further expansions of this study to other offshore wind markets such as the UK.

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List of abbreviations

Abbriviation	*Full name*
AC	Alternating current
AWEA	American Wind Energy Association
B2B	Business-to-business
BAFA	Bundesamt für Wirtschaft und Ausfuhrkontrolle
BAM	Bundesanstalt für Materialforschung und -prüfung
BE	Belgium
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe
bln	Billion (10^9)
BMWi	Bundesministerium für Wirtschaft und Energie
BOEM	Board of Ocean Energy Management
CAPEX	Capital Expenditures
CCI	Chambers of Commerce and Industry
CO2	carbon dioxide
COP21	The 2015 United Nations Climate Change Conference
DE	German
DEA	Danish Export Association
DG DEVCO	The Commission's Directorate-General for International Cooperation and Development
DIHK	The Deutscher Industrie- und Handelskammertag
DK	Denmark
DKK	Denmark Krone
DTU	Danmarks Tekniske Universitet
DWEA	Danish Wind Export Association
DWIA	Danish Wind Industry Association
e.g.	exempli gratiā
ECGs	Export credit guarantees
EEZ	Economic Exclusive Zone
EIA	Environmental Impact Assessment
ES	Spanish
EU	European Union or Europe
EUDP	Energy Technology Development and Demonstration Program
EZ	Economische Zaken
FLOW	Far and Large Offshore Wind
FR	French
FTEs	Full-time equivalent
GmbH	Gesellschaft mit beschränkter Haftung
GROW (NL)	Growth through Research, development & demonstration in Offshore Wind
GTAI	Germany Trade and Invest
GW	Gigawatt
HAWT	horizontal axis wind turbine
HHWE	Holland Home of Wind Energy
HTGF	High-Tech Gründerfonds
HVAC	High voltage alternating current
HVDC	High voltage direct current
i.e.	id est
IRO	The Association of Dutch Suppliers in the Oil and Gas Industry and Offshore Renewable Industry
ISO	International Organization for Standardization
IT	Italy
km^2	Square kilometre
kV	kilovolts
LCoE	The levelized cost of electricity
LCR	Local Content Requirements
LiDAR	Light Detection And Ranging of Laser Imaging Detection And Ranging
MIT	Mkb-innovatiestimulering Regio en Topsectoren
MKB	Midden- en kleinbedrijf
mln	Million (10^6)
MOU	Memorandum of Understanding

MW	Megawatt
NGOs	Non-governmental organizations
NL	The Netherlands
NMT	Netherlands Maritime Technology
NO	Norway
NTIO	The Netherlands Trade and Invest Office
NWEA	The Netherlands Wind Energy Association
O&M	Operation and maintenance
o.a.	Among others
OECD	Organization for Economic Co-operation and Development
OFTOs	Offshore Transmission Owner
ORE Catapult	The Offshore Renewable Energy Catapult
OWEA	Offshore Wind Energie Allianz
PhD	Doctor of Philosophy
PIB	Partners in International Business program
PTB	Physikalisch-Technische Bundesanstalt
R&D	Research and development
RAVE	Research at Alpha Ventus
RD&D	Research, development, and demonstration
RDA	Research & Development Aftrek
RVO	Rijksdienst voor Ondernemend Nederland
SBIR	Small Business Innovation Research
SDE+	Stimulering Duurzame Energie
SIB	Starters International Business
SME	Small and medium-sized enterprises
solar PV	solar photovoltaic
SQ	Sub-question
TKI-Water	Topsector Water
TKI-WOZ	Topconsortia voor Kennis en Innovatie - Wind op Zee
TSO	Transmission System Operator
UK	United Kingdom
USA	United States of America
VAT	Value added tax
WBSO	Wet Bevordering Speur en ontwikkelingswerk
WIPANO	Knowledge and technology transfer through patents and standards
WOZ	Wind op Zee
ZIM	Zentrales Innovationsprogramm Mittelstand

1. Introduction

The global offshore wind sector is rapidly growing, which is presenting new opportunities for countries to increase their exports of goods and services in the sector. Systematic methods to evaluate the roles that governments play in the stimulation of their domestic offshore wind industries to take advantage of these opportunities abroad are however missing in the literature. With one of the global leading offshore wind industries, the Dutch government is interested to find out how and where to best support its offshore wind industry. This study will look into what roles governments take in the stimulation of the export of their industries, where and how these roles can be applied to the offshore wind sector, and how the Dutch government can improve its current approach.

1.1. Offshore wind and the Netherlands

Increasing interest in the challenges and threats around climate change, future fossil fuel scarcities and volatility in oil prices calls for a transition of the world's current energy system (Scholten & Bosman, 2016) from a fossil fuel based system towards a system largely or fully based on sustainable energy sources. One of the sustainable energy technologies that is seeing a large growth in installed capacity and rapid technological development is offshore wind. Global offshore wind capacity has increased by 2.2 GW in 2016, bringing the global capacity up to over 12.6 GW (GWEC, 2017). A large increase in investments is expected in the sector, with markets in Europe growing and maturing, and markets in Asia Pacific and North-America starting to develop (GWEC, 2017; WindEurope, 2017). Technological advancements are lowering the prices of offshore wind, substantially reducing its reliance on subsidies and governmental support. The recently approved tender of the Borssele offshore wind park has seen a 54% price drop in the levelized cost of energy compared to 2010, surpassing the European goal of 40% in 2020 (Roland Berger, 2016), and Germany has recently seen a tender round where the plots were assigned without a subsidy (Clark, 2017). Installed capacity is expected to increase at least fivefold in the next 12 years (Bloomberg New Energy Finance, 2017), and recent cost-reductions suggest an even larger potential for growth of the sector (GWEC, 2017; Roland Berger, 2016).

Most of the developments in the offshore wind energy market have so far taken place in Europe, which hosted over 91% of all global installed offshore wind capacity in 2015 (Global Wind Energy Council, 2015). As a result of this early development, European companies are currently the global technological leaders in offshore wind energy. Especially Denmark, Germany, the Netherlands and the UK have strongly developed offshore wind sectors (Westra & Agterberg, 2016), with globally leading offshore wind companies. For the companies in these countries, it is becoming increasingly more interesting to invest in wind projects in upcoming markets in and outside of Europe; in countries like China, France, Japan, South-Korea, Taiwan and the USA (RVO, 2015).

Investments in foreign markets are not only interesting for the companies in the offshore wind sector of these European countries, but also for the home countries of these companies. Obtaining additional foreign projects for the domestic offshore wind sector can boost domestic economic development and employment, increase international exports, lead to local cost reductions and boost a country's national pride as a result of being able to display their technological achievements (J. Lewis & Wiser, 2005). Thus, it is interesting for national governments to help or stimulate their companies to gain a strong position in the international offshore wind market, and to support them in obtaining international contracts and projects.

While the Dutch offshore wind energy sector currently has a large market share (NWEA, SER Energieakkoord, 2016) and strong companies in its sector, offshore wind is a sector with many international players. Established offshore wind industries in Denmark, Germany, the Netherlands and the UK have to compete with each other. Additionally, upcoming offshore wind countries are establishing their own domestic offshore wind sectors, adding to the international competition. Each of these countries is establishing its own methods of supporting its domestic industry, focusing on both domestic development of offshore wind and the opportunities for export for their (upcoming) industry.

The global offshore wind sector is moving from a niche technology to a mainstream energy generation technology and thereby offering huge opportunities for countries with strong offshore wind sectors. The Dutch government is interested to understand how to ensure that the Dutch sector is able to take advantage of these developments. In the Netherlands, there are two ministries that are primarily involved with the development of the domestic market and the support given to Dutch companies regarding the capitalization of international opportunities. These are respectively the Dutch Ministry of Economic Affairs and the Ministry of Foreign Affairs' Directorate of International Entrepreneurship. This thesis study will be conducted in cooperation with the latter and aims to advise the Dutch government on possible points of improvement to their current role and approach to the offshore wind sector, regarding the stimulation of and support to exports of the sector.

1.2 Problem statement

The Dutch government acknowledges offshore wind as one of the country's sectors that excels internationally, and gives it a place in its Topsector program (Topsector Energie, n.d.-a) under the name of 'Topsector Wind op Zee' (TKI-WOZ). Domestic growth of installed capacity of offshore wind is however largely limited to the parcels offered by the Dutch government and at this time still depends on subsidies (Netherlands Enterprise Agency, 2015a). Whereas the Topsector's former main research program (FLOW) concerning the offshore wind sector was focused on cost-reductions (Vos, 2015), the current research program (GROW) has broadened its goals. After taking into account the unexpectedly high pace of cost-reductions, the new goals put a higher emphasis on value creation and the exports of the sector (Zuijlen, 2016a). Export of offshore wind products and services will be necessary for the Netherlands to attract sufficient projects in order to maintain an edge on international competition (Meijer, Zaaijer, & Van Zuijlen, 2015).

When comparing offshore wind to the somewhat similar technology of onshore wind it can be noted that the Dutch have not been very successful in developing a domestic onshore wind industry that is able to export its goods and services (Krohn, 1998). This in contrast to Denmark and Germany, which currently host some of the largest onshore wind energy industries in the world. With offshore wind, new opportunities arise for the Netherlands to become a key player in a segment of the sustainable energy market.

However, other European countries are also looking to take advantage of developments in the offshore wind industry. Denmark has recently launched a new export strategy, which has a key role for offshore wind products (Udenrigsministeriet, Energi- Forsynings - og Klimaministeriet, & Erhvervsministeriet, 2017). The UK and France are actively promoting the development of a local offshore wind industry, with the goal of offshore wind becoming a strong domestic and export sector (RVO, 2015). Germany has federal and regional authorities promoting their local wind industries, which share an export strategy for energy technologies including offshore wind (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-a). The governments of these countries plan to improve the competitiveness of their offshore wind industries with a mix of research and development activities and industrial policy focussed on exports. The TKI-WOZ program is also moving in this direction, with its new focus on internationalization. Countries are thus actively taking a role in their offshore wind sector, and are pursuing goals broader than just enhancing the sustainability of their domestic energy systems and the cost-reductions for energy technologies contributing to these systems.

In order to look into what the role of the Dutch government could be in the stimulation of exports of its offshore wind sector, literature on the governmental promotion of exports is consulted. In the field of international economics, governmental intervention in international trade is often associated with mercantilism (Acharyya & Kar, 2014; O'Brien & Williams, 2010). However, instruments traditionally related to mercantilist systems are no longer prevalent in developed countries (Belloc & Di Maio, 2011), as their use is prohibited by the World Trade Organization. Literature from the field of international economics and development often takes a market failure approach (Acharyya & Kar, 2014; Bacchetta, 2007; Diederich, 2016). While this literature does identify market failures which can be solved with specific governmental interventions, the solutions generally do not apply to specific industries but focus on country-broad issues or focus on specific instruments and their efficiency (Borrás & Edquist,

2013; Kanda, Mejía-Dugand, & Hjelm, 2015; Lederman, Olarreaga, & Payton, 2010). Literature assessing the role of a government in a specific sector focusing on the promotion of exports is missing. As the intervention in a sector generally encompasses governance processes, literature from this field is consulted.

When looking at governance processes, Bevir (2012) states that governments can apply a wide range of instruments of which the nature varies from hierarchical to more market-based. Hisschemöller (2006) identifies four governance paradigms which also reflect different natures of utilized instruments. Ménard (2012) describes that the nature of governance also differentiates in various forms of organizational structure in networks. Provan & Kenis (2008) argue that not only the structure of the network but also the position of an actor in a network determines the influence an actor can have on a network. Relating this to the offshore wind sector, the position of the government in the sector will determine which instruments a government can effectively utilize to steer or support its sector, and might determine the hierarchical nature of these instruments. For governance instruments applied to social-technical systems literature on innovation systems is consulted.

In the field of literature on innovation systems, categorizing public policy instruments is commonly done by dividing these into three categories, e.g. regulative, financial and 'soft' instruments (Borrás & Edquist, 2013). By forming a similar categorization based on the hierarchical nature of the instruments applied, the roles that governments take in a sector can be analysed. If such an analysis can be linked to the export process of a specific sector, then the instruments applied in such a sector can be evaluated, compared and possibly improved.

Concluding, a method to evaluate the current roles and instruments utilized by a government to promote a sector's exports is currently missing in the literature. Such a method could be applied to evaluate the roles different governments take in the stimulation of the exports of their offshore wind sectors. By applying this method to the Dutch offshore wind industry, along with some comparative cases, points-of-improvement to the current approach of the Dutch government can possibly be identified.

1.3 Research objectives

Considering the problems stated in the previous subchapter, a research objective and research questions are formulated. This study aims to develop a method to evaluate instruments and governmental roles in the stimulation of export of the offshore wind sector. This method will be applied to the Dutch offshore wind sector to identify possible points-of-improvement to the Dutch government's current approach. Resultingly, the research objective is formulated as follows:

"To determine where and how the Dutch government can improve its current role in the promotion of exports of its offshore wind industry."

In order to identify successful approaches to the stimulation of export, this study will, next to the Netherlands, also evaluate other countries which are active in the stimulation of exports of their offshore wind sector. These other countries will serve as comparative cases, with which the Dutch portfolio of instrument and role(s) in the sector can be compared. This can lead to recommendations for the Dutch government. Discussion with experts in the sector will be used to evaluate whether the recommendations found in this study will be likely to lead to an improvement of the current situation.

To reach the research objective, a set of research questions has been developed which will determine the structure of the study. The main question is in line with the objective of the study, and is defined as follows:

Q0 *"What roles should the Dutch government fulfil to effectively stimulate the Dutch export of offshore wind energy goods and services, in order to strengthen the competitiveness of Dutch companies?"*

This main question can be sub-dived into the following set of sub-questions (SQs). These sub-questions correspond with the research areas covered during this study, and the report follows the structure of these questions.

SQ1: *"Which goods and services can be exported to offshore wind markets?"*

SQ2: *"Which governmental roles can be distinguished for the stimulation of export in the offshore wind sector?"*

SQ3: *"What roles do the governments of leading offshore wind countries fulfil to support the export of their domestic offshore wind sectors?"*

SQ4: "*What roles should be utilized to improve the current approach of the Dutch government?"*

These sub-questions will be answered in respectively chapter two, three, five and six.

1.4 Research approach

This project will follow a research approach based on the method of Verschuren and Doorewaard (2010). The project will go through different stages, which correspond with different chapters of this report and the sub-questions of the previous subchapter. A visualization of this approach can be found in Figure 1. Each of the research stages is shortly elaborated hereafter.

The first stage of this study will look at what goods and services can be exported in offshore markets and to where these can be exported. This part of the study serves as context for the rest of the report and will make use of a range of literature sources and expert interviews. It will give the reader a better understanding of what kinds of export the rest of this report deals with and why the offshore wind sector is such a dynamic market at this moment. The findings of this stage are presented in chapter two of this report.

The second stage of this study will look into the literature on international economics, trade and development, the literature on governance processes and instruments and the literature on export processes. By combining concepts from these fields of literature, a research framework is constructed which will be utilized in the analysis of the case studies. The framework will look at different governmental roles in various stages of the export process. The findings of this research stage are presented in chapter three.

The third stage of this study will comprise of the case studies performed on leading offshore wind countries. Chapter four will expand on the methodology used for the study, and will explain the choice of the method of case study research using a combination of desk research and expert interviews. Chapter five will present the cases and the governmental roles found in the cases.

The fourth stage of this study will analyse and compare the findings of the case studies by comparing the roles utilized by governments per stage of the export process. From this comparative analysis, general findings on the prevalence of governmental roles in export processes and potential points-of-improvement for the Dutch government's role in the promotion of export of the offshore wind sector are distilled. This comparative analysis is presented in chapter six. Chapter seven contains the discussion

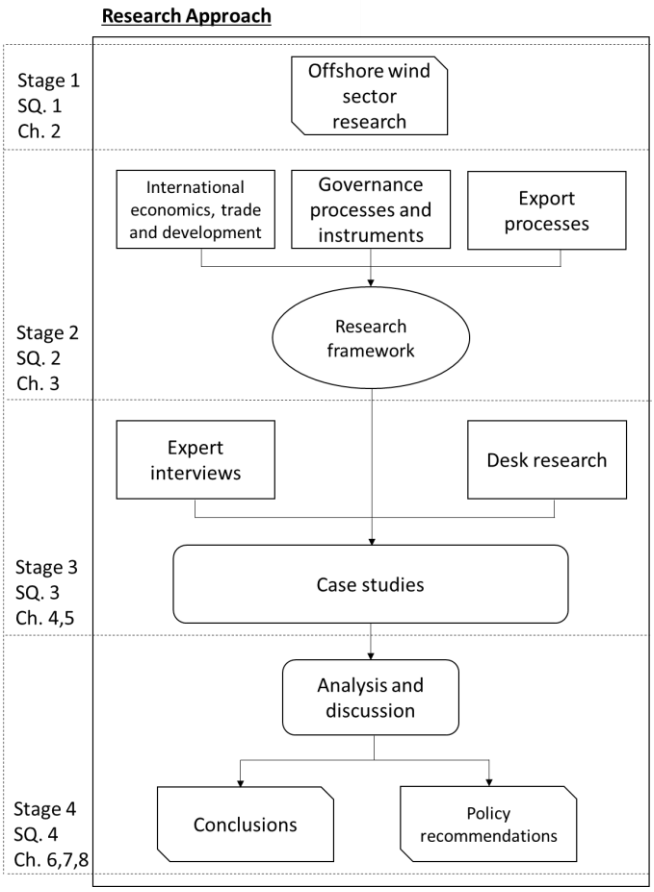

Figure 1: The research approach based on the method of Verschuren and Doorewaard

and reflection of the study. Chapter eight will contain the conclusions of the study, a range of policy recommendations for the Dutch government and suggestions for future research.

1.5 Relevance

This study aims to contribute to the understanding of the government's role in the export promotion of offshore wind industry. This subject has both *scientific* and *societal* relevance.

This study adds to the literature on governance and governmental roles by constructing a categorization of governmental roles based on their utilization of instruments. This categorization is suited for systems in which the government fulfils primarily a facilitative function for its private sector, but due to the public nature of some of the activities in the sector chooses to execute parts of the provision of these goods or services itself. The novel representation of the export process offers a methodological approach to evaluate a government's utilized instruments and roles in the export domain. The utilization of this approach can lead to a better understanding of *how* and especially *where* governments can support their domestic sectors in export processes. The framework combining these two concepts is used during the case-studies and leads to an overview of currently utilized instruments in the offshore wind sector. The framework can also be applied in the analysis of other sectors with similar technological characteristics to offshore wind.

The framework, case studies and analysis take into account both economic and societal goals of governmental policy by e.g. encompassing research, development and deployment instruments in export promotion methods. The case studies evaluate the roles and relations of actors in offshore wind systems and assess how the found differences between the cases fit with the Dutch institutional context. This multidisciplinary approach aligns with the methods taught during the master of Complex System Engineering and Management of the Delft University of Technology and contributes to its research on policy making in the sustainable energy sector.

This study's societal relevance can be found in its advisory nature to the Dutch government. The policy recommendations proposed by this study can lead to a more effective approach of the Dutch government in supporting the Dutch offshore wind sector in its ability to export its goods and services. Domestically, this can lead to an increase in the revenues of the Dutch offshore wind sector, leading to increases in tax income for the Dutch state and more employment in the Dutch economy. A flourishing offshore wind sector has more opportunities to invest in innovation, possibly leading to cost-reductions in the sector.

In addition to the domestic advantages of a more successful approach to export promotion in the Netherlands, increased exports of the Dutch sector can lead to a higher degree of diffusion of offshore wind innovations globally. The participation of Dutch companies with high levels of know-how in the offshore wind sector in other countries can lead to technology-transfers to the countries these companies operate in. This, in turn, leads to local cost reductions for offshore wind in these countries and can enhance the speed at which the offshore wind markets develop in these countries. More countries expanding their offshore wind sectors will lead to an overall increase in low-carbon energy sources being used in the world, replacing energy technologies that are harmful to the environment and cause global warming.

2. Offshore wind globally

This study looks at governmental support to the export of offshore wind goods and services. Before evaluating governmental support methods for this sector, this chapter will answer the first research question: *"which goods and services can be exported to offshore wind markets?"*. The aim of this chapter is to present the context of offshore wind technology for the rest of this report, and to define which parts of the offshore wind system are considered in this study.

The formerly mentioned research question can be divided into several parts which will be answered in this chapter. The first part of the research question looks at which *goods* and *services* in the offshore wind sector can be exported, looking at parts of offshore wind's technology. The *goods* part of this question will be dealt with by looking at the different components of a wind farm, the *services* part will be dealt with by looking at the different life-cycle stages of a wind farm. As many of these components and services show similar characteristics when being exported, a *value-chain* approach will be utilized to combine and cluster them in a range of categories; market segments of the sector. As offshore wind costs are strongly falling, new markets are opening up which provide new opportunities for export. The last part of this chapter will expand on the *most important drivers of cost reduction* of the technology, and the *opportunities and barriers* for export in the most important *future foreign offshore wind markets*.

Note that this study concerns the export of goods and services used to plan, construct, manufacture, operate and maintain offshore wind farms. It does *not* look at the export of the *energy* generated by offshore wind farms across countries.

2.1 Offshore wind technology

Offshore wind energy refers to energy harvested by converting the kinetic energy of the wind into electricity by structures located in bodies of water. These bodies of water are usually seas, but can also be inshore water areas (e.g. lakes, fjords, rivers). Offshore wind energy is generally generated by wind turbines operating in offshore wind farms, also often called offshore wind parks. Offshore wind turbines enjoy higher wind speeds compared to their onshore counterparts, which allows them to generate higher amounts of energy (Lynn, 2012). This compensates for the comparatively higher costs of factors like installation, operation and maintenance (Wüstemeyer, Madlener, & Bunn, 2015). As offshore wind farms generate intermittent energy, the costs of connecting and balancing them to the energy grid are higher than traditional energy generation methods based on fossil fuels (Siemens, 2014).

Offshore wind farms are connected to onshore electricity grids which require to be balanced as a result of the influx of intermittent electricity from these offshore wind farms (Siemens, 2014). While these onshore grid-balancing technologies are related to offshore wind, they are also applied for other intermittent electricity generation technologies. Following the example of Wüstemeyer (2015) and Agterberg (2016) only the components of the offshore wind farms located offshore are considered, i.e. the wind turbines, their foundations, array cables to the substation of the wind parks, the substations and the sea cables connecting the substations to the coast, as visualized in Figure 2. The study will not look into products or services concerned with the grid balancing as a result of the connection of more intermittent offshore wind capacity (e.g. transformers).

2.1.1 Main components offshore wind system

To identify which goods can be exported in the offshore wind sector, the different components of the offshore wind farms are expanded on. While many components can be identified in an offshore wind farm, for the sake of concision only the five main components are expanded on. These selected components are selected by first looking at the components supplied by the tier 1 suppliers of the wind farms; the turbine, the foundations and the substation with the sub-sea electricity cables (D'Amico, Mogre, Clarke, Lindgreen, & Hingley, 2017). The turbine comprises the largest part of the value of the

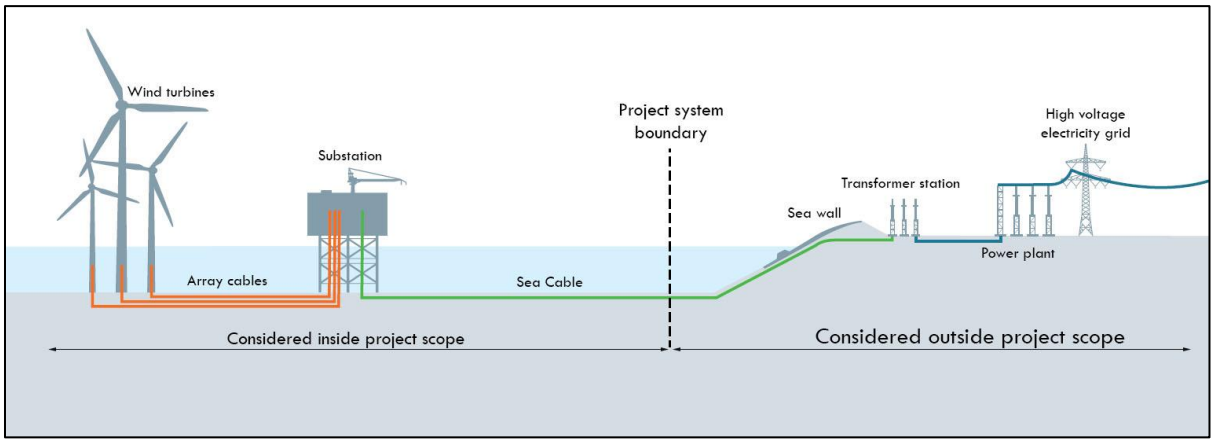

Figure 2: Visualization of the project system boundary. On the left are the components considered during this study, on the right are the components not part of this study.

construction of the system, and is subdivided into the three highest value components; the tower, the nacelle and the blades (Wüstemeyer et al., 2015).

The tower

The tower of a wind turbine is generally the least complex part of the system (Sharpley, 2013). The tower supports the nacelle and blades, and its bottom is attached to a foundation.

There are two types of towers typically used in the offshore wind sector: Tubular and truss construction towers. The tubular tower concept is the most common concept. This concept consists out of steel tubular pieces which are joined. This joining of the pieces is generally done onshore. Being able to assemble the tower offshore could greatly reduce costs of the installation of the turbines. Technologies like the Climbing Crane, a crane that attaches itself to the tower and is able to construct a modular tower on location, are currently being developed to suit offshore wind turbines (de Vries, 2017; Lagerwey, n.d.).

Truss construction towers have the advantage of using less material, receiving less force from waves, and are more flexible. However, the construction of these towers is more expensive, and the constructions can resist fewer external forces (Sharpley, 2013). As the aerodynamic characteristics and yaw control mechanisms of towers are improving, these external forces are becoming less problematic and European companies are testing concepts with truss constructions. In regions where hurricanes (USA) or earthquakes (South-East Asia) are common, these truss concepts will most likely not be used in the near future.

Due to the sheer size and weight of the towers, it can be advantageous to produce the towers locally. Due to their

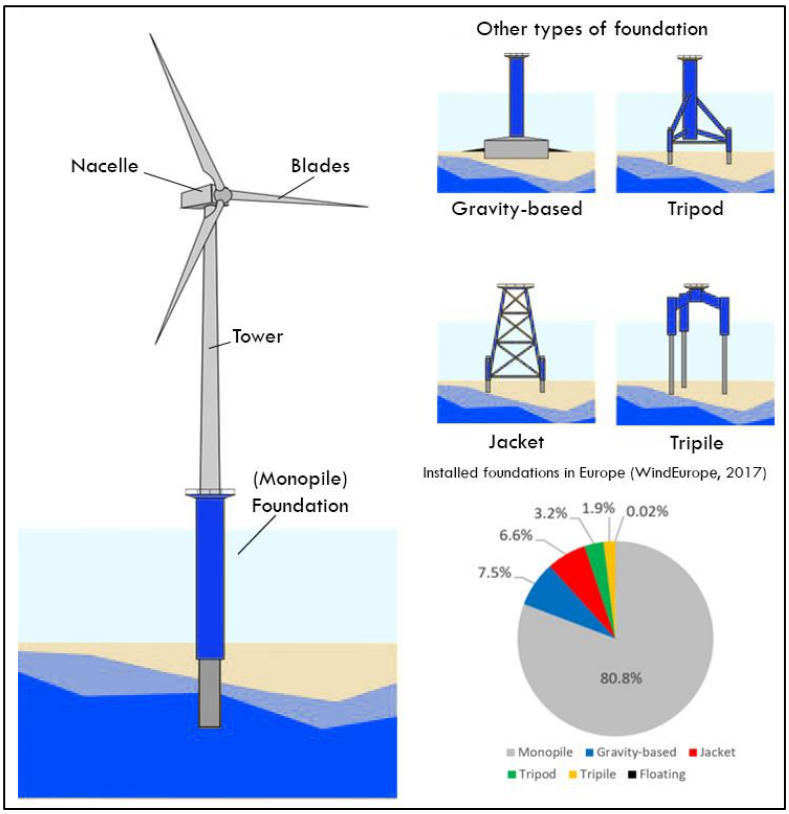

Figure 3: The components of offshore wind turbines, the most common foundations and the use of these foundations in Europe

relatively low complexity, the technology to construct offshore turbine towers is something that can be easily picked up by new countries entering the offshore wind market. Innovative technologies of wind towers, like the climbing crane, have a higher complexity and offer more opportunities for technology-exports, often in the form of licences (Appendix 1, x).

The nacelle

The nacelle sits on top the tower and contains the drive train and generator of the wind turbine. The rotational movement of the blades of the turbine is adjusted by a gearbox to be of an appropriate speed for a generator to generate electrical power. The nacelle also contains the power control system of the turbine, which can adjust the position of the blades or stall the turbine in times of heavy winds or maintenance.

The nacelle contains the most complex components of the wind turbine, which are situated on top of the tower, making the turbine top-heavy. Resultingly, the tower and foundation need to be designed to handle such a top-heavy structure, which is costly in terms of material and installation. Future concepts containing hydraulic systems can move the drive train and generator to a system next to the turbine, potentially bringing down the costs of the whole turbine. Developments in (the sizes of available) hydraulic pumping systems are necessary to make this concept viable, but could lead to large cost reductions in the future (Laguna & Kempenaar, 2013).

While most companies use a gearbox to transfer the speed of rotation, there are also companies which use a direct drive concept; connecting the generator to the axis of the turbine directly. The direct drive system tends to be heavier, but has less moving parts and thus requires less maintenance. Companies using direct drive are for example Enercon, some turbines of Siemens, and the Dutch company Lagerwey (Lagerwey, 2015).

Due to the complexity of the nacelle's components, its production requires a high amount of local expertise. Companies that produce nacelles are usually involved in the production of all parts of the turbine (e.g. Siemens-Gamesa and MHI Vestas). The nacelle is therefore often exported as part of a complete turbine. Its weight can make exports to far-away markets costly, but as setting up local production facilities is expensive as well its export can be viable if a small number of units is required in a market.

The blades

The blades of a wind turbine are connected to the nacelle of the turbine. They convert the mechanical energy in the wind into a rotational movement in the axis, which can be transferred to electrical power in the nacelle. The blades can be positioned / yawed to generate optimal power output, or put downwind during heavy winds to reduce the loads on the turbine.

Current offshore wind turbines predominantly use a three-bladed design on a horizontal axis (horizontal axis wind turbine, or HAWT). This design, which is also common for onshore turbines, is a proven concept that produces reliable results. Companies like 2-B Energy are currently challenging the three-bladed HAWT design, which owes part of its design decisions to criteria like noise and size constraints which are less important in offshore environments (2-B Energy, n.d.). 2-bladed designs for offshore turbines are being tested in (e.g.) Scotland, and could start challenging the three-bladed design in the coming years (4COffshore, n.d.-b).

The blades are complex products that are aerodynamically optimized to generate power from the wind, while reducing noise and wear. The blades are usually produced from fibre glass composites with a hollow shell, although aluminium concepts also exist (LM Wind Power, n.d.).

The blades are large and heavy parts. Their length varies, depending on the capacity of the turbine they are suited for, but designs for the last generation of 8 MW turbines have seen blade lengths of 88 meters, weighting over 60 tons (LM Wind Power, 2017). With wind turbine capacity expected to increase in the coming years, so will the size and weight of these blades. This restricts their exportability

to relatively nearby markets. In further markets (other continents), new production facilities will need to be founded.

The foundation

The foundation of an offshore turbine connects to the bottom of the tower, and ensures the balance and location of the tower.

There are currently three commonly used types of foundations for offshore wind turbines; monopiles, gravity based, and jacket foundations. Furthermore, there are some offshore wind turbines that use a tripod or tripile foundation. These foundations are suited for low-to-medium water depths, traditionally of up to ~50 meters (Lynn, 2012) (although newer models might be able to function in water depths of up to 80 meters[1]).

The most common type of foundation is the monopile. Over 80 percent of the currently installed offshore wind turbines in Europe use this technology. This technology places the turbine on a large monopile, which is drilled into the seabed. Gravity based foundation methods attach the turbine to a heavy structure (often concrete) on the seabed, and amount to 7.5 percent of Europe's installed foundations. Tripod structures place the turbine on a tripod, which is attached to the ground by drilled steel pipes, and amount to 6.6 percent of installed foundations in Europe (Dickson, 2017) (see Figure 6).

The currently used foundation types require low to medium water depths to be feasible. While these water depths are common in the European North-Sea waters, countries such as the USA and Japan have deep seas where other technologies are required. For these waters, floating wind turbines will be needed. These floating turbines place the towers on a floating structure. Currently, floating turbines face high costs, but test projects are taking place in Norway, Japan (Fukushima), and the first fully functional floating offshore wind park (Hywind II) is currently being installed in Scotland by Statoil (4COffshore, n.d.-a). Further developments and cost reductions in floating turbines are expected to open up new markets for offshore wind parks.

Foundations are usually the heaviest part of a turbine. Their sheer size and volume makes exporting them to far-away markets not economically interesting (Appendix 7, vi). As such, local production facilities will need to be set up in these markets.

The array cables, the sea cable(s) and the substation

The array cables, sea cables and substation connect the wind turbine to the onshore power grid. The array cables, often 33 to 66 kV cables, connect the wind turbines to a substation, with alternating current (AC) cables. The substation transforms the electricity to a higher voltage, often around 220 kV. The sea cables (also called export cables) then transport the electricity to the onshore electricity grid. The sea cables come in High Voltage Alternating Current (HVAC) and High Voltage Direct Current (HVDC) variants. Due to efficiency of transport reasons, HVAC is used if the distance from the substation to the onshore grid is less than 60 km, HVDC starts being more efficient on longer distances (Appendix 1, xxii). As offshore wind parks are starting to be realized further offshore, more of the export cables are becoming HVDC.

In systems that put the substation and export cables under the transmission system operator's responsibility, standardization of the substations is leading to significant cost reductions. Other developments in this part of the system take place in the interconnectors between country's offshore wind parks. Since some of the currently planned offshore wind parks will be located near each other, on the edge of the economic exclusive zones, there are opportunities to form interconnectors between countries by connecting these offshore wind parks (Appendix 1, xvi).

Substations are large and heavy structures, that are usually built locally. Physically exporting them is thus restricted to nearby countries. Cables (and especially the services surrounding cables) are well

[1] As presented by SIF during the WindDays 2017 conference.

exportable, also to far-away markets. They can however usually be bought locally as well, since most parts of the world have industries that produce cables, which is often a cheaper option.

2.1.2. Life-cycle stages offshore wind parks

Next to goods in the form of manufactured components of the offshore wind system, also services can be exported. These services are generally specific to project life-cycle stages of offshore wind farms (Shafiee, Brennan, & Espinosa, 2016). The next part of this report will therefore expand on the life-cycle stages of offshore wind farms.

Thomson (2015) identifies four life-cycle stages of offshore wind farms in a study assessing the carbon emissions of the farms: Manufacturing of components, Transport and Installation, Operation and Maintenance, and Decommissioning (i.e. dismantling and disposal). Agterberg (2015) furthermore identifies a planning phase of the wind farm; a part of the life cycle that is disregarded by Thomson ass it does not generate significant CO_2 emissions compared to other parts of the life-cycle, but can be relevant for exportable services.

While the life-cycles presented by Thomson and Agterberg are linear, it can be noted that parts of the experience and constructions used in a wind farm can possibly be used for a future offshore wind farm at the same location. Additionally, during the construction of an offshore wind farm standardized components from the whole-sale market are also utilized, which are developed parallel to the life-cycle of the development of a single offshore wind farm project. Taking these points into account, a visualization of this life-cycle can be found in Figure 4.

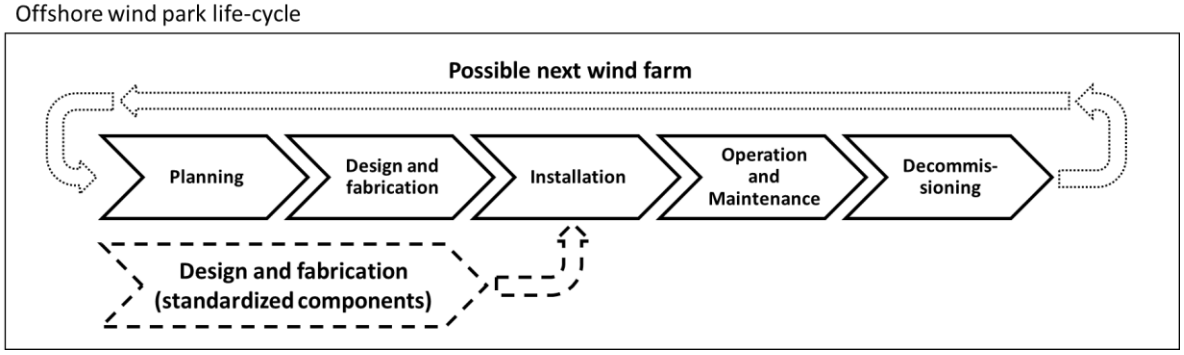

Figure 4: The life-cycle of a wind farm. Design and fabrication of standardized components runs parallel to the construction of the wind farm

Planning of the wind farm

The first life-cycle stage of the offshore wind farm project is the planning of the park. Offshore wind farms are generally situated in seas and lakes, which can make construction difficult and costly. Before the construction of a park can commence, several preliminary studies are necessary. These include an extensive study of the environmental impact of the farm (often in the form of an Environmental Impact Assessment (EIA)), geophysical and geotechnical studies on the seabed, measurements of wind speed and variation, and an assessment of power grid connection possibilities (Bruijne, 2017; Coriolis Energy, 2014; Splunder, 2017). In this process, the ownership of the area is also very important. The rights to build and operate installations in seas and lakes often lie with local or national governments. As such, these parties are in charge of granting permits for the construction of offshore wind farms, and often determine the area, size and capacity of to-be-constructed wind farms.

The preliminary studies of the parcel, the planning of the exact location and choice of the type of the turbines and electrical systems are sometimes performed by one party (the developer of the wind farm). Most European countries are currently moving towards a system where the preliminary studies and the grid connection of the farm are the responsibility of a governmental agency, and the choice of turbines and the exact layout of the park are the responsibility of a project developer (Bundesverband der Energie- und Wasserwirtschaft e.V., 2016; Netherlands Enterprise Agency, 2015a). As offshore

wind energy is currently still an industry that depends on subsidies, the planning of a remuneration (subsidy) scheme is also an important part of the planning of an offshore wind farm (GWEC, 2017).

Design and fabrication of components

The nature of the good determines whether they are designed specifically for one offshore wind farm, or if they are standardized goods which are chosen to be used in the wind farm. Once the time and place of an offshore wind farm have been chosen, the components specific to the wind farm can be designed.

The electrical substation of a wind farm needs to be adjusted to each farm to meet the specification of the farm and its layout. However, as some European governments have delegated the responsibility of the design of these substations to the transmission system operator for a time horizon of up to ten years (Appendix 1, vii & xvi), these components are also becoming more standardized (reducing costs). Cables used for offshore wind farms are standardized components.

Offshore wind turbines are generally not designed for specific wind parcels (de Vries, 2017). They are standardized products that are available to be produced for a range of wind farms (Appendix 1, xi). Foundations are partially standardized components, but need slight adjustments to fit the turbine and seabed conditions (Dirks, 2017).

Lastly, the ships used to install wind turbines need to be designed and produced as well. There are three main types of vessels used to install offshore wind turbines: Turbine installation vessels, Foundation installation vessels and Sub-sea cable installation vessels (Dirks, 2017; Roy, Reynolds, & Clayton, 2014). The ships used for installation are used for several wind farms (and often for other offshore activities), and are not individually designed for one farm (Appendix 1, ii).

Transport and installation of the components

The next step of the life-cycle of a wind farm is the installation of the foundation, turbine and electric installations (cables and substation). The installation of these components is performed by large ships, which can either transport the components themselves or work with a support vessel transporting the components (Appendix 1, xviii & 7, v).

The installation process starts with the installation of the foundations, and a transition piece to connect the foundation to the turbine. After this, the turbine is installed on the foundation. Typically, first the tower is installed and afterwards the nacelle is installed on the tower. The blades are either installed individually, or all at once already attached to the rotor (Lindvig, 2010). Recent developments in offshore installation have seen vessels that are able to install the full turbine in one go. Installation of foundations and turbine is still done separately (and with other equipment) (Dirks, 2017).

Independent on the timing of the turbines, the substation is separately installed. Cables between the turbines and the substation, and cables from the substation to the onshore grid are installed in different phases. These cables have different capacities (typically 33 kV and 66 kV for turbine – substation, and 220 kV for the substation – onshore grid cables) (Jaarsma, 2017).

Operation and maintenance

After the turbines are installed, they need to be operated and maintained. Maintenance of offshore wind farms can be done in three broad strategies. Work-boat based maintenance strategies use boats that operate from a nearby port. Heli-support based generally also work with work-boats, which are supported by helicopters. Offshore-support strategies maintain the wind farms from fixed or floating offshore maintenance facilities. Which strategy is used mainly depends on distance to shore of the wind farm (work-boats for closer farms, offshore-support for far offshore) and turbines (some turbines do not support helicopters) (GL Garrad Hassan, 2013). Operation and maintenance (O&M) activities are often a source of local employment, employing 50 – 100 FTEs over the lifespan of the wind farm (NWEA, SER, Energieakkoord, & Natuur & Milieu, 2016).

Operation and maintenance activities can be separated in two categories. The first category is supporting operations, which include on- and offshore logistics, and back-office administration and

operation activities. The second category is the equipment maintenance, which include maintenance of foundations and cables (array and export cables). The maintenance of foundations and array cables together form over 85 – 90 percent of the O&M costs (depending on strategy). As such, technologies lowering the costs of these parts of the maintenance (like corrosion-prevention measures) can be very valuable (Brink, Ole, & Salla, 2015; Buck & Langan, 2017; GL Garrad Hassan, 2013).

Decommissioning
The last stage of the life-cycle of a wind turbine is the decommissioning of the installations. As the offshore wind industry is still young, and offshore wind turbines have a typical life-span of 20 to 25 years, this stage has not been reached by any large offshore wind farms. As such, this part of the life-cycle will not be covered by this study.

2.2 Market segments of offshore wind

As can be seen in the previous subchapters, the offshore wind sector encompasses a broad range of goods and services. While some of these goods and services are offered by separate companies, others are typically combined. For example, most companies manufacturing wind turbines also design them (Appendix 1, xi). Companies installing foundations are sometimes also able to install turbines, and often offer operation and maintenance services to the wind farms as well (Appendix 1, ii & 7, v). Additionally, there can be a separation of the parties managing and executing the activities in the different life-cycle stages of the offshore wind farms (Appendix 7, iv). The following part of this chapter will categorize the sector into parts that create value performing broadly similar activities.

2.2.1 The value chain method

For the categorization of the sector, this report will make use of a value chain method. This method is particularly useful to understand how companies function in a global economy, and can be used to categorize the offshore wind sector is groups of goods and activities that show similar characteristics regarding their exportability.

The concept of mapping a firm's value chain to gain a competitive advantage stems from Porter's book *Competitive Advantage* (Porter, 1985). The value chain methods "disaggregates a firm into its strategically relevant activities" (Porter, 1985). Firms can build a " competitive advantage by performing strategically important activities more cheaply or better than its competitors" (Porter, 1985). The value adding activities identified by Porter can be divided into two broad categories: *Primary activities* which involve the physical creation of the product, and *support activities* which underpin the primary activities (Svensson, 2003).

This value chain method can also be applied to an industry; either by fitting the activities of the industry to Porter's categories (Hinson, 2010), or by tailoring the method to core activities performed by an industry (Kaplinsky & Morris, 2000). The second method is applied by Wieczorek (2013) on the offshore wind system, separating the industry in eight categories to compare the stakeholders of the offshore wind industry. This method is also utilized by both industrial parties (Roland Berger, 2016) and research programs (Zuijlen, 2016a) to identify actors and/or strengths of a domestic sector. The categories of the value chain representation differ slightly for each report, with some reports not including support activities such as R&D (depending on the audience and specific function of the representation). In this report, the value chain is categorized based on activities that show similar characteristics regarding their exportability.

Note that Porter's approach focuses on a 'compete on your strengths, not your weaknesses' view. In this approach it is assumed that firms are best off not investing in activities that they do not have a competitive advantage in, assuming that competing companies would outperform them. However, in the case of a strongly growing market it might be wise to invest in technologies that have potential large payoffs if even relatively small market shares are acquired. While competing on the strengths of an industry is likely a valid strategy, improving on the weak parts of a sector can still bring large financial gains even from companies that might not be the market leaders in their segment. Later chapters of

this report will therefore, next to looking at current strengths of the Dutch industry, also evaluate which current weaknesses of the current Dutch sector could be valuable to be remedied.

2.2.2 Categories Value Chain

To enhance the understanding of different parts of the offshore wind sector and how these relate to the export of their goods and services a range of categories has been identified. In order to identify these categories of the value chain, this study will look at a range of factors for categorization. These factors are also visualized in Figure 5. The first factor of categorization looks at the distinction between *primary and support activities.*

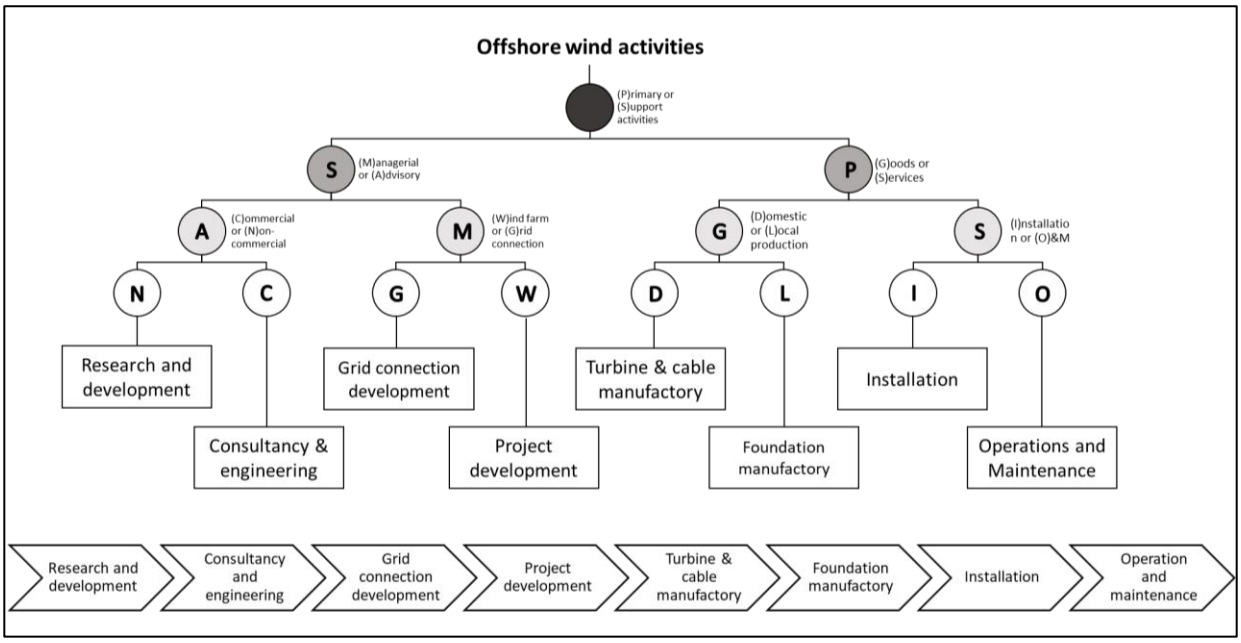

Figure 5: The categorization of the value chain of the offshore wind sector and the resulting value chain representation

The primary activities for the value chain can be derived from the components and life-cycle stages from earlier in this chapter. These are first separated looking at activities delivering *goods* or activities delivering *services.* Activities delivering *goods* are manufacturing activities, performed by companies creating a component of the offshore wind system. When looking at exporting these goods, this category can further be specified by looking at the necessity of *domestic or local production.* Some goods can be produced in an exporting country and transported to a foreign market. Other goods have to be produced locally (due to size or regulatory restraints). Goods that can be produced domestically are covered in the 'Turbine and cable manufactory' category, goods that have to be produced on-site or near the site are covered in the 'Foundation manufacturing' category.

Services are separated on their stage of the life-cycle. Services in the planning phase are generally executed by parties managing the wind farm construction projects, and are dealt with under support activities. Services in the design and fabrication stage of the life-cycle are either executed by the companies producing the components, or aim to support these companies, and as such fall under the formally mentioned manufactory categories or fall under the support activities. Services offered in the 'Installation' and 'Operation and Maintenance' stages are often executed by separate companies, and are not aimed to support other primary activities in the execution of their work. These are dealt with in their own categories.

Support activities in the offshore wind sector are activities performed to aid the execution of primary activities. These activities can be *managerial activities* which coordinate the primary activities, or can be *advisory activities*, such as forms of research and development and financial or technical consultation. In the offshore wind sector, the management of the construction of the offshore wind farms is often the responsibility of two separate parties; a party which develops the electricity grid connection of the wind farm, often a national transmission system operator, and a project developer for the rest of the wind

farm, usually a commercial party. As such, managerial activities are separated into two categories: 'Project development' and 'Grid connection development'. Advisory activities can be separated into two categories based on their *commercial nature*. The first category are the non-commercial support activities, which in the offshore wind sector are generally 'Research and development' activities. The second category comprises the commercial support activities. As these activities are generally offered by consultancy or engineering companies in the offshore wind sector, this category is called 'Consultancy and Engineering'.

As such, eight categories of the value chain of offshore wind have been identified: Project development, grid connection development, research and development, consultancy and engineering, foundations manufactory, turbine and cable manufactory, transport and installation, and lastly operations and maintenance. These categories are visualized in Figure 5. Note that the while the categories are put in chronological order in the visualized value chain, this is a simplification. In reality, many of these activities overlap or are executed in parallel.

The next part of this chapter will give a concise overview of these categories of the value chain. A short introduction to the category will specify the activities which fall into this category. After that, some examples of important global companies involved in the category are given. Lastly, category specific barriers to export are presented.

Project development and ownership

This part of the value chain consists of the project development, financing, project management and sourcing of the wind parks, excluding their connection to the electricity grid. Offshore wind farms are large engineering projects, which show strong similarities to projects in the oil and gas sector. Consequently, parties operating in this part of the value chain are usually large energy companies that have the financial sources, experience in the oil and gas sector, and the project management skills to lead such large projects. While these parties are often private parties, some of the larger utilities currently involved in offshore wind (e.g. DONG Energy and RWE/Innogy) are partially owned by their respective state or local municipalities (DONG Energy, n.d.).

Examples of large companies that are currently active in this part of the value chain in the European offshore wind sector are Dong Energy (DK), Eneco and Shell (NL), RWE Innogy and E.On (DE), Centrica (UK) and Vattenfall (SE). Additionally, investment groups like Copenhagen Infrastructure Partners (DK), banks such as the Rabobank (NL) and funds like the UK Green Investment Bank Offshore Wind Fund (UK) are investing in wind parks, providing financing (Karcanias, Arapogianni, Zhao, & Musuku, 2015; Roland Berger, 2013; WindEurope, 2017). Large offshore companies like Van Oord (NL), Seaway Heavy Lifting (NL), DEME (BE) and Jan van Null (BE) are also sometimes asked to manage the projects (Appendix 1, xviii & 7, iv & v).

Barriers faced in this part of the value chain are strongly country-dependent. Most western (European and USA) offshore wind markets are open to project developers of other countries taking the lead in their projects, and projects developers are open to bid for offshore wind farms. An exception to this open approach of western countries is found in France, where the Danish company DONG has revoked its plans of participating in the French tenders, as it was not allowed to be the main project manager of these tenders (Renews.biz, 2013). In Asia, project development in Japan, Korea and China is typically done by local companies, whereas in Taiwan the market is open for foreign developers (Appendix 2).

Grid connection development

This part the value chain consists of the project development, financing, project management and sourcing of the electricity grid connection of the wind farms. This includes the export cables and substation. This part of the project is often part of the legal responsibilities of transmission system operators and as such is commonly managed by the national (or regional) transmission system operator (Appendix 1, xvi & vii). Another option is a system with Offshore Transmission Owners tendering for this part of the project (Schittekatte, 2016a), in which case the project is managed by the owners of the wind farms or a commercial party specialized in the construction of this part of the project.

The largest European parties in this part of the value chain are the transmission system operators of the countries that currently operate offshore wind energy. These are TenneT (NL) (Appendix 1, xvi) and its subsidiary company TenneT GmbH (TenneT, 2017), Energinet.dk (DK) (Appendix 1, vii) and Elia (BE) with its subsidiary company 50Hertz (50Hertz, n.d.-a). As these companies are state owned, they are generally non-commercial and as such do not export their managerial experience for financial gain (Appendix 1, xvi).

While the services of these companies are not sold commercially, they are very interesting for parties and countries that are starting the development of their own offshore wind systems. Non-commercial exchange of the knowledge of these parties with strategically chosen partners can open up opportunities for commercial parties in the countries that host and own these companies[2].

Research and development

This part the value chain consists of the non-commercial research and development activities in the offshore wind sector. As this part of the sector is one of the main responsible parts for the innovation in the sector, the activities of this part of the value chain are vital to the sector to keep a competitive edge and attract foreign investments. Activities in this category of the value chain indirectly add value to all other categories of the value chain.

Examples of companies and institutions that are active in this part of the value chain are universities such as Delft University of Technology (NL), Norwegian University of Science and Technology (NO) and Danmarks Tekniske Universitet (DK), research institutions and groups like ECN (NL), TNO (NL), Forwind (DE) and Frauenhofer (DE) and research collaboration programs such as GROW (NL) (Westra & Agterberg, 2016) and Megavind (DK).

This part of the value chain generally does not export its research for commercial gains, but instead supports all the other parts of the value chain in their functioning and competitiveness. Some of these parties are aimed at supporting a national sector, other parties aim to support the worldwide wind energy sector, usually aimed at accelerating the global energy transition. Cooperation with the sectors in other countries can strengthen a country's reputation in that country and lead to network opportunities which can support commercial parties from the research and development organization's country to find potential partners or clients in these countries.

Consultancy and engineering

This part the value chain consists of the consultancy and engineering activities and studies on the parcels (i.e. environmental impact assessments (EIAs) and seabed surveys performed by external parties at the parcels). These services rely heavily on the experience of the party exporting these services and can be requested by the developing country of an offshore parcel, but can also be hired later in the process by project or product developers. Note that most project developers and manufacturers also have their own internal services to perform some of these studies.

Examples of companies that deliver these kinds of services are engineering consultants like Rambol (DK), KCI (NL) and DNV GL (NO), management consultants like K2 Management (DK) and consultancy offices offering a wide range of services like Roland Berger (DE), BLIX (NL) and Windminds (NL). Examples of companies performing seabed surveys are Fugro (NL) and Bibby HydroMap (UK) (Roy et al., 2014).

The services in this part of the value chain are commonly contracted by either governmental agencies or project developers preparing and assessing the offshore wind parcels and projects. As such, companies in this part of the sector profit from a close relation with project developers (Appendix 7, i). The presence of a domestic project developer taking on projects abroad can help these companies to sell their services abroad. As these services only take a fraction of the value of an offshore wind project, they are usually not affected by local content criteria (Appendix 1, xiv). To adapt their services

[2] As confirmed in expert verification sessions with the Dutch Ministry of Economic Affairs and the Dutch Wind Energy Association (which included a representative of TenneT).

to the local environment, contact or collaboration with local stakeholders and consultancies is often required (Appendix 1, xix & 7, i).

Foundations manufactory

This part the value chain consists of the manufacturing of the foundations of the offshore wind turbines, including their transition pieces connecting the turbine to the foundation. Foundations form the base of offshore wind turbines and have to ensure the balance of the turbine, which makes them the heaviest part of the turbine and foundation construction. Due to the physical nature of these parts, transporting them to far markets is difficult and costly. Therefore, these parts are usually produced at or near the country that hosts the to-be-installed wind park (Appendix 7, vi). Note that the nature of foundations might change with the introduction of floating constructions.

Examples of companies that are active in this part of the value chain are SIF (NL), Bladt (DK), Smulders (BE), Ambau (DE) and EEW (DE). A consortium of Navantia (ES) and Windar (ES) are active in the development and production of floating foundations (OffshoreWIND.biz, 2017c).

Foundations thus face barriers in their exportability due to their physical nature. As foundations also form around 19 percent of the value of the construction of an offshore wind turbine (Wüstemeyer et al., 2015), they potentially face local content requirements as a criteria to enter certain markets (Appendix 1, xx) (local content requirements are explained under Turbine manufactory). Another physical limitation to the export of currently used foundation is that current technologies cannot be installed in deep waters (deeper than approximately 100 meters). Floating foundations look to solve this problem, but are currently not commercially viable.

Turbine and cable manufactory

This part the value chain consists of the manufacturing of the tower, nacelle, rotor and blades of the wind turbine. These components are also heavy, but transporting them to foreign markets is possible. The decision on whether to produce these components in a foreign market or domestically depends on the distance to the market and the projected pipeline of projects in this market. Typically, local construction of turbines is not interesting unless a pipeline of at least one GW of capacity is available in that country for the turbine producer. Most producers of turbines are able to produce all of the parts of the turbine (e.g. Siemens-Gemesa), but some work together with companies specializing in specific parts of the turbine (e.g. General Electric made use of the blades made by LM Power, and has now bought LM Power). Cables have similar characteristics in terms of manufacturing and are thus included in this part of the value chain (Offshore Wind Programme Board, 2015). Examples of companies that are active in this part of the value chain are the Siemens-Gamesa (DE/DK), MHI Vestas (DA), Senvion (DE) and Adwen (SP), of which Siemens-Gamesa and MHI Vestas have respectively a 68 and 16 percent market share in the European market (WindEurope, 2017). In China, Shanhai Electric, Envision and GoldWind are the largest producers of turbines (GWEC, 2017), which produce turbines primarily for the Chinese market (up to now). The largest European cable producers are Prysmian Group (IT) and DSW (DE).

The production of the turbine typically forms around 40 percent of the value of the construction of an offshore wind farm (Wüstemeyer et al., 2015). This includes the cost of the array cables. As turbines form a large part of the value of the construction of offshore wind farms, they are the primary part of the wind farm that faces local content criteria. Local content criteria are regulative barriers that state that certain components of a wind farm (or a certain percentage of the value of a wind farm) have to be produced locally. These are primarily aimed at local industrial development, and can lead to technology transfers to these foreign markets (Hu, 2017). Setting up local manufacturing complexes can thus be more cost efficient in large potential markets, but is often also mandatory for companies in order to operate in specific foreign markets.

Transport and Installation

This part the value chain consists of the transport and installation of the to-be-installed foundations, turbines and cables. Due to the large physical size of these components, transport and installation can

only be done by large specialized vessels, which require high up-front investments to be produced. Therefore, the amount of companies being able to perform such activities is limited.

Examples of companies that install foundations, turbines and cables are A2SEA (DK), Fred Olsen Windcarrier (DK), MPI Offshore (UK), Van Oord (NL), Seaway Heavy Lifting (NL), Boskalis (NL) and DEME (BE). Some of these companies are able to install all components of the wind farm, but most companies focus on specific parts of the installation.

The transport and installation of the components typically forms around 23 percent of the value of the construction of an offshore wind farm (Wüstemeyer et al., 2015). Transport and installation ships from Europe can usually operate in global markets, but face some regulative and technical restrictions in some specific markets. In the USA, the Jones Act makes operation for installation ships which do not work together with support vessels impossible (more on this in Appendix 2 and Appendix 1, xviii). In China, current offshore wind farms are installed in tidal or low-depth waters, for which the current European ships are usually not suited (Appendix 1, xviii & 7, v). Lastly, some countries require the use of local residents as part of the crew of the ships (Appendix 1, xviii).

Operation and maintenance
This part the value chain consists of the operation and maintenance activities of the turbines. This encompasses technologies to improve operation and maintenance of turbines, foundations and cables, logistics concepts and services offered for and by maintenance vessels. These activities can be separated into logistics, preventive maintenance and corrective maintenance activities (Brink et al., 2015).

The range of operation and maintenance activities in operation and maintenance is broad, and as such the range of companies active in this field is as well. The previously mentioned offshore wind installation companies offer a range of operation and maintenance activities. Additionally, companies like Seafox (NL), Boskalis (NL), Ampelmann (NL), A2Sea (DK), EDF Energies Nouvelles (FR) and Deutsche Windtechnik (DE) offer activities in this part of the value chain. In this part of the value chain, many SMEs are active offering specific services.

The value of operation and maintenance activities during the operation of a wind farm accounts for 25 to 27 percent of the total costs of installing and running the offshore wind farm (McKinsey&Company, 2016). Operation and maintenance concepts are well-exportable, but face many of the same difficulties that the installation part of the value chain faces; namely the regulative restrictions of the Jones Act and the technical difficulties with water depth in China (Appendix 1, xvii & ii). Another difficulty operation and maintenance companies face are local content requirements in the form of demands for local personnel on their vessels, which makes operating in foreign markets riskier and less attractive (Appendix 1, xvii). The sale of concepts can also run into problems with countries not respecting European patent rules, leading to unwanted technology-transfers (Appendix 1, x).

2.3 Global developments

After assessing the value chain of offshore wind, it is also important to assess what global developments are driving the growth of offshore wind, and in which countries this growth is expected. These two issues are addressed in this section.

2.3.1 Cost developments

Offshore wind has seen large reductions in its costs in the recent years. Looking at Europe, the offshore wind industry (especially the Dutch research programs) set themselves the goal of substantially reducing the Levelized Cost of Energy (LCoE) of offshore wind energy. The goal set in 2010 was to reduce costs by 40% in 2020, and another 40% reduction in 2030 compared to 2020, substantially lowering the industry's dependence on subsidies (Vos, 2015; Zuijlen, 2016a). The 2030 goal was exceeded in the Borssele tender in 2016 (Roland Berger, 2016), and tenders for offshore wind farms in Germany this year have seen the first tenders where the winners do not require subsidies for the construction and operation of the wind farms (Clark, 2017). These huge reductions of costs have propelled offshore wind energy from a subsidy-supported niche energy generation technology to a

technology that is becoming competitive with traditional energy generation technologies with commercial risks, and further cost reductions are expected (Bloomberg New Energy Finance, 2017). While technological advancement of offshore wind plays an important role in its falling costs, other important factors for these price reductions are shortly discussed hereafter. The factors expanded on below are identified by the Topsector Wind op Zee in collaboration with Ecofys (Hunkar, 2017) and Roland Berger (Roland Berger, 2016) and are focused on the cost reductions in offshore wind farms constructed or to be constructed in the period of 2010 to 2020.

Scale advantages
The capacity of offshore wind turbines has strongly increased. As offshore wind turbines are less bound by limitations like visibility and sound, compared to their onshore counterparts, upscaling of the turbines is a viable way to reduce operation and maintenance and installation costs (Roland Berger, 2016). Offshore turbines on the market have increased from 1.8 MW in 2010 to 8.5 MW currently, and the last tenders are banking on further increases in size of turbines up to 10 to 15 MW in 2023/2024 (de Vries, 2017; Huebler & Radov, 2017), leading to strong scale advantages resulting in lower costs.

Regulatory certainty
Offshore wind developments are strongly dependent on governmental commitments, as governments ultimately decide the possibly added capacity of offshore wind in their national waters. Long-term commitments are necessary to lower investment risks and making long-term research and development viable (Appendix 1, viii & xiv & 7, iii). Several north-sea countries have made long-term commitments to the roll-out of offshore wind farms, adding large capacities to their energy generation mix. The stable pipeline of projects has allowed for investments of companies in facilities and research programs, and reduced financial risks, lowering the cost of capital for the offshore wind sector (Roland Berger, 2016). A coalition of north-sea countries and companies active in offshore wind have signed a memorandum of understanding during the London Offshore Wind Energy conference, expressing their goal to increase offshore wind capacity in the North Sea by 60 GW in 2030, further increasing certainty in the market (Shankleman, 2017).

Competitive tender system
Several European countries have introduced a competitive tender system, where project developers bid for the height of the needed subsidy per unit of generated electricity. Additionally, the national transmission system operators take care of the grid connection of the wind farm (Appendix 1, xvi), and governmental agencies are generally responsible for the surveys of the to-be-tendered area. This tender system has been very successful in increasing the competitiveness of the European offshore wind industry, while lowering the risks of the developers by centralizing the grid connection and survey system (Roland Berger, 2016).

Cyclical factors
Additionally, some cyclical factors lower the cost of the current development of offshore wind farms. Current interest rates in financial markets are low, which lowers the costs for the development of offshore wind farms. Steel prices are low, lowering the costs for the manufacturing of the components of the wind farms. Oil prices are lower than the average in the previous decade, lowering the price and increasing the availability of offshore equipment and services (GWEC, 2017; Roland Berger, 2016).

2.3.2 Expected growth of offshore wind
With the recent cost reductions, a large growth in global installed offshore wind capacity is expected. Bloomberg's New Energy Outlook predicts a more than fivefold increase in globally installed capacity of offshore wind in 2030 (Bloomberg, 2017) (Figure 6). This prediction is however a purely economic prediction, and has not yet taken into account the substantial cost-reductions of offshore wind in the latest tenders in the Netherlands, Denmark and Germany, and as such is likely to be rather conservative. To get a better image of the developments of offshore wind globally, this study has gathered the predictions of primarily the Global Wind Energy Council, WindEurope, 4COffshorewind

and the Dutch Enterprise Agency regarding the growth of offshore wind in potential markets. An extensive analysis can be found in Appendix 2 and in the case studies in chapter five. A short description of the countries with the largest potential for offshore wind is given below, which are described in alphabetical order. Perceived market barriers are regarded from a Dutch perspective.

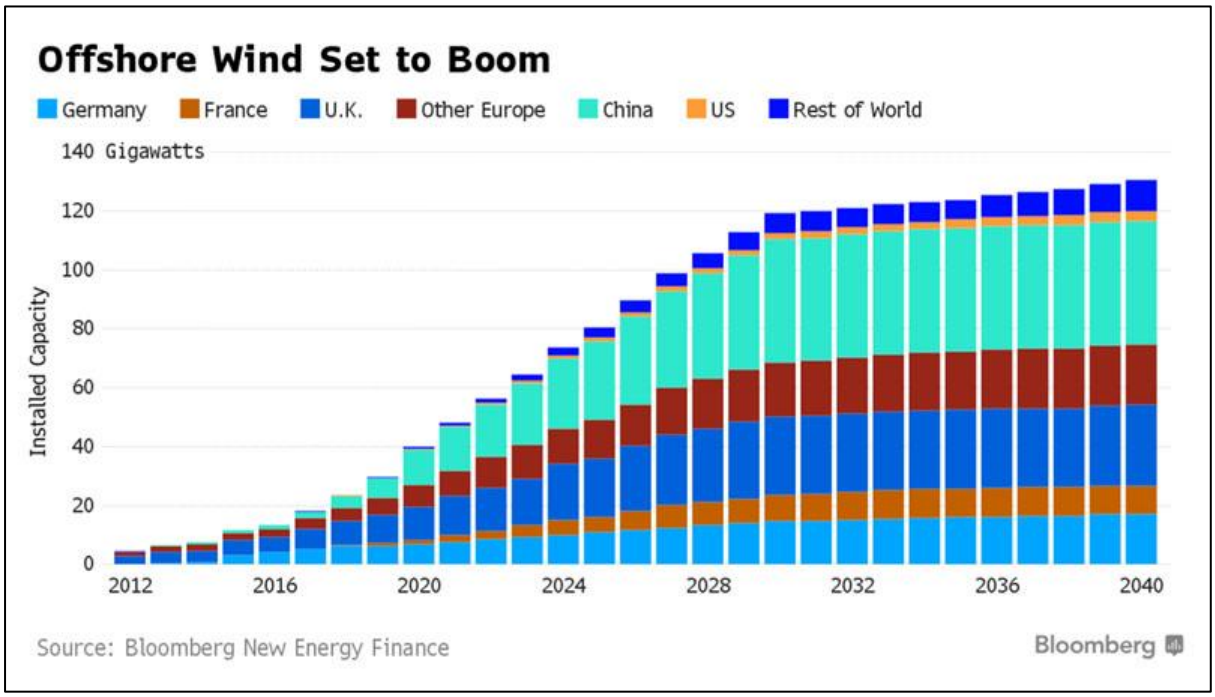

Figure 6: A cost-driven prediction of the global growth of offshore wind capacity by Bloomberg New Energy Finance

China has, as of January 2017, over 1.6 GW of installed offshore wind capacity (GWEC, 2017), which it is planning to expand to 5 GW by 2020, and up to 40 GW in 2030 (Bloomberg New Energy Finance, 2017). China is however a difficult market to access for foreign firms. Strong preferences for domestic developers, cultural and language barriers a non-acceptance of European patent laws make market access difficult and costly (Appendix 1, ix & xiii & x). Current Chinese offshore farms are located in intertidal or low water-depth waters which are unsuited for Dutch installation ships (Appendix 7, v).

Denmark currently has 1.25 GW of installed offshore wind capacity (4COffshore, n.d.-b), and is planning to install an additional 1.5 GW before 2021 (GWEC, 2017). Denmark has a strong domestic offshore wind industry, but is open to foreign firms entering the domestic projects.

France currently has no installed offshore wind capacity, but is planning to install approximately 7 GW of offshore wind capacity by 2030 (Dickson, 2017; PWC, 2017b). France is seen as one of the hardest European markets to enter as a Dutch firm (Netherlands Enterprise Agency, 2015b), with cultural barriers and local content criteria as main barriers (Appendix 1, xv & xviii).

Germany currently has 4.6 GW of installed offshore wind capacity, and is planning to install an additional 15 GW by 2030 (GWEC, 2017). Germany is open for foreign parties to participate in domestic projects.

Japan currently has 60 MW of installed capacity (4COffshore, n.d.-b), and has a 2.5 GW pipeline of projects, in different stages of development (GWEC, 2017). The Japanese market aims to have 400 MW of installed capacity in 2020, and 10 GW in 2030, of which 4 GW will be floating offshore wind (GWEC, 2017). Japan is open to cooperate with European companies, but joint-ventures are often required to overcome cultural- and language barriers (Appendix 7, ii).

South-Korea currently has 35 MW of installed capacity (4COffshore, n.d.-b), and is planning to install 400 MW by 2022 and another 2 GW by 2030 (GWEC, 2017). South-Korea is a relatively closed market,

which strongly favours domestic companies (Netherlands Enterprise Agency, 2015b). Joint partnerships with Korean companies with high degrees of technology transfer are often required to operate in the Korean market.

Taiwan is currently testing turbines (4COffshore, n.d.-b), and has a goal of 500 MW by 2020 and 3 GW by 2025 of offshore wind capacity (Hu, 2017). Taiwan is very open to western companies participating in the development of its offshore wind farms, and is often seen as a stepping stone to access the Asian market by companies (Appendix 1, xvii). Technology transfer is often mandatory when participating in the Taiwanese market (Hu, 2017).

The Netherlands currently has 1 GW of offshore wind capacity installed, and is planning to install an additional 11 GW before 2030 (GWEC, 2017). The Dutch market is very open for foreign companies and investors (Netherlands Enterprise Agency, 2015b).

The UK has, as of January 2017, over 5.1 GW of offshore wind capacity installed, and has consented approximately 12 GW of projects. This makes the UK the country with the current highest capacity of offshore wind (Dickson, 2017; GWEC, 2017). UK capacity is expected to exceed 9.7 GW in 2021 and 20 to 25 GW in 2030 (EWEA, 2015; PWC, 2017b). The UK market is very accessible for European players, but the UK is trying to set up its own manufacturing industry (Netherlands Enterprise Agency, 2015b; REVE, 2017). The Brexit creates market uncertainty, but is not expected to impact the development of offshore wind in the UK (Appendix 1, xx).

The USA currently has one small (30 MW) offshore wind farm (4COffshore, n.d.-b), but several states on the east coast are aiming to develop offshore wind farms, especially in the states of Massachusetts (Serreze, 2017), Maryland (AWEA, 2017) and the state of New York (State of New York, 2016). Prediction of the growth of the American sector vary widely, but at least 10 GW of installed offshore wind capacity is expected by 2030 (U.S Department of Energy & U.S. Department of Interior, 2016). The Jones Act and local industrial development criteria restrict activities in the otherwise very open American markets (Appendix 1, ii & xviii & 7, iv & v).

Other countries which are developing offshore wind, or are expected to develop offshore wind before 2030 are *Australia, Belgium, Estonia, Finland, India, Poland and Russia.* More details on these countries can be found in Appendix 2.

2.4 Conclusions

This chapter has looked at which goods and services can be exported to foreign markets in the offshore wind sector.

For this it has first looked at the components of wind farms and the technological developments in these components: The tower, nacelle, blades, foundations and the offshore grid connection. The production of the tower, nacelle and blades are sometimes done by separate firms, but sometimes also manufactured by one company. The turbine, foundation and offshore grid connection are generally manufactured by separate companies. While each of the components of the offshore wind farms is still seeing developments in terms of technology and scale, especially the introduction of floating offshore wind foundations has the potential to significantly change the global landscape of offshore wind.

After this, the chapter looked at the life-cycle of offshore wind farms to identify services in these life-cycle stages: The planning, design and fabrication, installation, operation and maintenance and decommissioning of the wind farm. Services in the planning phase are done by a mix of commercial and non-commercial companies. Services in the design and fabrication, installation and operation and maintenance stages or generally performed by commercial parties. The decommissioning stage was excluded from the study due to this stage not being prevalent in the wind farms currently operating.

The identified goods and services are categorized into groups that show similar characteristics when being exported, using a value chain approach. Additionally, supportive activities have been identified which are also relevant for the export of the offshore wind sector. While not all supportive activities are exportable for direct monetary gains, some non-commercial activities can support other

commercial parts of the industry to strengthen its international position and improve its competitiveness. European large companies in the value chain are primarily located in Denmark, Germany, the Netherlands, the UK, with Belgium, Norway and Spain also having companies in specific parts of the value chain.

With large cost reductions in the offshore sector due to technological development, scale advantages, regulatory certainty, the application of competitive tender systems and current low interest rates, oil prices and steel prices, the offshore wind market is expected to grow strongly in the coming ten to fifteen years. The main growth markets are expected to be China, Denmark, France, Germany, Japan, South-Korea, Taiwan, the Netherlands, the UK and the USA. Of these countries, China, Japan and South-Korea are hard to enter markets due to cultural and sometimes regulatory barriers. The USA can be difficult to enter for specific parts of the sector due to the Jones Act legislation. The European countries generally have low entry barriers, with France being a notable exception.

3. Governmental roles in export

The previous chapter has introduced the offshore wind technology and opportunities for several of its market segments. While the export of these goods and services leads to increased revenues or profits for the companies in the sector, these exports also benefit the countries hosting these companies. Increased exports of national companies lead to for example increased tax income and employment. As such, governments involve themselves in the stimulation of the export of these goods and services. This chapter will look into what roles governments fulfil in the stimulation of export of the offshore wind sector, which kinds of instruments they apply in these roles and in which stage of an export process these instruments are applied. Consequently, it aims to answer research question two: *"Which governmental roles can be distinguished for the stimulation of export in the offshore wind sector?"*.

3.1 Roles of governments in export-promotion

To understand what the roles of governments are in the stimulation of export it is important to understand why governments intervene in markets during export processes. The promotion of exports of a country can be seen as a part of a government's task to promote the welfare of a country, as an increase of the exports of a country can have a range of beneficial effects for the country exporting.

3.1.1 Governmental intervention

The promotion of exports is seen as an area of high priority for governments in both developing and developed countries, as increasing exports is seen as one of the main methods of stimulating domestic economic growth (Belloc & Di Maio, 2011; Giles & Williams, 2000). The resulting economic growth would lead to an increase in welfare for the exporting country in the forms of (amongst others) increased employment and income for both firms and the government (Dodaro, 1991). Exporting firms can, as a result of increased demand for their goods, take advantage of economies of scale and experience from foreign projects, potentially leading to local cost reductions (Belloc & Di Maio, 2011; Hinson, 2010). Additionally, increases in exports have a beneficial effect on a country's balance of trade (Pettinger, 2017) and exported technologies can serve as a display of national technological success (J. Lewis & Wiser, 2005).

Governments therefore intervene in the export domain, primarily aiming to reach two goals. In order to reach goals of economic growth, governments aim to increase the flow of exports (Belloc & Di Maio, 2011). General measures to increase export flows are however not always effective, and vast literature suggests that governments also play an important role in the selection of the sectors in which a country should specialize for exports (Belloc & Di Maio, 2011; Hausmann & Rodrik, 2003).

In the literature on international economic politics, governments intervening in the export domain is often associated with mercantilist systems, where governments stimulate the export of goods and discourage the import of goods in order to maintain a trade surplus (Acharyya & Kar, 2014; O'Brien & Williams, 2010). However, in current developed countries import controls and local content requirements for most sectors have been largely abolished. Export subsidies are globally regulated by the World Trade Organization, and in Europe by the European Union, and their use is severely restricted (Belloc & Di Maio, 2011; Czinkota, 2002; World Trade Organization, n.d.). While some of the goals of mercantilism regarding increased competition across states still form a motivation for the implementation of export promotion policy, typical instruments such as import restrictions and export subsidies used in mercantilism are less prominent nowadays. This limits the use of mercantilism to explain governmental intervention, and especially to explain the instruments currently applied by governments in export promotion.

Literature that approaches exports from an economic or international development perspective therefore commonly approaches governmental intervention in the export domain by looking at market failures (Bacchetta, 2007; Belloc & Di Maio, 2011). This literature generally assumes that free trade is a zero-sum or a positive-sum game and that governments can take away market barriers by addressing market failures, leading to an overall increase in welfare (Acharyya & Kar, 2014; Belloc & Di Maio, 2011). The justification for governmental intervention here lies with a range of theories. Infant industry

protection states that selective interventions can help young industries discover their latent comparative advantages by being able to utilize Marshallian externalities during the development of their sector (Harrison & Rodrígues-Clare, 2009). Market failures such as information and coordination failures within a market are costly to address for firms, as a large part of addressing these failures translates to positive externalities for the public instead of direct advantages to the firm itself, leading to potential underinvestment in this field (Subramanian & Lawrence, 1999). Governments can intervene by identifying sectors with comparative advantage, identify market opportunities, offer public information and improve information exchange between actors in a sector (Hausmann & Rodrik, 2003). Lastly, research and development activities are often a pre-requisite for the industrial development which can potentially lead to an industry that is able to export its goods (Diederich, 2016; Jacobsson & Johnson, 2000; Lund, 2009). Due to the lack of the short-term profitability of these activities, governmental intervention may be necessary to reach an optimal level of investment in such research and development activities for the development of an internationally competitive sector (Sung & Song, 2013).

3.1.2 The spectrum between market and hierarchy

Considering these previously mentioned justifications for governmental intervention in the export domain, the next part of this chapter will assess how governments intervene. Consequently, it will look at which governance processes are applied by governments. Governance and government are however terms which can have a broad range of meanings in the literature. To avoid ambiguity in this report, the terms government and governance as used in this report are defined hereafter, making use of Bevir's (2012) definitions.

Bevir states that governance is "the process of governing. It is what governments do to their citizens, but also what corporations and other organizations do to their employees and members" (Bevir, 2012). Following this definition, governments are not the only party that can govern. "Markets and networks of actors can also govern, produce coordination and make decisions" (Bevir, 2012). This study however focuses on the role of governments and thus looks at processes from a government's perspective. In this study, governments are defined as political institutions forming a governing body of persons in a state or region. Governance is defined as the processes of rule that this governing body applies. As this study serves to advise the Dutch Ministries of Foreign Affairs and Economic Affairs, within this study this definition of governments will primarily focus on governments on a ministerial level.

The processes of rule applied by governments are generally aimed to affect the social or socio-technical systems present in society (Borrás & Edler, 2014). For the realization of these changes governments often rely on societal private parties to deliver goods and services. While governments have a mandate to adopt (formal) rules and laws, and a limited amount of capacity to provide services and goods themselves, they are increasingly using other methods aimed to steer societal actors to behave in a way they see fit. The nature of these methods is switching from a more hierarchical way of operating, to a network or market approach, relying on negotiation and financial incentives. A switch from a leading government to a more steering government can be observed (Bevir, 2012). The governance instruments applied to reach a government's goals also reflect this; instruments used are less hierarchical and more focused on the steering of networks or markets. Note that the term hierarchical in this study is used to indicate a hierarchical position of a government in a system.

The divide between the hierarchy- and market-based nature of applied instruments is also found in the field of institutional economics. In this field, markets and hierarchies are understood as respectively horizontal and vertical coordination mechanisms, which can compete with or complement each other. Instrumentation is chosen based on considerations between revenues and costs, including the transaction costs related to the chosen instruments (Hazeu, 2000). Several authors use this public-private divide to construct a categorization of possible governance approaches.

In the field of organizational economics and industrial organization, Ménard (2012) uses this hierarchy-market divide to identify different classes of organizations. He argues that between the arrangements based on pure market relations and hierarchical arrangements that fall within 'firm boundaries' a range

of other organizational arrangements exist that he classifies as 'hybrids'. These hybrids are various forms of networks or alliances. The more hierarchical forms of these networks rely on contractual obligations, while the more market-based forms rely on third-party coordination or are information-based. Provan and Kenis (2008) argue that the hierarchical character of such networks also depends on the power-relations in the network. They identify three archetypes of networks, ordered from more to less hierarchical. Lead-organization networks consist of a structure that features one lead actor responsible for taking key decisions and coordination of the network. Network Administrative Organizations have a separate administrative entity, which governs the network and its entities. Participant-governed networks have no formal administrative entity and rely on typically uncoordinated efforts from those who have a stake in the networks success.

Note that a government's options to affect a network do not only rely on the type of the network, but also a government's position in that network. For example, a government participating in a lead-organization network in which it is not the lead actor has little means to utilize hierarchical methods of control and will be more reliant on informal forms of persuasion to further its goals.

Hisschemöller approaches these governmental options differently, and identifies four 'governance paradigms', which he defines as "fundamental concepts of viewing the dynamics of society and the way in which governments and/or governance can or cannot give direction to those dynamics" (Hisschemöller et al., 2006). Governance by government looks at governments performing activities safeguarding the public interest and covers a wide range of means and interventions. These range from governments establishing generic policies for innovation and supporting specific technologies, to governments acting as entrepreneurs by making large-scale investments in specific parts of a sector; interventions ranging from strongly hierarchical to steering interventions. Secondly, governance by policy networking relies on the government facilitation, formation and maintenance of policy networking consisting of socio-economic actors, emphasising a government's steering role in a network. Thirdly, governance by corporate business claims that the private sector should be the driving factor behind societal change, with especially corporate business determining policy priorities. In this strongly market-based paradigm, companies indicate where support for both private and public interest is necessary, which directs the application of governmental intervention. Lastly, governance by challenge looks at how governments can address rules, regulation and privileges, lowering thresholds inhibiting the intended change in society by removing the privileges of vested parties that inhibit societal change. The application of this paradigm strongly differs per sector; in some sectors, a heavily hierarchical approach is suggested. In other sectors this paradigm is largely focused on removing governmental influence.

The governance paradigms of Hisschemöller (2006) assess governmental approaches based on a policy claim relating to the strategic principles that the paradigm puts forward. Instruments used in these paradigms serve primarily as examples for the identified paradigms and vary widely in some of the paradigms. Ménard (2012) and Provan and Kenis (2008) approach governmental approaches by assessing the government's possible position in networks. While they focus on the position of governments in the networks and relate this to a government's opportunities to affect or steer these networks, they spend little attention to the instruments used for this steering. Decisions regarding the strategic principles of a government towards a sector and the position of the government herein are generally made on a political level, but for policy making on a ministerial level, it is especially information on the effective application of various instruments which can aid them in the execution of their tasks. Literature in the field of innovation policy commonly focuses on this level of policy.

3.1.3 Categories of instruments

Borras and Edquist (2013) make a categorization of policy instruments to affect innovation systems. They state that governments can use three kinds of instruments: Regulatory, financial and soft instruments. Regulatory instruments consist of laws, rules and directives. Financial instruments cover all forms of cash transfers, subsidies, taxes, but also tariffs and customs duties. Soft instruments focus on e.g. mutually developed codes of conduct, recommendations and private-public partnerships.

The regulatory instruments as identified by Borras and Edquist (2013) partially coincide with the instruments incorporated in the governance by challenge paradigm and governance by government paradigm of Hisschemöller (2006). In both cases, the government uses its position as a regulator to steer a system in a desired direction. The use of regulation signals the more hierarchical approach to these governance paradigms. Ménard (2012) also identifies organizations which make use of formal authority as the most hierarchical form of his hybrids. The government making use of its role as regulator can thus be seen as a government making use of a hierarchical type of instrumentation.

The financial instruments identified by Borras and Edquist (2013) coincide with the governance by government and governance by corporate business paradigms of Hisschemöller (2006). In the governance by government paradigm financial instruments are utilized to ensure the supply of public goods. This is done by either supporting specific technologies using means like subsidies or acting as a procurer of projects or public goods. In the governance by corporate business the demand and deployment of such support instruments is determined by the private sector instead of driven by public needs identified by governments. Other than instruments used for domestic procurement of goods and innovation, in the export domain traditionally financial instruments such as export subsidies, tariff barriers, taxes and customs duties are applied (Belloc & Di Maio, 2011; Czinkota, 2002). Financial instruments differ strongly in their market-based or hierarchical nature but are generally aimed at steering or facilitating, rather than obligating, actors in the private sector. Therefore, a government making use of financial means to stimulate or steer a sector can range between a very market-based approach (subsidies or general tax-cuts for innovation) to slightly hierarchical approach (tariff barriers or governmental procurement).

The soft instruments that Borras and Edquist (2013) mention mainly concern the government's role as a network player, using soft power instead of financial or regulative means, to steer and influence players in the market. This form of governance relies on persuasion of the stakeholders in a network, or on aligning their interests to meet a shared goal. The government takes a role as coordinator and facilitator. The usage of such instruments is emphasised in Hisschemöller's (2006) governance by policy networking paradigm. Ménard (2012) views the use of these non-formal agreements as a less hierarchical form of governing an organizational structure. The nature of the instruments applied depends strongly on the role and position of governments in the network (Provan & Kenis, 2008), but generally the character of this method of governance is less hierarchical than regulative methods (yet can be highly hierarchical in cases where a government utilizes a 'shadow of hierarchy' approach). Governments which have a role in information-based networks can rely strongly on market-based instruments (Ménard, 2012), and as such this category of instruments fall between the hierarchical regulative role of government and a market-based approach of governance.

The three categories of instruments described in the last paragraphs emphasise a government's ability to steer or direct actor in the private sector and other non-governmental organizations, and can be seen as "a set of techniques by which governmental authorities wield their power in attempting to ensure support and effect (or prevent) social change" (Borrás & Edquist, 2013). As such, they describe forms of governance which fall between a purely hierarchical or purely market-based form of governance.

Looking at the two extremes of the spectrum, a purely market-based organizational structure would imply that governments do not intervene with markets, and as such the government has no relevant instruments nor role. However, Ménard (2012) describes a purely hierarchical organizational structure as falling between 'firm boundaries'; a purely hierarchical method of governance would be a government acting as a firm, taking the role as an executive party in a sector. This role partially coincides with Hisschemöller's (2006) governance by government paradigm, where governments ensure the supply of public goods.

However, in Hisschemöller's governance by government, governments procure goods and do not produce them. When looking at global value chains and global production networks, Horner (2017) notices an increasingly prominent role of governments as buyers in the last couple of years (in the form

of public procurement), but also as producers (in the form of state-owned enterprises). In the field of renewable energy, governments often take up this role as executive party in the form of innovator (e.g state-owned research agencies), supplier of public goods- and services (e.g. state-owned transmission network operators) and as the executive party of market exploration activities (e.g. in the form of embassies and consulates). A fourth category of instrumentation is thus identified, in which a government takes up the role of an executive party in a sector.

3.1.4 Roles of government

Governments can thus utilize different forms of governance to affect systems in the export domain, but governments itself are also part of these systems. Therefore, in this study the roles of governments in these systems are discussed by assessing their utilization of instruments. In the previous subchapter four roles of governments have been identified: A government taking up the role as an executive party in a sector, *the executive role of government,* a government making use of its position as regulator, *the regulative role of government,* a government making use of soft instruments to steer networks in a sector, *the networking role of government,* and a government utilizing financial incentives to steer a sector, *the financing role of government.* A short description of each role is presented below.

Note that governments generally fulfil a combination of roles in the realization of a policy goal, yet the prominence of these roles differs per goal and per sector.

The executive role

In the executive role, a government uses its own internal sources to deliver a good or a service. These internal sources can consist of civil servants working at ministries or executive governmental branches, but can also exist in the form of state-owned companies. In this role, the government can have complete control over the processes that are in place, although commonly the executive parties are given a certain degree of freedom in the execution of their activities. Within this role, it can choose to take charge of a part of a sector, or it can choose to offer facilitative services to market parties in the sector. Services and goods offered by companies owned by the government, such as state-owned transmission system operators, are considered within this role.

The regulative role

In the regulative role, a government uses its mandate to form formal laws and rules to restrict or enable behaviour of the private and non-profit sector. With these rules and laws, governments "define the framework of interactions taking place in the society and in the economy" (Borrás & Edquist, 2013). Within this framework, parties are free to act. The strictness of this framework determines where the balance between its hierarchical or its free market character lies. Not all rules come directly from the government. A government can stimulate a sector to develop its own formal standards and rules, using its position of having the right to implement these rules themselves as a shadow of hierarchy. Such formal standards and rules are considered within this role as well.

The networking role

In the networking role, a government uses informal processes to affect the organization of and coordination between stakeholders in a sector. The type of networks, and the role of the government in these networks determines how hierarchical this approach is. A government as a lead actor in a lead-organization network will be more hierarchical than a government that takes place in a participant-governed network. Public-private partnerships with commercial, non-governmental owned companies are considered within this role as well.

The financing role

In the financing role, a government uses financial support, incentives or disincentives to steer a sector. Financial support can be directly given to specific players in the sector to support a function not covered by the market (such as the support of trade organizations and research institutions). Incentives and disincentives can for example stimulate research and development, and can either aim at steering the sector to develop certain technologies or provide general support to a sector. The financial role is

strongly based on stimulating market-driven dynamics, and as such the financing role is usually not a very hierarchical role.

3.1.5 Domains of the governmental roles

As noted before, these governmental roles all have their respective character, based on a more hierarchical approach or a more market-based approach. However, due to the varying nature of the instruments applied in these roles the character within these roles also varies. In Figure 7 an illustration of the character of the respective governmental roles is presented. The most hierarchical approach is found in the executive role, where a government has full control over that a part of a sector. However, heavily regulated market parties can theoretically be more hierarchically steered than more independent state-owned companies. More market-based approaches can be found in the networking and financing role.

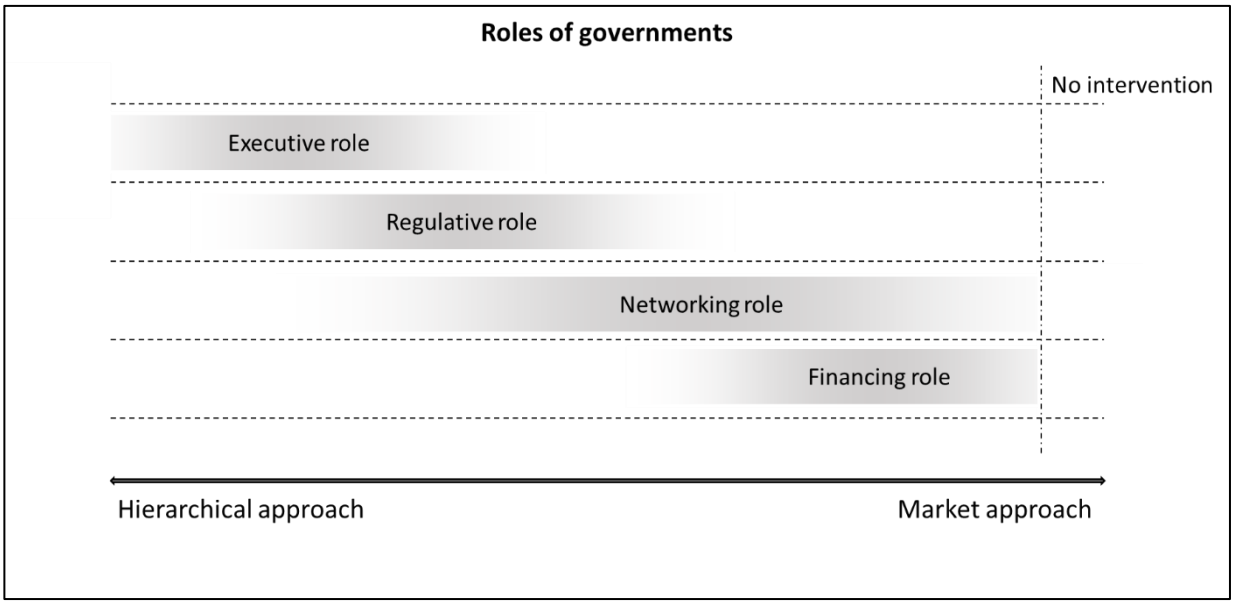

Figure 7: The theoretical domains of the governmental roles on a scale from fully hierarchical to fully based on market mechanisms

3.2 The export process

When analysing governmental roles in the export domain it is important to delineate what exactly encompasses the export domain. A narrow view on export promotion exports would only consider instruments specifically designed to promote the export of a certain sector, or even of a certain technology. A vast body of literature focuses on the analysis of these instruments, looking at for example (the organization of) trade missions and shows, export credit guarantees and similar financial incentives, export promotion agencies and services offered by embassies and consulates (Badinger & Url, 2013; Barneveld van, 2014; Durmuşoğ lu, Apfelthaler, Nayir, Alvarez, & Mughan, 2012; Kanda et al., 2015; Lederman et al., 2010). Most of these studies are aimed at quantifying the efficiency of these methods, and most of them find that in specific settings each of these instruments can have a positive effect on the exports of their respective markets (Spence, 2003).

However, when looking at literature concerning instruments used to protect infant industries (Belloc & Di Maio, 2011), or stimulate specific sectors for future exports (Dunn & Mutti, 2004), traditional tools like export subsidies and import tariffs are becoming less prevalent due to stricter global regulation. Still wanting to support specific industries in their global competitiveness, governments are applying subsidies which stimulate the innovation and domestic development of their firms, which leads some authors to question whether these subsidies should also be considered as instruments for export promotion (Snape, 1988). Vast literature confirms that the stimulation of innovation and development of domestic sectors lead to significant increases in export (Diederich, 2016; Jacobsson & Johnson, 2000; Lund, 2009) in specific sectors (D'Angelo, 2012). Domestic stimulation of onshore wind has led to large export industries (J. Lewis & Wiser, 2005), and strong domestic support for

innovation and deployment of eco-innovation is necessary for the export of these technologies (PBL, 2016), which is also the case for offshore wind (TKI Wind op Zee, 2013).

Considering the importance of innovation and domestic development in the promotion of export for the offshore wind sector, this study takes a broad view and considers them part of the export domain. This however diversifies the instruments applicable to the stimulation of exports in this sector covered by this study compared to an approach only taking into account direct export promotion services. As the nature of the instruments used to stimulate the innovation of the sector (e.g. subsidies) and the facilitation of the entry of foreign markets (e.g. trade-missions) differs greatly, instruments or roles supporting the whole of this process are hard to identify. This study will therefore look at which parts of the export process, which ranges from the conception of an idea to the successful export of a product, require which means of support.

3.2.1 Commercialization

Most authors in the field of innovation policy focus on the innovation system of a country (Hughes, Dogson, Foster, & Metcalfe, 2009; J. Lewis & Wiser, 2005), but generally do not take in account the stages after the commercialization of the technology. Lund (2009) describes this commercialization process and support mechanisms but also describes possibilities for technology diffusion to foreign markets as a part of possible market growth strategies. He however focuses on the commercialization process and views foreign market entry as a separate process. The commercialization process of Lund is a chronological process from conception of an idea to its introduction to a market (see Figure 8). This process of Lund is adapted to only feature the relevant stages for export products. If the stages of entering a foreign market are added, this can serve as a framework to identify which stages of this process can be supported to more successfully innovate and export.

3.2.2 Market entry

For these missing stages, literature regarding foreign market entry is consulted. Most of this literature is focused on market entry from a business' perspective and looks at success factors when entering a market (Darling & Seristö, 2004; Murray, Gao, & Kotabe, 2011). It identifies steps a firm has to take, but does not identify stages on a similar level of abstraction to those of Lund's commercialization process (Lund, 2009). Lund's own description foreign market entry is also unsuitable. Is it looks at possible paths a firm can take when entering domestic of foreign markets, yet does not look at their chronologic order, nor are these stages on the same level of abstraction as Lund's commercialization stages. It identifies the possibility of entering a foreign market, but does not focus on the process of entering a foreign market itself. Literature that does focus on this process usually separates the stages of exploring the potential of the market, finding the right way to enter a market, and establishing businesses in this market (Darling & Seristö, 2004).

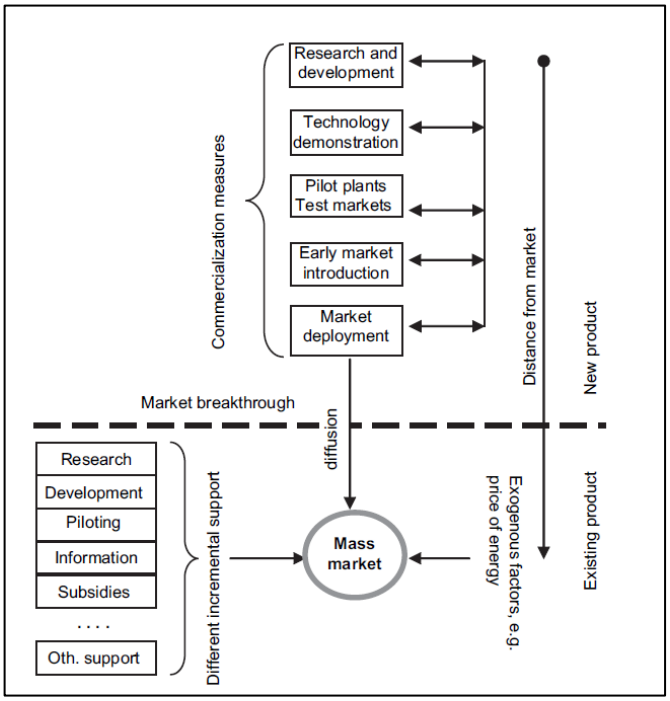

Figure 8: Lund's illustration of the commercialization process for new energy technologies

The exploration of a market before entry is vital to the success of the firm entering the market. Gaining an understanding of a market before entry enhances the chance of success in this market. However, delaying entry can mean potential revenues are lost, and competitors have a chance to establish a foothold in the market before you do (Sheard, 2014). Important data of foreign

markets can for example be information about the market potential of the foreign market, or the legal environment of the foreign market (Robertson & Wood, 2001).

The entry of a foreign market can take place in several ways. Root (1994) calls these 'foreign market entry modes', which he defines as "*an institutional arrangement that makes possible the entry of a company's products, technology, human skills, management or other resources into a foreign country*". Gunnarsson (2011) identifies several categories of foreign market entry modes: Export modes (direct and indirect exporting of goods), Contractual entry modes (licensing, franchising, contract manufacturing, management contracts and turnkey construction contracts) and Investment entry modes (foreign direct investments, acquisition and international joint ventures). Different products and services will use different market entry modes, and will thus face different market entry barriers. Governments can support their companies in overcoming (some of these) market barriers.

This exploration of the market, as well as these market entry modes, usually require communication with local stakeholders. Finding and contacting the right stakeholders can be difficult, and can form a substantial part of a firms' transactional costs towards entering a new market. As such, many events and support mechanisms aim towards lowering these thresholds. Such support mechanisms exist in for example the shape of translation services, trade shows, trade missions and embassy networks facilitating firms in finding relevant local stakeholders (Kanda et al., 2015; Lederman et al., 2010).

After a foreign market has been explored, and the correct contacts have been established for the appropriate market mode, the actual exporting will start. Depending on the method of market entry, this stage often requires high investments which can carry risks for the investing party. Such investments can be supported by several instruments, which can reduce risks and lower investment barriers. For example, one of these instruments that are commonly used is export credit guarantees, which protect investors from non-payment of a client in a foreign market (Badinger & Url, 2013).

Concluding, the following stages have been identified where national governments can support the entry of a firm in a foreign market: Exploring the market, connecting with relevant stakeholders and starting to export.

3.2.3 The full export process

Now that the stages of the foreign market entry have been identified, they can be combined with an adapted version of Lund's process of the commercialization of a technology. For this, one more step needs to be taken regarding the simplification of Lund's process. Lund's process has four stages before reaching a stage of commercialization of the mass market (and thus a total of five steps). The first step, research and development, also applies for innovations that lead to export. The second step, technology demonstration, and the third step, pilot plants & test markets, both encompass the testing process of the technology. To maintain a level of abstraction that fits the earlier identified stages in market entry, stage two and three are merged to one stage, called 'testing'. The fourth and fifth steps, respectively the early market development and market deployment, both entail the development of the technology on the domestic market, and are also combined to one step called domestic market development.

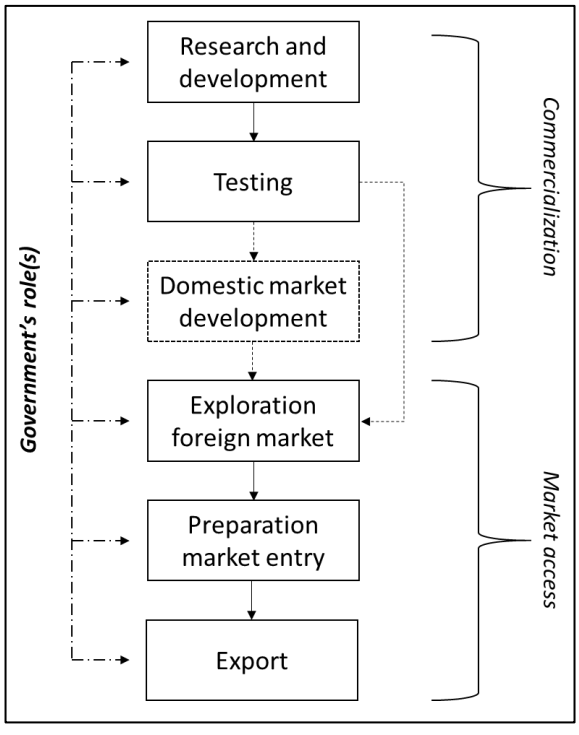

Figure 9: The visualization of the six consecutive stages of the export process

While there is an important relation between the success of a technology on the domestic market and its success in foreign markets (Lund, 2009; PBL, 2016), the

stage of development of a domestic market is not always necessary. It is possible to develop technologies purely aimed at foreign markets.

Combining the adapted version of Lund's commercialization process with the stages identified for foreign market access thus yield a process of six steps: Research and development, Testing, Domestic market development, Foreign market exploration, Market entry preparation and Export. Of these steps, the domestic market development can be skipped in the case of some technologies. This is illustrated in Figure 9.

Now that the different stages of the export process have been identified, the next part of this chapter will look into how these are linked to the different governmental roles, and which instruments are used during these stages.

3.3 Research framework

After the different stages of the export process have been identified, the presence of the governmental roles and their respective instruments per stage of the export process can be analysed. For this analysis, a framework is constructed cross-linking the stages of the export process to the different governmental roles. For each of the stages of the export process, the presence of the various governmental roles is evaluated. The evaluation of the governmental roles in an export stage can possibly lead to a policy advice. This framework can thus be applied to an offshore wind sector (or comparable technology) in order to evaluate the utilized governmental roles and instruments.

3.3.1 Structure of the framework

The structure of the framework follows from its purpose. As the application of governmental roles is studied per stage of the export process, the stages of the export process are put on the vertical axis of the framework and the governmental roles are put on the horizontal axis. The intersecting cells represent search areas, in which governmental instruments and approaches in the studied sector are described. By comparing a horizontal row of cells, the prevalence of governmental instruments in the respective export stage can be evaluated. By doing so, possible policy recommendations for that stage can be derived. These are represented by a separate column on the right side of the framework. A visualization of this framework can be found in figure Figure 10.

	Executive	*Regulative*	*Networking*	*Financing*	--->	*Policy advice*
Research and development						
Testing						
Domestic market development						
Foreign market exploration						
Market entry preparation						
Export						

Figure 10: The research framework which combines the identified roles of government to the six stages of the export process

3.3.2 Instrumentation in roles and search areas

Combining the stages of the export process and the governmental roles has led to a framework with 24 search areas. These search areas each theoretically have a range of possible instruments available for governments to utilize. Before applying the framework to a case or sector, it is important to define which instruments or governmental constructs are considered a representation of each search area (i.e. the operationalization of the framework). As such, the following part of this chapter will expand on the instruments used in each of the search areas. This is done by first looking at which tools are available in each role of government, and where these tools are commonly applied in the export process. From there a range of tables is presented with a short definition of the tools in each search area and with examples of these tools.

Note that some governmental solutions warrant the use of several governmental roles. For example, when offering test locations for offshore wind farms governments generally regulate the use of the

locations (regulative role) but also offer financial incentives to parties executing the testing activities (financial role). In these cases, the different aspects of these governmental interventions will be dealt with under their respective governmental roles.

3.3.3 Instruments in the executive role

Governments commonly choose to take charge of the provision of a good of service in order to safeguard the public interest. This takes place when the situation concerns the provision of public goods (or services) (Hisschemöller et al., 2006) or when the provision of the activities, goods or services yields too little pay-off for private parties, yet has large public benefits (Belloc & Di Maio, 2011). A government is considered to make use of the executive role when it supplies goods or services which fall in the categories of the value chain defined in the previous chapter, or when state-owned agencies or organizations offer goods or perform activities for actors in the private sector. If these goods and services are produced and executed by non-state-owned organizations but are supported by the government, this is considered to be governmental steering or support falling under the other roles of government.

When considering the offshore wind sector, several commonly applied forms of executive governments are identified. Governmentally executed research, development and testing projects can be performed by executive governmental agencies (such as the Netherlands Enterprise Agency and the Danish Energy Agency) or governmentally owned research organizations (such as the Bundesanstalt für Materialforschung und -prüfung in Germany). Transmission system operators are often state-owned and perform their own research, development, testing and domestic market development activities regarding the offshore electrical grid (e.g. TenneT in the Netherlands (TenneT, n.d.-c), Energinet in Denmark (Energinet.dk, n.d.)). Governments can choose to export the knowledge gained during these activities to improve government-to-government cooperation, potentially finding business opportunities for domestic companies.

Looking at the market access stages of the export process, governmental agencies in the form of embassies, consulates, chambers of commerce and other governmentally owned trade promotion organizations offer a range of goods and services aimed at supporting the private sector's access to foreign markets (Barneveld van, 2014). Commonly offered services are the organization of trade missions, fairs and shows, export consultation meetings with potential exporters, various forms of information on foreign markets and international branding services or platforms for export-sectors (Belloc & Di Maio, 2011).

Lastly, some governments choose to found their own organizations offering various forms of export financing (as opposed to collaborating with private-sector parties offering these goods) (Badinger & Url, 2013), which supports companies during the last stage of the export process.

3.3.4 Instruments in the regulative role

Governments can use regulative instruments to affect social or market interactions. The field of regulative instruments is very broad, yet this study focuses on regulative instruments which are related to the offshore wind sector. Higher-level regulatory instruments such as free-trade zones, export processing zones or other country-broad regulation are unlikely to be changed as a result of developments in the offshore wind sector alone (Dunn & Mutti, 2004), nor to be implemented on a ministerial level. Therefore, this study will look into regulation stimulating or restricting the innovation and deployment of offshore wind, regulation or contractual agreements with inhibit or stimulate foreign market access for the offshore wind sector, and regulation which would impede the export of offshore wind goods and services.

Regulation in the commercialization part of the export process generally takes place in the definition of market conditions for innovation and domestic deployment (Borrás & Edquist, 2013). Research and development can be stimulated by affecting the regulation around the nature of research organizations, allowing them to perform commercial activities (Borrás & Edquist, 2013). The innovativeness of a domestic sector can also be enhanced by implementing stricter environmental regulation (Diederich, 2016) or other standards for to-be-developed domestic projects. At the same time, these can inhibit

domestic growth of an industry (or increase its reliance on subsidies). The regulation regarding the construction of offshore wind test locations and farms also strongly determines the opportunities for testing and domestic growth. Lastly, local content requirements can protect a nation's infant industry, yet their use is strongly discouraged by both the World Trade Organization and European Union (Belloc & Di Maio, 2011; Eikeland, 2011).

Looking at the foreign market access stages of the export process, most regulation to encourage trade is high-level and generally country-broad instead of industry-specific. While trade-agreements are too high-level, ministries and other governmental agencies (as well as businesses) often sign formal agreements for cooperation in certain sectors. These documents are often in the form of memorandums of understanding, which stimulate industrial cooperation and open up opportunities for domestic parties to engage in foreign markets. Lastly, some industrial sectors face specific visa-regulations, of which the regulatory strictness differs.

3.3.5 Instruments in the networking role

In the networking role, a government steers and connects actors in the private sector (or other non-governmental organizations) in order to further its goals. The role of the government depends on the type of network and on the government's position in this network.

Activities in research, development and testing can be stimulated by improving cooperation in a sector and by enhancing a sectors coordination by for example setting common goals for innovation (Smits & Kuhlmann, 2004). Sectorial research and development programs are common on both national and international levels in the (offshore) wind sector (e.g. the Danish Megavind (Danish Wind Industry Association, n.d.) and the European Horizon 2020 Wind program). Additionally, international innovation networks can enhance international cooperation stimulating innovation in a sector (Federal Ministry of Education and Research, 2014). Governments can position themselves as main organizing actors of these programs, choose to steer and cooperate with these programs or leave these programs to the private sector.

Trade organizations can connect stakeholders of a sector and stimulate cooperation, coordination and information exchange between actors in a sector, both promoting research, development and testing, domestic development of a sector and sometimes feature their own export-promotion programs. The tasks of these organizations and the role governments have in these organizations differs per sector and country. Specific tasks such as the branding of a sector, export promotion (from e.g. trade promotion organizations) or the stimulation of the cooperation between small- to medium-sized enterprises and large companies are sometimes executed by separate organizations (Belloc & Di Maio, 2011; Danish Wind Export Association, n.d.; State of Green, n.d.-a). The delegation of these tasks to non-governmental organizations, often in the form of private-public partnerships, is considered as governmental steering from a government's networking role. This often happens in combination with governmental financing of these initiatives.

Next to their ability to execute their own activities, international delegations of governments in the form of embassies, consulates and similar organizations also perform a bridging function between national and foreign companies or organizations. Lastly, governments have to option to improve the coordinating the activities of exporters, potentially leading to cost-reductions or package deals for foreign markets (Belloc & Di Maio, 2011; Smits & Kuhlmann, 2004).

3.3.6 Instruments in the financial role

In the financial role a government uses financial (dis)incentives to steer private parties and non-governmental organizations. Similar to the regulative instruments, a government can utilize a wide range of instrumentation to steer its sector and enhance its ability to export (Borrás & Edquist, 2013). Instruments such as currency controls, import duties, tariff duties and export subsidies on specific goods can be used to stimulate export (Dunn & Mutti, 2004; O'Brien & Williams, 2010), yet are prohibited or discouraged by the World Trade Organization and the European Union (Belloc & Di Maio, 2011; Dunn & Mutti, 2004; Snape, 1988). These high-level instruments thus fall outside the scope of this study.

Research, development and testing is commonly supported by subsidies, in forms such as direct subsidies to projects, tax-reductions on innovative firms or low-interest loans (Belloc & Di Maio, 2011; Borrás & Edquist, 2013; Michaelowa, 2005; Snape, 1988). These subsidies can be ascribed to specific projects or technologies, can be awarded to research organizations or can be applicable to all companies in a country. Reimbursements for private companies to have research performed by independent research organizations can also stimulate the innovation and the domestic development of a sector.

For the development of its domestic sector a government can offer a range of financial incentives to its companies. While direct subsidies for individual companies are uncommon (and in the European Union generally illegal due to state-aid regulation (The European Commission, 2008)), a government can offer general forms of financing like seed- or venture capital and low-interest loans (Belloc & Di Maio, 2011; Czinkota, 2002). Export credit guarantees and other financial products aimed to reduce the risks of exporting are generally supported (or offered) by governments, often in cooperation with commercial companies (Badinger & Url, 2013).

Additionally, a government can choose to financially support trade organizations or other export promotion organizations, which often happens in the form of private-public partnerships (Risse, 2002; Velotti, Botti, & Vesci, 2012). Individual activities like the visiting of trade fairs, missions or conferences are also commonly incentivised with (partial) financial reimbursements for participating parties (Spence, 2003; Wilkinson & Eliot Brouthers, 2000).

3.3.7 Instruments per search area

The previous subchapters have described the instruments that governments can utilize in the different governmental roles and has indicated where in the export process these instruments are generally utilized. What can be noted is that some instruments are useable in more than one export stage. For example, trade promotion organizations are active during both the *foreign market exploration* and the *preparation market entry* stages. Therefore, when assessing the possible instruments, some search areas in the table show that similar instrumentation are combined. A definition of each search area, the identified instruments useable in theses search areas, and (potential) examples of such instruments applicable to the offshore wind sector are presented in Table 1, Table 2, Table 3 and Table 4.

Concluding, this chapter has identified four governmental roles, six stages in the export process, and has linked them in a framework which can be used to assess the roles and instruments applied by governments in their offshore wind sector. The next chapter will look into the methodology applied in the rest of this study.

Executive role

Phase	Description	Instruments	Example(s)
Research and development	Governmental agencies performing their own research and development activities	State-owned transmission system operators, governmental executive agencies and governmental research organizations performing research activities	Bundesanstalt für Materialforschung und -prüfung (GE) performing research activities
Testing	Governmental agencies testing concepts to bring them to the market	State-owned transmission system operators, governmental executive agencies and governmental research organizations performing testing activities	Testing of HVDC cable technologies by TenneT (NL)
Domestic market development	Governmental agencies or state-owned companies providing a good or service in the domestic market	State-owned transmission system operators developing the offshore wind farm electricity grid	TenneT (NL) developing offshore electricity infrastructure
Foreign market exploration	Governmental agencies exploring opportunities in foreign markets	Market exploration studies, exploratory trade missions and organization of trade fairs and shows organized by governmental agencies	Market research performed by embassies and consulates
Market entry preparation	Governmental agencies contacting or facilitating contact with local actors	Trade missions, business scans, branding activities organized or executed by governmental agencies	Trade missions accompanying state visits organized by the Dutch Ministry of Affairs
Export	Governmental agencies exporting goods, methods and / or services or executing services supporting these activities	Export of research findings, regulatory frameworks and procedures, governmental organizations offering export credit guarantees	Sharing of knowledge on tender procedures between European governments

Table 1: Description and examples of the executive governmental role in different stages of the export process

Regulative role

Phase	Description	Instruments	Example(s)
Research and development	Rules and laws stimulating market parties to perform research and development activities	Regulatory framework around governmentally funded research organizations, national or project specific standards for domestic market, regulation on patents	Allowing commercialization of R&D activities. Enforcing stricter environmental regulations for tenders
Testing	Rules and laws allowing and stimulating the testing of goods and services	Regulatory framework on the availability, construction and utilization of test facilities	Availability and regulatory framework around offshore wind test sites at Borssele V
Domestic market development	Rules and laws shaping, stimulating or restricting the growth of a domestic market	Regulatory framework on the opportunities and restrictions on constructing offshore win farms nationally, local content requirements	Dutch government deciding on the roll-out of offshore wind parks in the domestic market through tender procedures
Foreign market exploration & entry	Rules, laws and formal agreements stimulating or discouraging market exploration and entry preparation activities	Formal agreements of government-to-government cooperation or formal agreements of government-to-sector cooperation	Memorandums of understanding between the Dutch offshore wind sector and the Korean and Japanese sector
Export	Rules and laws that stimulate or restrict the export of goods and services	Sector-specific visa regulation	Visas for ship personnel operating in foreign seas

Table 2: Description and examples of the regulative governmental role in different stages of the export process

Networking role

Phase	Description	Instruments	Example(s)
Research and development & testing	Governmental influence in the formation, steering or leading of innovation networks	Governmental participation in international innovation networks, national research projects and international research projects	The topsector's Offshore Wind's GROW program (NL)
Domestic market development	Governmental influence in the formation and upkeep of trade organization and other forms of (cross-)sector cooperation	Governmental participation in trade organizations, governmental influence in linking programs for companies in domestic sector	Innovatielink connecting small and large companies (NL)
Foreign market exploration & entry	Governmental influence in the exploration and the formation of contacts and entry modes for foreign markets, branding of sector	Embassies and consulates connecting domestic and foreign parties, national branding initiatives, trade promotion agencies	Network and consulates with a local network connecting national companies to foreign partners, following market developments, Danish government co-founding of State of Green
Export	Governmental influence in the coordination and negotiation during export	Coordinating programs connection exporting actors	Stimulation of cooperation of national actors to offer a full package of goods and service in installation and O&M

Table 3: Description and examples of the networking governmental role in different stages of the export process

Financing role

Phase	Description	Instruments	Example(s)
Research and development	Financial incentives to research and development programs and activities	Subsidies, tax-cuts and low interest loans for research and development activities. Reimbursements for external research and development activities	The subsidy package 'Hernieuwbare energie regeling' of the Dutch government
Testing	Financial incentives and risk coverage for testing activities	Subsidies, tax-cuts and low interest loans for testing activities. Reimbursements for external research and development activities, (higher) subsidies for products made by test-facilities.	SDE subsidy to innovation parcel Borssele V (NL)
Domestic market development	Financial incentives and risk coverage for developing goods in domestic market	Subsidies, tax-cuts and low interest loans for the development of renewable energy projects, seed- and venture capital	Subsidies schemes for national wind parks
Foreign market exploration & entry	Financial incentives stimulating market exploration and entry activities	Funding and reimbursements for parties organizing and participating in trade shows, fairs and trade missions. Reimbursements for expert consultation costs during export.	Subsidies to organizations arranging trade missions and foreign networks through the 'Partners in International Business' program
Export	Financial incentives and risk coverage programs stimulating exports	Export credit guarantees and similar products	Export credit guarantees offered by Atradius (NL)

Table 4: Description and examples of the financing governmental role in different stages of the export process

4. Research design and methodology

This chapter will discuss the approach and methodology used in this study. The first section of this chapter will look at the choice of the type of research used. The second section will look at which methods and techniques are applied in the study and discusses their advantages and disadvantages. The third section will focus on the case selection for the chosen research method. The fourth section will discuss the data collection of the study and the fifth and last section will discuss how the information gathered in the data collection is analysed.

4.1 Research approach

The aim of this study is to explore the possible roles that governments have in the promotion of the export of their offshore wind sector. Its focus is to provide new insights and broaden the understanding of the field of export promotion in this specific setting. Quantitative research can be used in such explorative settings to generate theories and provide insights (Gunnarsson, 2011; Hinson, 2010)

Most studies in the field of export promotion focus on the efficiency of export promotion methods; exploring causal relations between export promotion methods and a country's or sector's exports (Badinger & Url, 2013; Lederman et al., 2010; Spence, 2003). These studies are usually focused on specific instruments and do not cover the whole field of options available. Perhaps even more importantly, these studies require a large sample of historical data from numerous companies to be able to derive statistical significant conclusions. The offshore wind market is a young sector which is rapidly changing. Little historical data of the industry exists, available data is very high level (largely national or European level) and public data regarding the utilization or efficiency of export promotion instruments is not available. Due to the rapidly changing character of the industry, methods applied in the infancy of this industry are not guaranteed to be effective today. Performing quantitative research on the efficiency of export promotion in the offshore wind industry will thus prove extremely difficult.

Taking in account the suitability of qualitative research methods for the explorative nature of this study and the difficulties regarding the execution of a quantitative study in this field, this study will make use of primarily qualitative research methods. The next section will discuss which methods are applied in the study.

4.2 Research methods

In this qualitative study, the main method of research that is applied is that of a case study. "Case studies are the preferred strategy when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context" (Yin, 1994). The case study approach offers the opportunity for a thorough and in-depth analysis of the leading countries' approaches to export promotion in the offshore wind sector. As the focus of this study lies in the improvement of the Dutch approach to export promotion, an in-depth study to understand the organization and stakeholders of the Dutch sector will form the central part of this study. Case studies on other countries will serve to supply comparative data, which is used to evaluate governmental approaches to export promotion in general and is used to identify possible points-of-improvements for the Dutch approach. Two forms of the case study method are thus applied; An in-depth case study of the Dutch situation and a comparative case study focused on the comparison between the Dutch government and other countries' governments approaches. An overview of the methods, with some of their advantages and disadvantages, can be found in Table 5.

Method	Advantage method	Disadvantage method
Case study	A case study offers a level of detail and understanding of a system generally not reached by quantitative research methods. Case studies are able to capture unique characteristics of groups and systems, can process input from a wide range of data collection methods (Hinson, 2010), and have the capacity to make surprising discoveries (Bricki & Green, 2007).	As case studies look at specific situations, their results might not always be generalizable (Bricki & Green, 2007). The results of case studies might be susceptible to bias, both from the researcher and the subjects researched. Verification methods also rely on experts, which can introduce bias and are not infallible.
Comparative case study	By comparing the Dutch approach to that of other countries, new methods of export promotion can be identified. Additionally, comparing the Dutch methods with foreign methods can yield lessons for the improvement of the Dutch methods.	Effectiveness of approaches of export promotion depend on the institutional environment they are applied in. Not all foreign methods might be applicable in the Netherlands. Conducting three case studies is a very time-intensive process. Non-Dutch interviewees might have conflicting interests when participating in a study aimed at advising the Dutch government
Expert interviews	Interviews are a way to access information in unknown fields, and can be used to gather specific information. The experts interviewed can identify new sources of data, and expand the network of the study.	Experts can have biased views on the topic discussed, and might present information in a way that benefits their organization best. Preparation, executing and processing interviews can be very time consuming.

Table 5: Description of the advantages and disadvantages of the chosen research methods, based on amongst others Hinson (2010) and Bricki & Green (2007)

4.2.1 Case study

An in-depth case study is executed on the Dutch offshore wind sector in order to gain a good understanding of the Dutch offshore wind sector, the currently applied export promotion methods in the Dutch sector and the actors active in the sector.

The case study will be structured as follows. First, the current domestic offshore wind market and relevant developments are shortly presented. Secondly, the current organization of the sector is assessed by identifying the stakeholders in the sector and their respective roles. After this introduction to the country and its actors, the framework from chapter three is utilized to identify which instruments and roles the government utilize for the different stages of the export process.

4.2.2 Comparative case study

The sectors of two other offshore wind countries will be studied to serve as comparative cases next to the Dutch sector. The case-selection is expanded on in chapter 4.3. The analysis of these sectors will follow the same steps as the in-depth cases study of the Dutch sector, but have a lesser focus on the implementation of possibly missing instruments or roles. The results of these studies will be compared with the Dutch case by performing a comparative analysis. The utilization of the different governmental roles will be compared and identified approaches to export promotion not used in the Netherlands will be further analysed. Furthermore, similar approaches across the case studies will be compared and evaluated to identify possible differences in the execution of these approaches.

4.2.3 Expert interviews & verification

In addition to the data found in the literature and other secondary sources, primary data is found by performing expert interviews. This data serves to identify different methods of export promotion, the differences in approaches between the countries, and the governmental involvedness in the sector. For these interviews, experts from companies in the industry, the trade organizations, and governmental organizations are consulted. The questions in the interviews are adapted to the nature of the interviewee. The questions generally aim to identify the instruments of a specific governmental role

sector-wide, identifying instruments for a part of a value chain for all governmental roles, or identifying the instruments of a specific governmental role for a specific part of the value chain.

A table linking the interviews to the relevant parts of the study these are used for can be found in Appendix 3. The interviews will be summarized, and the interviewees will be asked to verify or correct the contents of the summaries.

Experts in the Dutch sector will be consulted to assess the viability and applicability of the results of the study. These consultation meetings generally take place the form of a presentation given by the author to the experts, with room for discussion during and after the presentation. These presentations are also part of the practical implementations of the results of this study, further discussed in chapter 8.

4.3 Case selection

A selection of cases is made for the comparative case study. As one of the main goals of this study is to improve the Dutch government's approach to export promotion, the Dutch case will serve as the base case. Next to a base case, the timing of the project allows for two more cases to be carried out to the desired level of detail. These cases are selected based on the following criteria (see Table 7).

#	Case selection criterium	Clarification
1	The presence of an offshore wind industry	To compare the export promotion of an offshore wind sector, a domestic industry needs to be present and have goods or services to export.
2	Comparable institutional context	Export promotion approaches in countries with a completely different institutional context will most likely not be applicable for the Dutch case. Some institutional differences are unavoidable, but these should be limited if possible.
3	Likely to lead to new insights	The case country should be likely to portray a different approach to export promotion, as a result of a difference in industrial strengths or governmental structure
4	Data and information availability	The case country must have accessible data and information for the case study to be successfully executed.

Table 6: Selection criteria for the case studies

To apply the framework designed in chapter three, a country needs to host an offshore wind sector and have a government that plays a role in the stimulation of this sector's exports. As the comparative cases are meant to lead to potential points of improvements for the Dutch government, the governmental approaches of the case countries need to be to a certain extend transferrable to the Dutch context. Therefore, the comparative cases should have a comparable institutional context, yet should be likely to lead to new insights. A balance has to be found between transferability and likeliness of new insights. Lastly, for practical purposes, there should be enough data available on the cases to perform a case study. This leads to the following criteria for the remaining two cases.

Taking into account these criteria, a selection of candidates for the case studies is found. Starting at the first criterium, there are only a few countries in the world which currently have an offshore wind industry that is involved with more than just small-scale (<50 MW) or pilot projects. These countries are Belgium, China, Denmark, Germany, the Netherlands and the UK (Dickson, 2017; Roland Berger, 2016). Taking into account the second and fourth criterium, China has a vastly different institutional context and has a very difficult situation regarding the availability of information and data, and is therefore eliminated from the case selection.

Of the five remaining countries, Belgium has the smallest offshore wind industry (measured by revenue) (RVO, 2015). The strength of the Belgium industry is also mostly focused on its two dredging

companies (Jan de Nul and DEME), and as such Belgium's strengths overlap with the Dutch parts of the value chain. Considering the limited size of the industry and the overlap with the Dutch industry, studying the Belgian sector is deemed the least likely case to lead to many new insights.

As such, three candidates remain to form the cases next to The Netherlands: Denmark, Germany and the UK. Of these three countries, Denmark has the largest offshore wind industry, owns companies in almost every part of the value chain and hosts companies who have been extremely successful at exporting their services to markets within and outside of Europe (DONG being a prime example, operation in the USA and Taiwan (GWEC, 2017; Hu, 2017)). Therefore, Denmark is chosen as the second case.

The UK is the country with the largest installed capacity of offshore wind, but has not been very successful in the development of their own industry; its domestic offshore wind farms are largely produced and installed by foreign companies. An often-heard expression in the offshore wind sector: "The Danish and German produce the turbines, the Dutch install them and the English hand out the sandwiches". In contrast, the German sector is leading in the production and installation of cables and electrical components (RVO, 2015), and is one of the leading countries in terms of industrial size for its offshore wind industry. As such, Germany is chosen as the third case for this study.

4.4 Data collection

To gain a good understanding of the different governmental roles and instruments, data from a wide range of sources and actors is needed. This data can be classified into two types of data: primary data and secondary data. Primary data is data gathered by the researcher for the specific purposes of their study; i.e. surveys, interviews and direct observations. Secondary data is data gathered by other agencies or researchers. This data will need to be modelled to the researcher's requirement, but if often less time- and cost intensive to acquire (Bryman & Bell, 2015). This study will utilize both forms of data. Primary data will be used to identify methods of governmental support for export to different segments of the sector, determine a governments position in a sector and its relation to other parties in the sector, and to gain an in-depth understanding of some specific instruments. Secondary data is used to evaluate current market developments, enlarge the understanding of used instruments and gain a better understanding of the industry's actors, as well as adding to governmental support methods and functions not identified in the interviews.

Methods of data collection are hereunder specified. The overview of interviewees can be found in Appendix 1 (for public interviews) and Appendix 7 (for confidential interviews).

4.4.1 Desk research

Desk research has been used to gather information about global developments in offshore wind and initial exploration of the case studies, and is used for the development of the theory presented in chapter two and three and the identification and verification of instruments and governmental structures for chapter five. Several sources of information have been used for different parts of this study.

For the development of theory in chapter three, literature in the fields of (amongst others) international economics, trade and development, governance processes and instruments, and literature on export processes has been consulted.

For information about global developments in offshore wind, value chain approaches, and information about the cases, a wide range of sources has been consulted. Reports, presentations and other forms of information published by or obtained from consultants like Roland Berger, Make Consultancy, 4C Consulting Group and BLIX offer information about global developments and market potential of offshore wind. Additional information is found in reports and presentation published by governmental agencies (Ministries and executive branches), trade organizations (WindEurope, NWEA, DWIA, AWEA), NGOs and consortia (GROW, TKI-WOZ) and publications by companies. Information on regulation, financial support, export promotion instruments and domestic sector developments is found on governmental websites.

As the sector is rapidly developing, articles on websites tracking the development of offshore wind (e.g. Offshorewind.biz), newspapers and blogs have been important sources of information to identify changes and developments in the sector.

4.4.2 Semi-structured interviews

Primary data for this study is gathered by performing semi-structured interviews. A list of questions steering the interview is prepared by the interviewer to ensure that the necessary information is gathered. The questions intentionally give room to the interviewees to express their own views and to identify possible methods of support not known by the interviewer. A list of elements discussed in the interview and their relevance to the study can be found in Table 7.

A total of 26 interviews have been conducted. A list of interviews can be found in Appendix 1 and 7. The interviews have been summarized (in English), generalized, stripped of confidential information and verified by the interviewees. The summaries of the interviews can also be found in Appendix 1 and 7.

Interview Element	Relation to study	Relevance
Current and future offshore wind markets and barriers	Potential markets, value chain specifics	Identification of potential markets and market barriers, whereas applicable related to elements in the value chain
Method of market access	Value chain specifics, export support instruments	Understanding the possibilities of market access for parts of value chain and identification of instruments supporting these possibilities
Experienced support	Export support instruments, domestic sector	Understanding what support instruments are used and how they function
Regulatory support and barriers	Export support instruments	Identifying relevant regulatory frameworks and understanding their mechanisms
Cooperation with sector	Domestic sector	Understanding the relations and delegation of tasks between stakeholders in the sector
Support methods from abroad	Export support instruments	Identification of support mechanisms used in non-domestic sectors
Ideas for improvement	Export support instruments, recommendations	Identification of possible ways to improve the current situation of governemental export support
Further contact	Domestic sector	Identification stakeholders in the sector, expanding network for additional interviews or sources of information

Table 7: Interview elements, their relevance and relation to the study

4.4.3 Written correspondence

Additional primary data is gathered through written correspondence with experts in the offshore wind sector. Written correspondence (in the form of e-mails) was chosen as a method of data gathering in cases where the information sought was very specific, and time-consuming interviews were deemed unnecessary (in the case of foreign market potential), or when potential interviewees were occupied but able to answer short questions by e-mail. Key parties which helped in finding the relevant sources of data for the case studies were: The Dutch embassies of Washington DC, New York City, Indonesia, Taiwan, Japan, Poland, Denmark, Germany and Warsaw, the Danish Wind Association and the Danish Export Association, the Danish Export Promotion Agency, Germany Trade and Invest, Wind Energy Network (GE), the BMWi and EKF.

4.4.4 Expert verification

The results of this study have been presented to and discussed with experts in the Dutch offshore wind sector. Parties that have participated in the validation (and for some recommendations the implementation) of the research findings and recommendations include several working groups of the Dutch Ministry of Foreign Affairs, several working groups of the Dutch Ministry of Economic Affairs involved with offshore wind, parties involved in the Dutch offshore wind export meeting (NWEA, HHWE, RVO, TenneT, IRO), representatives of the TKI-WOZ and GROW programs, a delegation of Dutch project developers and a delegation of Dutch SMEs active in the Dutch offshore wind industry.

4.5 Data analysis

The primary and secondary data are used as input for the description of the offshore wind sector presented in chapter two and to construct the case studies in chapter five. After the case studies have been conducted, the utilized instruments are inserted in the research frameworks for each case country. These case-country-specific frameworks containing the instruments of each case can be found in Appendix 6.2, 6.3 and 6.4.

The results of these case studies are used for a comparative analysis, which can be found in chapter six. This comparative analysis will identify the difference in the roles of governments for export promotion of their offshore wind sectors, and the instruments these governments utilize. After the comparison, methods used in the Danish and German case which are not used in the Dutch case are evaluated, to access their fit to the Dutch institutional context. Suggested methods of improvement for the Dutch government found in the interviews are reviewed to identify points in the Dutch sector that can be improved. Lastly, patterns found in the roles that governments play in the different stages of the export process will be assessed and compared.

4.5.1 Analysis of used instruments

The first part of the analysis aims to identify the differences in instruments used by different countries in the different stages of the export process. From this analysis, possible unutilized instruments or approaches to instruments can be identified serving as points of improvement for the Dutch situation. This part of the analysis is executed by performing a comparison across the instruments utilized by the governments of the case countries. First, instruments used in the German and Danish case that are currently not being utilized in the Dutch case are discussed. Secondly, different approaches to instruments are discussed. Possible novel approaches to the utilization of the instruments is discussed with the relevant governmental agencies and related organizations in the sector.

4.5.2 Analysis of roles

The second part of the analysis will focus on the respective roles the governments utilize in different stages of the export process. The government's prevalences of their roles per stage of the export process are operationalized to compare them between the case studies. This is done by rating the prevalence of a governmental role on a four-point qualitative scale. Each qualitative rating of the prevalence of a governments role is determined by comparing the utilized instruments both with the potential instruments identified in chapter three and the utilized instruments in the cases.

Initial ratings are given by comparing the prevalence of the governmental roles with a range of indicative determinants for their value (presented below). After being given a primary value, these ratings are then compared cross-case. If ratings coincide in cases where a governmental role's prevalence is deemed to be significantly different across cases, these are possibly corrected by at most one step on the scale. Findings are discussed and confirmed with experts at the Ministry of Foreign Affairs. The levels of prevalence of the governmental roles for each stage of the export process are presented in a table at the end of each case study. In Appendix 6.5 the prevalence of the governmental roles for each case along with indicators of why this score was established is presented.

The governmental levels of prevalence are rated on the following four-point scale: None, Low, Medium and High.

None
The 'None' level of prevalence is established if the respective governmental role is not found to be utilized in the given category.

Low
The 'Low' level of prevalence is established if the respective governmental role is found sporadically, the role of the government is incidental or relatively unimportant compared to other actors in this segment. This level can also be applied if only instruments not specific to the offshore wind sector have been found, or if found instruments are not always able to be utilized by the offshore wind sector. Governmental presence in this part of the sector can be useful but is generally not necessary.

Medium
The 'Medium' level of prevalence is established if a government is an influential actor in this segment or plays an important role in this segment, but is neither the most important nor the most influential actor. The governmental policy at this level is consistent, but not of high priority. Without governmental presence, the sector would be able to cope but would face significant difficulties.

High
The 'High' level of prevalence is established if a government utilizes its role as one of the lead actors in the sectors. This can be in the form of being a lead actor in a network, a founder and or manager of a vital program in the sector, one of the main suppliers of financing, or as one of the main suppliers of a part of the value chain.

The framework presented in chapter three will be structured in several different ways to compare the instruments, prevalence of roles per country and prevalence of roles per stage of the export process. This comparative analysis can be found in chapter six.

5. Case studies

In this chapter, the case studies on export promotion of the offshore wind sector in the Netherlands, Denmark and Germany will be presented. Chapter 5.1 will expand on the Dutch case, chapter 5.2 will expand on the Danish case, and chapter 5.3 will expand on the German case. The analysis of these cases will be presented in chapter six. Note that each of these chapters is a summary of the full case studies, which can be found in Appendix 4. An overview of the findings of the case studies in a table can be found in Appendix 6.1, an overview of the ratings and criteria used for rating the prevalence of governmental roles can be found in Appendix 6.5 and an overview of all the ratings of the prevalence of governmental roles in the countries can be found in Appendix 6.6.

Each case will start with an introduction of the country's domestic offshore wind industry. Quantitative figures on the sector are given if available. Additionally, an overview of the current domestically installed offshore wind capacity and the predicted developments of the domestic market in the coming years are presented (up to 2025 or 2030, depending on the availability of data on the growth of the market). To determine the government's role in a sector, and to understand which governmental organizations are active in the sectors and with which non-governmental organizations they cooperate, an overview of the sector and its most important actors is also included.

After the introduction of the respective cases, the cases will move towards the governmental roles found in the cases. Each case is expanded on by discussing the governmental instruments and roles per stage of the export process. An overview of the governmental roles per export stage and an overview of the prevalence of the governmental roles in the case is presented in a table at the end of each case.

5.1 Case: The Netherlands

The Netherlands is a country in the north-west of Europe with a population of ~17 mln (Het Centraal Bureau voor de Statistiek, 2017). It is the world's 18th largest economy (International Monetary Fund, 2017), and it is the world's 8th largest export economy (OEC, n.d.-c).

5.1.1 Domestic market

The Dutch offshore wind industry has a market share of around 25 percent of the European market (measured in industrial revenue, not power generated) (Bais, 2015). It employed over 2000 FTEs in 2014 and is expected to employ 10.000 FTEs by 2020 (Bais, 2015), which is expected to further increase after 2020 with future growth in the industry (NWEA, SER Energieakkoord, 2016). Of the 2000 FTEs, 600 to 800 FTEs are working on national projects, and the rest is employed in international projects (Jager, Gastel, & Winkel, 2014). The Dutch offshore wind industry had a turn-over of approximate €1 bln in 2014, and this number is expected to grow to €6 bln in 2020 (Jager et al., 2014; NWEA, SER Energieakkoord, 2016). The Netherlands currently has the fifth most installed capacity of offshore wind globally, and is expected to remain one of the top five offshore wind markets until at least 2030 (Dickson, 2017; GWEC, 2017).

The expansion of the Dutch offshore wind industry forms an important pillar of the Dutch sustainable energy goals (Sociaal-Economische Raad, 2013b). Future plans for expansion of the installed offshore wind capacity have been presented in the Offshore Wind Energy Law (Kamp, 2017a). A detailed roadmap for the expansion of offshore wind has been published in the document 'Offshore wind energy in the Netherlands' (Netherlands Enterprise Agency, 2015a). This roadmap describes the growth of the Dutch offshore wind sector from the approximately 1 GW of current installed capacity to 4.5 GW in 2023. A new roadmap for an additional 7 GW of added capacity until 2030 is expected to be released late 2017 or early 2018 (Appendix 7, ii).

5.1.2 Organization of the sector

The Dutch offshore wind sector comprises a wide field of actors, with varying responsibilities. Figure 11 gives a simplified representation of the sector and the relations between its actors. Key actors are shortly expanded on below.

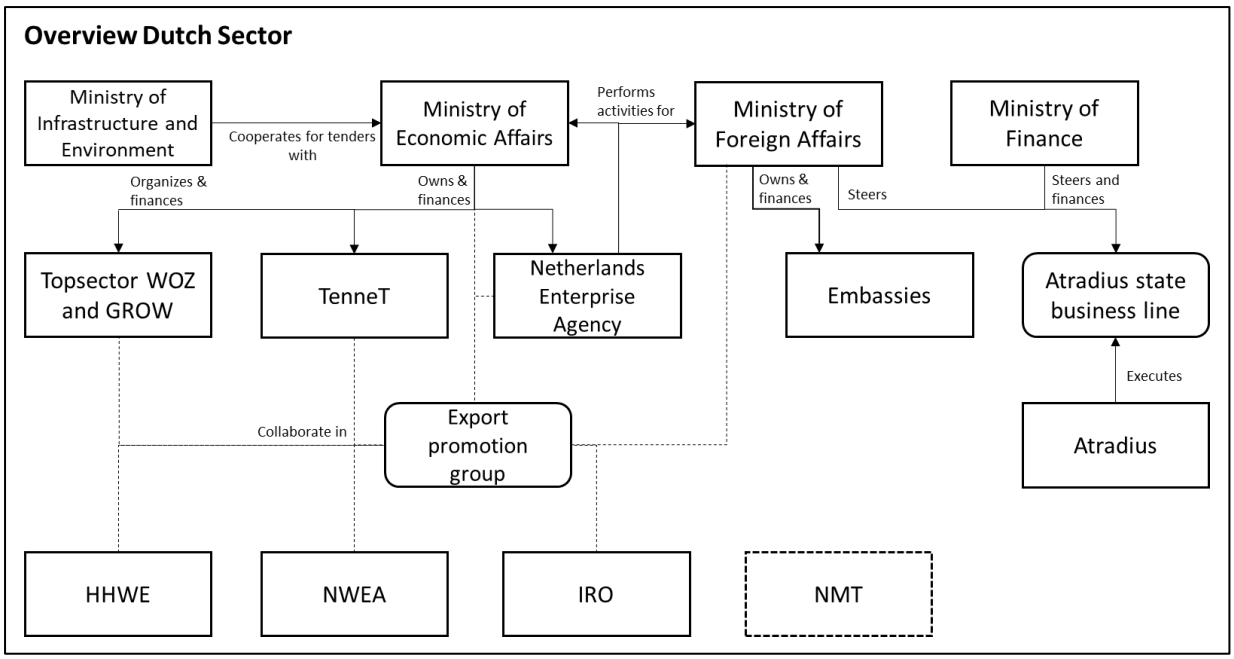

Figure 11: Overview of the Dutch sector, its most important actors and their relations

On a governmental level, the two main responsible ministries involved in offshore wind, its domestic rollout and its exports are the Ministry of Economic Affairs and the Ministry of Foreign Affairs (Appendix 7, ii). The Ministry of Economic Affairs is responsible for the policy on innovation and domestic development of offshore wind, including the Topsector policy and the financing of TenneT (Sociaal-Economische Raad, 2013a). The Ministry of Foreign Affairs is responsible for economic diplomacy, including the Dutch embassies (Rijksoverheid, n.d.). Additionally, the Ministry of Finance shares responsibility with the Ministry of Foreign Affairs for export promoting financial products supplied by Atradius' Dutch State Business line (Appendix 1, i), and the Ministry of Infrastructure and Environment cooperates with the Ministry of Economic Affairs in the creation of tender procedures and usage of marine areas in the Netherlands (Ministerie van Infrastructuur en Milieu, 2013). The Netherlands Enterprise Agency is part of the Ministry of Economic Affairs, and acts as an executive organization for all of the ministries (Appendix 7, ii, (Nederland, n.d.)).

TenneT is the state-owned Dutch Transmission System Operator (TSO) which is responsible for the electricity grid connection of the offshore wind projects wind parks in the Netherlands (Rijksoverheid, 2016; TenneT, n.d.-c). The governmentally founded consortium Topsector Wind op Zee (TKI-WOZ) is the main research consortium for offshore wind in the Netherlands (TKI Wind op Zee, n.d.). The Topsector coordinates GROW, the largest research program on offshore wind in the Netherlands (Zuijlen, 2016b).

Three more organizations play an important role in the export of the offshore wind sector in the Netherlands, each having their internal sources focusing on export; The Netherlands Wind Energy Association (NWEA, trade organization wind energy), Holland Home of Wind Energy (HHWE, export association wind) and The Association of Dutch Suppliers in the Oil and Gas Industry and Offshore Renewable Industry (IRO, trade organization offshore energy). These organizations work together in an offshore wind export group, joined by the Ministries, RVO, TenneT and The Netherlands Maritime Technology (NMT) (Appendix 1, ix & xii).

5.1.3 Dutch government's roles in the export process

With the Dutch sector and its actors introduced, the next part of the chapter will look into the governmental roles in the different stages of the export process. The different stages of the export process are expanded on separately. At the end of the chapter, Figure 12 will show the instruments of

the different roles inserted in the framework, and Figure 13 shows the level of prevalence of the governmental roles in the case. A large version of this framework is also presented in Appendix 6.2.

Research and development

Research and development activities in the offshore wind sector in the Netherlands are generally not executed by governmental parties. Exceptions to this are research and development activities performed by state-owned transmission system operator TenneT, on cable and cooling concepts for offshore grid concepts (TenneT, n.d.-b), grid stability and HVDC interconnectors. Additionally, the Dutch Ministry of Economic Affairs and the Dutch Enterprise Agency develop methods and procedures for the roll-out of wind farms and manages their preliminary studies (Appendix 7, ii). Through an international innovation attaché network the Dutch government promotes international cooperation for innovation (Netherlands Enterprise Agency, n.d.-b).

The Dutch government is one of the founding partners and main organizers of research and development program 'Topsector Wind op Zee', and its main research program GROW, aimed specifically at innovation in offshore wind. Through these programs it supplies specific subsidies primarily focused on cost-reductions and system integration of offshore wind in the Dutch domestic market (Topsector Energie, n.d.-a; Zuijlen, 2016b). The Topsector Wind op Zee is part of a larger program called Topsector Energy, which also has subsidies that can be used for offshore wind innovation (TKI Energie, 2017). The Dutch government also provides financing to a number of independent research organizations which perform offshore-wind related research, most importantly NWO, ECN, TNO, Marin and Deltares (TKI Energie, 2017; TO2-federatie, n.d.). General subsidy programs that can be utilized by offshore wind projects and companies are the MIT-program (reimbursement for external research and development), SBIR-program (competition for projects based on market-potential), and the WBSO and coupled RDA program (tax-cuts for innovative firms) (Netherlands Enterprise Agency, n.d.-d; Pienter, n.d.).

Tender regulation around current wind farm tenders is primarily focused on cost-reduction of the technology, although some technology-specific regulations have been applied in previous offshore wind farms (e.g. Lichterduinen), and upcoming innovation parcels feature regulation pushing innovation (de Boek & van der Hem, 2016; Kamp, 2016; Netherlands Enterprise Agency, n.d.-a). Governmentally funded research organizations are generally allowed to perform commercial research, yet not all choose to do so (ECN, 2014; TNO, 2017; TO2-federatie, n.d.). Patent rules specific to the offshore wind sector are not found in the study.

Concluding, the Dutch government has some governmental agencies that perform research and development activities, but only as an extension of their core activities. It is highly active in the organization of research programs and cross-sectoral cooperation, and offers a wide range of financial instruments stimulating research and development, both in general and specific to the offshore wind sector. It makes little use of regulation to steer innovation.

Testing

Similar to research and development activities, testing activities in the Netherlands are also generally not executed by governmental parties, with the exception of tests related to the grid concepts developed by TenneT (TenneT, n.d.-b).

The Topsector Energie offers the 'Hernieuwbare Energie' arrangement for demonstration projects, which are primarily aimed at cost-reductions of the technology, and offers funding through the GROW program (TKI Energie, n.d.-a; Zuijlen, 2016b). Currently, no offshore wind test farms are available in the Netherlands, but a co-location innovation parcel at the Borssele wind farm will be tendered between October 2017 and January 2018 with a capacity of 20 MW (RVO, n.d.-a), which will incorporate both the innovativeness and exportability of the to-be-tested technologies as tender criteria (Kamp, 2016). Several onshore test facilities are available, yet not all of these are accessible for upcoming offshore wind manufacturers due to regulatory restrictions in the access to these facilities (Appendix 1, x).

The co-location innovation parcel will also supply an SDE+ subsidy to the winners of the tender for the parcel, which will refund the testing party based on the electricity delivered to the grid (Kamp, 2016), and an additional subsidy on electricity supplied to the grid to compensate for the innovative nature of the technologies applied. Another subsidy available for testing of energy related technologies is the DEI-arrangement, which has primarily been used for other renewable energy technologies (Netherlands Enterprise Agency, 2017). Lastly, the Topsector Energie's 'Hernieuwbare Energie' arrangement' is available for the testing of renewable energy technologies that lead to future cost-reductions of these technologies. Next to the subsidies offered, the Topsector and the Innovatielink organization (described under next header) connect parties in the sector to actively stimulate testing.

Concluding, the Dutch government has some governmental agencies that perform testing activities, but only do so as an extension of their core activities. It does utilize regulation to stimulate testing, yet testing is often a secondary goal. It is very active in the organization of research programs that include testing and cross-sectoral cooperation, and offers a wide range of financial instruments stimulating testing to take place, both in general and specific to the offshore wind sector.

Domestic market development

In the Netherlands, state-owned transmission system operator TenneT is responsible for the development of the (on- and) offshore electricity grid, including the export cables and offshore substations of the offshore wind farms (Appendix 1, xvi) (TenneT, n.d.-d). For these activities, it is financed by the Dutch Ministry of Economic Affairs. The preliminary studies on the parcels are managed by the Dutch Enterprise Agency, which commonly cooperates with private consultancy- and seabed exploration firms (Bruijne, 2017; Splunder, 2017).

While primarily aimed at innovation, the Topsector programs also play a role connecting domestic actors enhancing cooperation in the sector (Rijksdienst van Ondernemend Nederland, n.d.). The Dutch government cooperates with trade organizations such as the Netherlands Wind Energy Association (NWEA) and IRO but does not have representatives in the boards of these organizations, nor supplies financing to these organizations (Appendix 1, xii). Several governmental agencies are partners of the InnovatieLink initiative, and its Offshore Wind Innovators agency. This initiative connects SMEs to large companies in the sector, enhancing innovation, growth and financing possibilities for SMEs (Appendix 1, xiii & ix). No large role for the Dutch Chambers of Commerce has been found during this study.

The Dutch government regulates the domestic growth of offshore wind farms in its territorial seas by yearly tenders of offshore wind capacity in designated offshore wind areas (Netherlands Enterprise Agency, 2015a). Offshore wind development in lakes falls outside of this regulation, which is demonstrated by the development of an offshore wind farm in the Dutch Province of Frisia (Windpark Fryslân, n.d.).

The Dutch government offers several subsidies to promote the domestic development of offshore wind, next to the financing of the offshore wind farm's grid and preliminary studies. The primary subsidy for renewable energy in the Netherlands comes from the SDE+ program, which in the case of offshore wind reimburses the winners of the offshore wind farm tenders for a difference in price between market- and tender price per unit of generated electricity (Netherlands Enterprise Agency, n.d.-f). Other non-sector-specific arrangements are the 'Borgstelling MKB Kredieten' (collateral for SMEs), 'Garantie Ondernemingsfinanciering' (low-interest loans for large projects), 'Innovatiekrediet' and 'seed-business angels program' (financing for start-ups) (Rijksdienst voor Ondernemend Nederland, n.d.-a, n.d.-b, n.d.-c, n.d.-d). Due to a current lack of risk and venture capital for Dutch firms, the Dutch government is launching the InvestNL program in 2018. Its applicability to offshore wind projects is currently uncertain (Kamp, 2017c; Octas.nl, n.d.), but could provide a source of capital currently missing in the Dutch sector.

Concluding, Dutch governmental agencies perform managerial and contracting activities on large parts of the offshore wind farms, but none of the construction activities. Domestic regulation is the main determining factor of domestic growth. The government cooperates actively with the main trade

organizations, but is not part of them. It is active in research organizations and specialized organizations that stimulate sectorial cooperation. It has a wide range of subsidies for domestic market development, but currently seed-, growth- and venture capital are lacking; something which InvestNL could solve.

Foreign market exploration

The Dutch embassies, which fall under (and are financed by) the Dutch Ministry of Foreign Affairs, offer a range of services to companies wanting to explore foreign markets. They supply general information on markets, can perform market exploration studies for specific products and offer information on foreign legislative frameworks (Netherlands Enterprise Agency, 2015b). The Dutch government also organizes pitches for domestic companies on potential foreign markets. The services of the Dutch embassies are generally demand-driven, are financed by the Dutch government and free-of-charge for Dutch companies (Barneveld van, 2014) (Appendix 1, xi & xvii). The Dutch Chambers of Commerce also have an international network supporting Dutch companies, but no examples of the use of this network in the offshore wind sector have been found (Kamer van Koophandel, n.d.-b). No paid follow-up services or cooperation with local consultancies for follow-up services have been found relevant to the offshore wind sector in the Dutch embassies. Upkeep of the embassies is paid for by the Dutch government.

To coordinate with its sector, Dutch governmental agencies meet a mixed group of actors in the Dutch sector to discuss export of the (primarily) offshore wind sector approximately every 6 weeks (Appendix 1, ix). This export group is looking into possibilities to improve the Dutch branding of its offshore wind sector. The Dutch government is also hosting a masterclass for foreign policymakers on the Dutch tender system, which can lead to valuable contacts in future export markets. In cooperation with several private parties, the Dutch Enterprise Agency has held pitches for Dutch companies stimulating them to export. Several governmental agencies organize or aid in the organization of trade missions.

The Dutch Ministry of Foreign Affairs offers companies which want to start exploring their opportunities for export the 'Starters International Business' program, refunding costs for expert consultation and participation of trade missions and fairs (Netherlands Enterprise Agency, n.d.-e). Additionally, the Dutch Ministry of Economic Affairs has a yearly competition called the 'Oranje Handelsmissiefonds'. Winners of the contest receive intensive support from the Dutch Enterprise Agency (in kind) and large companies (financially) with their export plans. No companies in the offshore wind sector have participated in this contest yet (RVO, n.d.-c).

No regulative restrictions or stimulants for foreign market exploration have been found during this study.

Concluding, the Dutch government offers and facilitates a wide range of instruments and financial incentives stimulating companies to explore foreign markets. It works together with domestic organizations to stimulate exploration, but does not work together with consultants in foreign markets.

Market entry preparation

The Dutch embassies fulfil the function of connecting Dutch companies with foreign companies and partners. The Dutch embassies generally work on an on-demand base. They wait for requests from companies in the Netherlands, or from one of the ministries, and in response to these requests they expand their networks or perform business scans. The programs of the embassies are focused on establishing first contact, further parties for consultation regarding entering the market need to be found by companies themselves. Through the 'Partners in International Business' program the embassies support clusters of companies in among others the offshore wind sector with longer-term programs (Netherlands Enterprise Agency, n.d.-c).

Next to the embassy network, the Dutch Ministry of Economic Affairs hosts an innovation attaché network that performs functions similar to the economic attachés, but focused on research and development (RVO, 2015). The 'International Innovatie Matchmaking' program can organize

research-focused trade missions, yet has not been utilized for the offshore wind sector (Netherlands Enterprise Agency, n.d.-b). This program, as well as the upkeep of the embassies providing these activities, is paid for by the Dutch government.

The Ministry of Economic Affairs and The Ministry of Foreign Affairs, aided by the Netherlands Enterprise Agency often organize, or cooperate in the organization of trade missions. This is often in cooperation with Holland Home of Wind Energy. Additionally, the Dutch government puts a moderate priority on economic diplomacy (Ministerie van Buitenlandse Zaken, 2016), having MOUs running with the Chinese National Energy Administration and the Taiwanese Bureau of Energy on renewable energy and offshore wind (OffshoreWIND.biz, 2014; Schutten, 2015). The Dutch government utilizes its knowledge on offshore wind development to strengthen networks with foreign policymakers. The Dutch government has a national branding initiative called 'Holland Branding', which is currently barely utilized for the offshore wind sector (RVO, n.d.-b).

No regulative restrictions for market entry preparation have been found during this study.

Concluding, the Dutch government offers a moderate amount of activities stimulating market entry, yet for the most part relies on financially stimulating companies to initiate these activities. It has a large foreign network, but does not work together with consultants to offer follow-up activities after initial steps have been made. It has little focus on international government-to-government sector-specific cooperation in the offshore wind sector and is not active in offering support to the execution of relevant branding activities for its offshore wind sector.

Export

No examples of the Dutch government commercially exporting goods and services in the offshore wind sector have been found during this study. No governmental involvement in networks connecting exporting companies in the Netherlands has been found during this study. No regulative restrictions regarding the export of offshore wind goods and services have been found during this study.

The Dutch government supports exporters financially through its Dutch State Business line of products, offered through a public-private partnership with Atradius (NL) (De Minister van Financiën, 2010). The products of this line include export credit guarantees and other similar products insuring companies and potential investors against the additional financial risks when exporting goods (Atradius, n.d.). So far, no companies in the Dutch offshore wind sector have made use of these services (Appendix 1, i).

Concluding, the Dutch government cooperates with commercial parties to offer a range of financial products stimulating export which, while available and presumably suitable for the offshore wind sector, are rarely used by the sector.

Overview

The findings of this case are presented in Figure 12. After having compared and rated the governmental roles Figure 13 represents the prevalences of the governmental roles found in this case.

	The Netherlands			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Tennet (NL) researching and developing new grid concepts, Dutch Ministry of Economic Affairs and Netherlands Enterprise Agency designing tender procedures	Innovation design obligations in former wind farms, commercial freedom governmentally funded research organizations	Governmentally founded Topsector policy and involvement in GROW project, Dutch embassies hosting an international Innovation Attach é network	Financing to Topsector management and research projects, funding independent research organizations, MIT, SBIR and WBSO programs
Testing	Tennet (NL) testing grid-connection concepts	Separate tender procedure for offshore wind demonstration site Borssele V, onshore test location permits and access criteria	Innovatielink, Topsector policy	SDE+ for demonstration site, DEI and Hernieuwbare Energy programs
Domestic market development	TenneT (NL) developing offshore wind grid and substations, Netherlands Enterprise Agency managing preliminary studies parcels	(yearly) Tenders for domestic offshore wind farms, no state-level regulation for nearshore or lake areas to develop offshore wind farms	Innovatielink, Topsector policy	SDE+ for domestic offshore wind farms, Borgstelling MKB Kredieten, Garantie Ondernemingsfinanciering, Innovatiekrediet and seed-business angels program, Future InvestNL program
Foreign market exploration	Embassies performing exploratory studies, general information on foreign markets and their regulatory frameworks, organization trade missions by several governmental agencies	-	Public-private export meetings, Policy-level cooperation, pitches for domestic parties, Oranje Missiefonds program	Upkeep embassies ,SIB program
Market entry preparation	Embassies performing business scans, Netherlands Enterprise Agency organizing innovation matchmaking missions, governmental agencies organizing trade missions, Holland Branding	Government-to-government cooperation in the form of memorandums of understanding with China and Taiwan	Innovation attach é s and embassies hosting networks connecting domestic parties to international partners, knowledge exchange of tender procedures	Upkeep embassies, PIB program, partial reimbursements trade-missions
Export	-	-	Cooperation with Atradius (NL) for offering export promotion financing	Financing of Atradius' Dutch State Business line of export promotion financing products

Figure 12: The research framework applied to the Dutch case

	The Netherlands			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	*Low*	*Low*	*High*	*High*
Testing	*Low*	*Medium*	*High*	*High*
Domestic market development	*Medium*	*High*	*Medium*	*Medium*
Foreign market exploration	*High*	*None*	*Medium*	*High*
Market entry preparation	*Medium*	*Low*	*Medium*	*Medium*
Export	*None*	*None*	*Low*	*Low*

Figure 13: The rated prevalences of the governmental roles in the Dutch case

5.2 Case: Denmark

Denmark is a country in the north of Europe with a population of approximately 5.8 mln. It is the world's 35th largest economy (International Monetary Fund, 2017), and is the world's 37th largest export economy (OEC, n.d.-a).

5.2.1 The domestic sector

The Danish onshore and offshore wind sector are closely intertwined, and separate data on the offshore industry is hard to come by. The Danish wind industry employs 32.900 FTEs in 2016, and the sector had a turnover of €13 bln. The sector exported €7.5 bln worth of goods and services, totalling 57 percent of the turnover (Vindmølleindustrien, 2016). The share of exports in the offshore wind is even higher, estimated to be between 60 and 70 percent of the total turnover of the offshore wind industry (Appendix 1, xvi). Denmark currently has the fourth most installed offshore wind capacity globally, and is expected to maintain a top six position until at least 2023. Plan for the domestic Danish sector are uncertain after 2025 (Dickson, 2017; GWEC, 2017).

Denmark is the world's country with the most wind capacity installed per capita (WindEurope, 2017), and the extension of especially offshore wind plays an important role in the country's goal to be completely fossil-free in 2050 (Danish Energy Agency, 2015; GWEC, 2017). Expansions of offshore wind capacity are governmentally determined in multi-year plans, of which the one for after 2025 is currently being negotiated (Appendix 7, ii). Denmark currently has 1.25 GW of installed offshore wind capacity, and will add another 1.5 GW until 2021. No offshore wind farms will probably be added between 2021 and 2025, plans for offshore wind farms after 2025 are uncertain.

5.2.2 Organization of the sector

The Danish offshore wind sector comprises a wide field of actors, with varying responsibilities. Figure 14 gives a simplified representation of the sector and the relations between its actors. Key actors are shortly expanded on below.

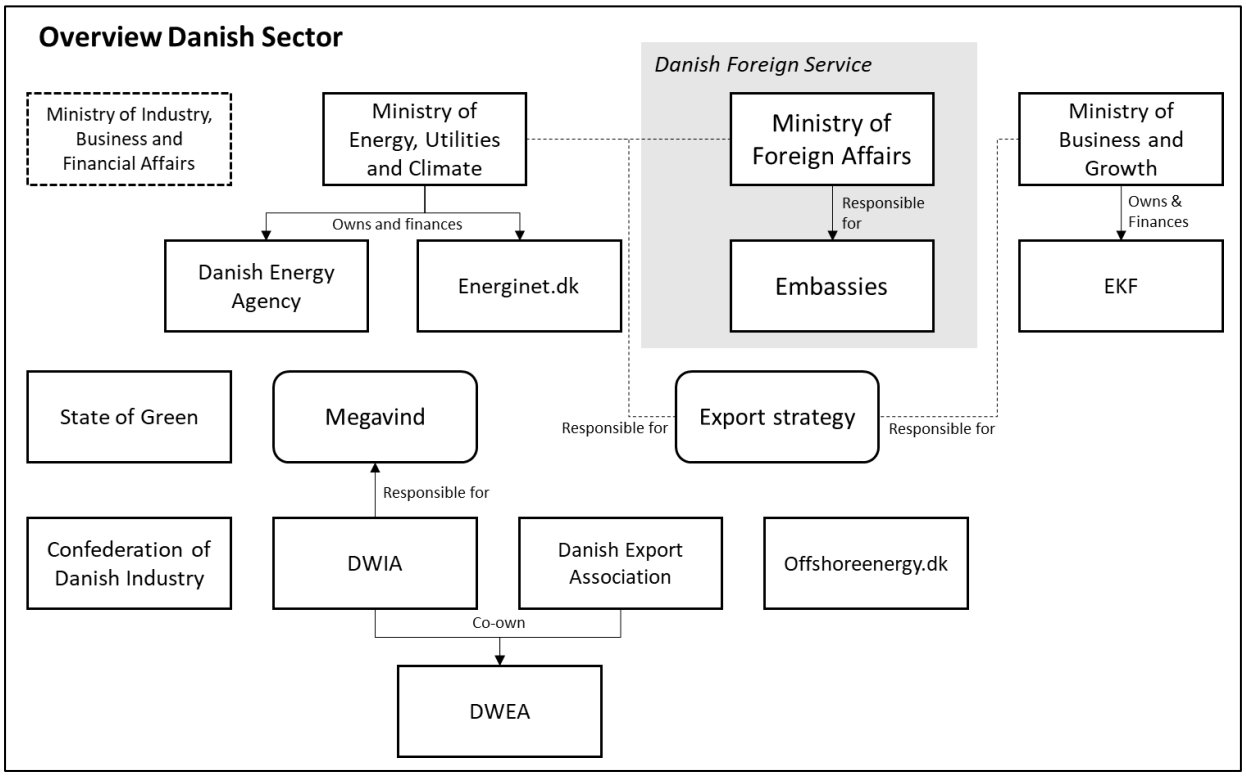

Figure 14: Overview of the Danish sector, its most important actors and their relations

In Denmark, there are three main responsible ministries for the offshore wind sector. The Danish Ministry of Energy, Utilities and Climate is responsible for the promotion and legislation of sustainable energy supply and usage. The Danish Energy Agency, responsible for offshore wind farm tenders, dialogue and regulation (Appendix 1, iii) (Danish Energy Agency, n.d.-a), and Energinet.dk, the Danish state-owned TSO, are departments of this ministry (State of Green, n.d.-c; The Danish Ministry of Energy Utilities and Climate, n.d.). The Ministry of Industry, Business and Financial Affairs is responsible for business regulation, intellectual property rights, competition policy and the financial sector and has growth teams for green-energy (State of Green, n.d.-d). The Danish Trade Council and The Ministry of Foreign Affairs form the Danish Foreign Service, and are responsible for the promotion of Danish exports, also being responsible for the Danish embassy network (Ministry of Foreign Affairs of Denmark, n.d.-e). Additionally, the Ministry of Business and Growth is the owner of the publicly owned EKF (The Danish export credit guarantee agency), and shares responsibility with the Ministry of Foreign Affairs and Ministry of Economic affairs for the financial export promotion products offered by EKF (EKF, n.d.-b).

The Danish Ministry of Energy, Utilities and Climate, the ministry of Foreign Affairs and the Ministry of Business and Growth have launched an export strategy for the period of 2017 to 2019, focusing on

doubling the exports of the Danish green energy sector by 2030 (Udenrigsministeriet et al., 2017). Initiatives from this strategy are incorporated in the roles and instruments in the rest of this chapter.

Additionally, the Danish sector has some non-governmental organizations which are important for the development and export of this sector. The Confederation of Danish Industry focuses on promoting business competitiveness, a clean environment and energy security, create coherence and promoting the visibility of the Danish (energy) industry (State of Green, n.d.-b). One of the main organizations to promote coherence and visibility is State of Green, a public-private partnership organization focused on improving Denmark's branding of its green sector, including offshore wind (Appendix 1, xv). Offshoreenergy.dk is a cluster organization for offshore oil, gas and wind focusing on internationalization and innovation projects (Appendix 1, xiii). The Danish Wind Industry Association (DWIA) is a trade and network organization for the Danish Wind Industry, which focuses on lobbying, connecting companies and stimulating innovation. The DWIA hosts the largest research and development project for its wind industry 'Megavind'. DWIA also works together with the Danish Export Association to promote exports of offshore wind, by working together in the commercial organization 'The Danish Wind Export Association'. The services of this organization, which are accessible for member of both the DWIA and the Danish Export Association, focus on international networking, market intelligence and joint export groups for specific markets. DWEA coordinates all joint export activities for the Danish wind industry (Danish Wind Export Association, n.d.)

5.1.3 Danish government's roles in the export process

With the Danish sector and its actors introduced, the next part of the chapter will look into the governmental roles in the different stages of the export process. The different stages of the export process are expanded on separately. At the end of the chapter, Figure 15 will show the instruments of the different roles inserted in the framework, and Figure 16 will show the level of prevalence of the governmental roles in the case. A large version of this framework is also presented in Appendix 6.3.

Research and development

Research and development activities in Denmark are generally not executed by governmental parties. As an exception to this, similar to the Dutch situation, the Danish nationally owned transmission system operator Energinet performs tests on grid concepts for offshore wind farms (Appendix 1, vii). Tender procedures are developed by the Danish Energy Agency, which performs research and development activities related to these tenders (Appendix 1, iii). The Danish government maintains an international innovation hub network, aimed to connect Danish and foreign organizations for collaboration in innovation.

The Danish government does not control or coordinate the main (offshore) wind innovation programs in Denmark; Megavind and the programs organized by Offshoreenergy.dk (Danish Wind Industry Association, n.d.; MegaVind, 2016) (Appendix 1, iv & xiii). These programs are coordinated by the private sector, but sometimes receive support (in finances or kind) from the Danish regions (provinces) (Wind Offshore Denmark, 2014) (Appendix 1, iv). Offshoreenergy.dk does receive funding from both the Danish state and the Danish regions, yet mostly relies on membership fees and project-specific funding from non-governmental organizations.

The main funds for innovation in Denmark are supplied by the Innovation Fund Denmark (supplied by the Danish Ministry of Higher Education and Science) (Ministry of Foreign Affairs of Denmark, n.d.-d), which includes the Large-Scale Projects (long-term development for large projects), InnoBooster (development of innovation for SMEs) and Entrepreneurial Pilot programs (companies wanting to offer PhD or Postdocs) (Innovationsfonden, 2015). Additionally, Danish firms are allowed to write off capital expenditures for R&D, which can be reimbursed by the government (PWC, 2017a).

The Danish offshore wind tenders offer no incentives or specific regulation on tender criteria for innovation outside of cost-reductions (Appendix 1, iii). Most of the research in the offshore wind sector outside of the private sector is performed by the Danish universities. No commercial activities have been found in the universities most active in offshore wind research projects like Megavind; Danmarks Teknisike Universistet and Aalborgh University (Danish Wind Industry Association, n.d.).

Concluding, Denmark has some governmental agencies that perform research and development activities, but only as an extension of their core activities. The government's role in domestic research networks is small to absent. It does host an international innovation network and offers a wide range of financial incentives for research and development.

Testing

Similar to research and development activities, testing activities in Denmark are generally not executed by governmental parties, with the exception of tests related to grid concepts developed by Energinet (Appendix 1, vii).

The Danish Energy Agency has recently tendered 50 MW of offshore wind testing capacity including locations, of which 28 MW is currently being developed (ENS, 2016). Additionally, Denmark has a range of onshore testing facilities, of which the locations in Østerild and Høvsøre are suited for the testing of the next generation of offshore wind turbines (DTU Wind Energy, 2015). These locations, owned by Danmarks Tekniske Universitet (DTU), will be expanding in the coming years (State of Green, 2017a). Test locations receive a feed-in tariff similar to onshore wind farms (DTU Wind Energy, 2015). Connections to the grid of these test facilities are the responsibility of the owners of the test locations (Appendix 1, vii).

The Large-Scale Project program supplied by the Innovation Fund Denmark is also suited to supply financing to the testing stage of these projects. Additionally, the Danish Energy Agency offers financing to development and demonstration energy projects under its EUDP program (EUDP, 2017), specifically aimed at innovations which show potential for future exports.

Concluding, Denmark has some governmental agencies that perform testing activities, but only as an extension of their core activities. It allows a wide range of options for test facilities for its industry and actively stimulates the creation of such facilities. It is not active in trade organizations or other networks stimulating testing, but offers a wide range of financial instruments to stimulate testing.

Domestic market development

In Denmark, state-owned transmission system operator Energinet is responsible for the (on- and) offshore electricity grid. This includes the export cables and offshore substations of the offshore wind farms, as well as the preliminary studies performed on the offshore wind parcels (Appendix 1, vii). Energinet performs the role of project manager and contractor for these projects. Costs of the grid activities are recaptured by levies to consumers, costs of preliminary studies are paid by the winners of the tenders.

Danish state-level governmental influence in trade organizations is limited, but region-level governments participate in and finance the Danish Wind Energy Association and Offshoreenergy.dk. No large influence of the Danish Chambers of Commerce in the offshore wind industry has been found during this study (DIHK, n.d.).

The Danish government regulates the domestic growth of offshore wind in its national waters, by hosting tenders for potential offshore wind areas. The Danish Energy Agency is responsible for the execution of these tenders. Additionally, an open-door system allows project developers to suggest additional offshore wind farms. Applications for the open-door system are evaluated on a case-by-case basis (Danish Energy Agency, n.d.-c). Tendered offshore wind farms receive the difference between tender and market price per unit of electricity, open-door procedure wind farms receive the onshore equivalent of a feed-in tariff (Danish Energy Agency, n.d.-c).

The Danish Government has a range of funds which facilitate companies in domestic growth, of which the largest are The Danish Growth Fund and the Market Development Fund. The Danish Growth Fund is the official investment fund of the Danish state, which supplies investments to SMEs that show potential for socio-economic return (MegaVind, n.d.). The Market Development Fund (offered by the Danish Business Authority) takes over where R&D and demonstration programmes stop in

order to assist in the final market adaptation of enterprises' innovative new solutions (Markedsmodningsfonden, n.d.).

Concluding, Denmark has governmental agencies that are responsible for a significant part of the offshore wind farms, yet these agencies are primarily focused on managerial and contracting activities and do not perform the physical construction activities. Domestic growth is almost completely determined by regulation. The government is not active in trade organizations or other networks connecting domestic parties, but offers a wide portfolio of subsidies and funds for companies and projects in the offshore wind sector.

Foreign market exploration

The Danish embassies and the Danish Trade Council, both part of the Danish Ministry of Foreign Affairs, offer a range of services to companies that want to explore foreign markets. General services offered by embassies such as general market information, shallow market explorations and information on legislative frameworks are generally free of charge. Business-drive services tailored to the companies requesting them are commonly on a pay-per-hour basis (Barneveld van, 2014) (Appendix 1, xvii).

The embassies also organize trade missions, which can be policy driven (exploring new possibilities) or business driven. When policy driven, these are free-of-charge. When business driven, the companies participating finance them. Consultancy firms working with the embassy offer additional business-specific market explorations on a pay-per-hour basis (Barneveld van, 2014; Ministry of Foreign Affairs of Denmark, n.d.-c). Upkeep of the embassies and part of the price of the services is paid for by the Danish government.

The Trade Council offers three more programs for Danish companies wanting to start exploring possibilities for export. It offers sparring sessions with local offices in Denmark, which offers SMEs with no experience in exports basic market information and guidance to make an export plan. Its GROW program can be used by a group of SDEs for to make a plan of exporting to a sector, which is partially subsidized (Ministry of Foreign Affairs of Denmark, n.d.-d). Lastly, its VITUS program actively offers an export support program to 10 yearly selected firms (Ministry of Foreign Affairs of Denmark, n.d.-f).

No regulative restrictions for foreign market exploration have been found during this study.

Concluding, the Danish government offers and facilitates a wide range of instruments stimulating companies to explore foreign markets. It works together with parties in the sector and local consultancies in foreign markets, and has programs connecting domestic parties which want to explore new markets. It partially reimburses companies for many of the services it offers, or activities these companies execute, yet expects companies to contribute financially as well.

Market entry preparation

The Danish embassies and Trade Council also offer a range of services supporting companies during the market entry preparation stage. Services offered by on a pay-per-hour basis by consultants working for the Trade Council are: Consultancy on setting up companies abroad, recruiting foreign staff and dealing with corruption, business partner scans, strategic advice to approach relevant networks, setting up companies abroad and getting access to international financing (Barneveld van, 2014; Ministry of Foreign Affairs of Denmark, n.d.-c). Upkeep of the embassies is paid for by the Danish government.

The Danish Trade Council also subsidizes export activities like trade fairs, company visits, seminars or individual contact meetings. Commercial consultancy firms working closely together with the embassy offer business-specific market explorations on a pay-per-hour basis (Barneveld van, 2014; Ministry of Foreign Affairs of Denmark, n.d.-c). The VITUS program mentioned earlier also applies to activities in the market entry preparation stage. The Danish Ministry of Foreign Affairs' innovation hubs can also play a role in connecting domestic and international companies (Ministry of Foreign Affairs of Denmark, n.d.-b).

Denmark has a national branding organization for its green energy sector called State of Green, which is organized by a collaboration between governmental parties, trade organizations and companies. The organization hosts an extensive website, is present at trade missions and fairs, writes white-papers and news articles, has a physical location in Copenhagen for visitors, and facilitates tours for incoming delegations of foreign visitors (Udenrigsministeriet et al., 2017) (Appendix 1, xv). State of Green is partially publicly and partially privately financed.

As a part of its national export strategy, the Danish government actively looks for bi-lateral cooperation on a governmental level with countries that they view as having a high potential for their green sector. It does so by offering advice and knowledge in the development of green technologies and systems, aiming to affect foreign regulative frameworks in order to make them accessible for Danish firms, and opening up communication lines to foreign policymakers (Udenrigsministeriet et al., 2017). This strategy particular focuses on the USA, UK and Germany and China (Udenrigsministeriet et al., 2017). The Danish government has memorandums of understanding with the USA and China related to the development of offshore wind (The Government of the Kingdom of Denmark and The Government of the People's Republic of China, 2014; The Government of the Kingdom of Denmark and The Government of the United States of America, 2016).

No regulative restrictions for market entry preparation have been found during this study.

Concluding, the Danish government offers a wide range of market entry preparation activities, and works together with a large international network and local consultants. It also actively works on government-to-government cooperation. Additionally, the Danish government finances or partially finances a range of activities for companies, has programs for international market entry, and provides support and financing to its sector's branding initiative.

Export

The state-owned company Energinet.dk has a fully owned commercial department called Energinet.dk Energy Consultancy A/S, which exports knowledge about grid-related solutions including the connection of offshore wind farms (Energinet.dk Energy Consultancy A/S, n.d.). The Danish state is also the owner of the EKF, an organization which offers a range of financial products such as export credit guarantees (EKF, n.d.-a). EKF has a special program for the wind sector, and wind projects contribute to almost 80 percent of its awarded export credit guarantees (EKF, 2016).

No governmental involvement in networks connecting exporting companies in Denmark has been found during this study. No regulative restrictions regarding the export of offshore wind goods and services have been found during this study.

Concluding, the Danish government owns the organization which offers financial support to exporting companies and governmental agencies sporadically export some consultancy services. The financial products offered by the former organization are often used by the offshore wind sector.

Overview

The findings of this case are presented in Figure 15. After having compared and rated the governmental roles Figure 16 represents the prevalences of the governmental roles found in this case.

	Denmark			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Energinet researching and developing grid security and voltage control concepts, Danish Energy Agency designing tender procedures	-	Innovation hub network	Innovation Fund Denmark offering Large-Scale Projects, InnoBooster and Entrepreneurial Pilot programs, Tax incentives capital expenses of R&D, Funding Offshoreenergy.dk
Testing	Energinet testing grid security and voltage control concepts	Open door tenders for test locations, onshore test permits for locations for large offshore turbines	-	Market premium subsidies to test locations, EUDP program, Large-Scale Projects program, Funding Offshoreenergy.dk
Domestic market development	Energinet developing offshore grid and substations and managing preliminary studies	Tenders for domestic offshore wind farms, additional open door procedure for offshore wind farms	-	Market premium to bid for tenders, feed-in tariff for open door, Danish Growth Fund, Market Development Fund, Large-Scale Projects program, Funds Offshoreenergy.dk
Foreign market exploration	Trade Council offering information on foreign markets, legislative frameworks and performing shallow market explorations, local sparring sessions and GROW program	-	Embassies cooperating with local consultancy firms	VITUS program, GROW program financing, upkeep embassies
Market entry preparation	Trade Council offering advice on setting up companies abroad, recruiting foreign staff, dealing with corruption, business partner scans, strategic advice to approach networks and getting access to international financing	Government-to-government framework and regulation design in foreign markets, memorandums of understanding with China and USA	Embassies cooperating with local consultancy firms, Innovation centres networks, State of Green	Financing of trade fairs, company visits, seminars and individual company meetings, State of Green, upkeep embassies
Export	Energinet.dk's Energy Consultancy, state-ownership of EKF offering export credit guarantees	-	-	Financing of products EKF

Figure 15: The research framework applied to the Danish case

	Denmark			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Low	None	Low	High
Testing	Low	High	None	High
Domestic market development	Medium	High	None	High
Foreign market exploration	High	None	High	Medium
Market entry preparation	High	High	High	High
Export	Low	None	None	High

Figure 16: The rated prevalences of the governmental roles in the Danish case

5.3 Case: Germany

Germany is a country in the north-west of Europe with a population of approximately 82 mln. It is the world's 3th largest economy (International Monetary Fund, 2017), and is the world's 3rd largest export economy (OEC, n.d.-b).

5.3.1 Domestic market

The German offshore wind industry employed ~20.500 FTEs in 2015, with a turnover of ~4.7 bln euros (GWS, 2016), and these numbers are expected to rise in 2016 and 2017. Of this 4.7 bln, around 67 percent is accounted for by exports (in 2015) (German Wind Energy Association, 2015), amounting to ~3.1 bln euros. The German offshore wind industry holds a 20 percent (global) market share, mainly in offshore foundation construction, grid infrastructure and wind turbine exports (German Wind Energy Association, 2017). Germany currently has the second most installed capacity of offshore wind

globally, and is expected to remain one of the top three markets until at least 2030 (Dickson, 2017; GWEC, 2017).

The expansion of offshore wind forms an important part of the German Energiewende (Die Bundesregierung, 2017) and the growth of its offshore wind capacity is described in its recently revised renewable energy act (Bundesverband der Energie- und Wasserwirtschaft e.V., 2016). Germany's system for the roll-out of offshore wind tenders is currently in a transitional period, moving towards a centralized tender system with yearly added capacity similar to the Dutch system (Clark, 2017). Germany had approximately 4.6 GW of installed capacity in August 2017 and has a steady pipeline of projects expected to lead to a total capacity of at least 15 GW by 2030 (Allen & Overy, 2016; Dickson, 2017; Norton Rose Fulbright, 2017a).

5.3.2 Organization of the sector

The German offshore wind sector is comprised of a wide field of actors, with varying responsibilities. Figure 17 gives a simplified representation of the sector and the relations between its actors. Key actors are shortly expanded on below.

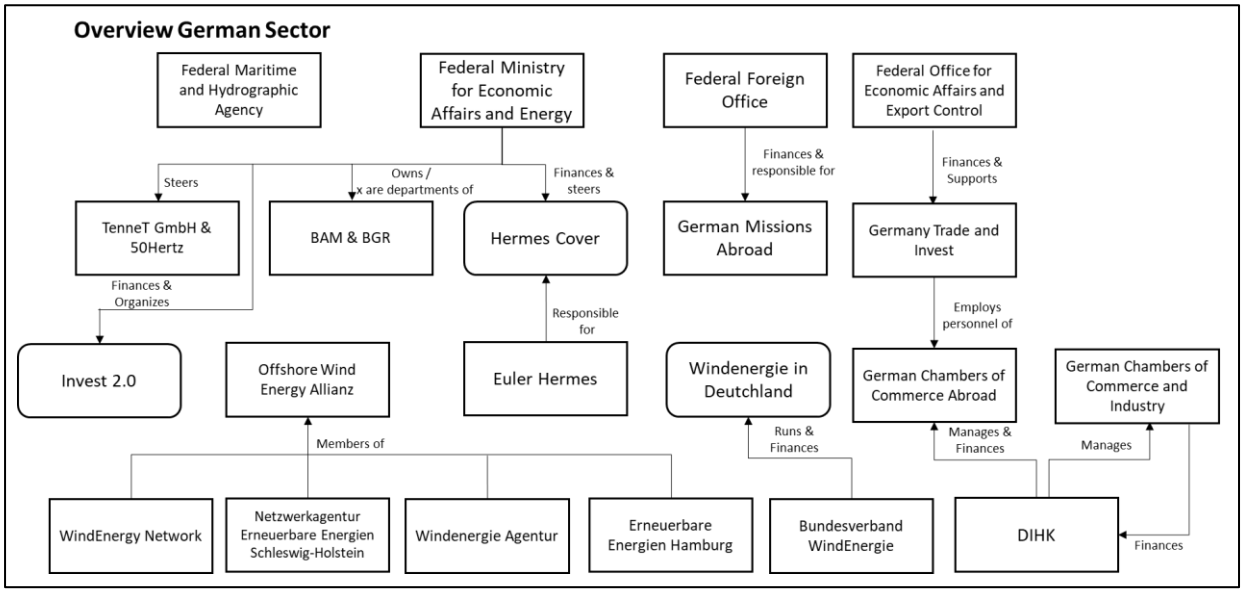

Figure 17: Overview of the German sector, its most important actors and their relations

The most important ministry in Germany regarding innovation and export of the offshore wind sector is the Federal Ministry for Economic Affairs and Energy (Bundesministerium für Wirtschaft und Energie, BMWi). Three of the departments of the ministry are research organizations: The Bundesanstalt für Materialforschung und -prüfung (BAM), the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Physikalisch-Technische Bundesanstalt (PTB). Of these, the first two mentioned are active in offshore wind related activities. BMWi also steers the non-state owned TSOs TenneT GmbH (North-Sea farms) and 50Hertz (Baltic-Sea farms) (Federal Ministry for Economic Affairs and Energy, n.d.). It also works together with Hermes Euler to offer export finance products under the Hermes Cover line (Euler Hermes Aktiengesellschaft, n.d.), and is the ministry responsible for the Invest 2.0 program. Additionally, the Federal Foreign Office (BAFA) is responsible for the German Missions Abroad (similar to embassies) and economic diplomacy. The Federal Office for Economic Affairs and Export Controls (The Federal Office for Economic Affairs and Export Control, n.d.) manages the Germany Trade and Invest (GTAI) organization, which focuses on promoting German investment both domestically and abroad (Germany Trade and Invest, n.d.-a). Lastly, the Federal Maritime and Hydrographic Agency is responsible for the permit procedures around domestic offshore wind tenders (50Hertz, n.d.-b).

All German (commercial) companies are by law required to be members of their Chamber of Commerce and Industry (CCI). The Deutscher Industrie- und Handelskammertag (DIHK) is the

association of all the 79 CCIs, and represents all German companies. The DIHK operates a worldwide network of German Chambers of Commerce Abroad (130 locations in 90 countries), which provides services similar to embassies in other countries. It does so in a public-private partnership construction (Deutscher Industrie- und Handelskammertag, n.d.). The DIHK is an independent organization, largely privately financed, but regularly works together with German state-level and national government(s).

Germany hosts a range of trade organization on nation-wide and regional level. The 'Bundesverband WindEnergie' is the German Wind Industry Association, which lobbies for the industry and provides information to domestic companies through its 'Windindustrie in Deutchland' platform. There are four regional trade organizations in the north of Germany which are active in the promotion of (offshore) wind. These are the Windenergie Agentur (Wind Energy Agency, north-west of Germany, including Bremen), Erneuerbare Energien Hamburg (Renewable Energy Hamburg, metropolitan region Hamburg, Netzwerkagentur Erneuerbare Energien Schleswig-Holstein (Renewable Energy Network Agency, northern part of Germany connected to Denmark) and WindEnergy Network e.V. (Wind Energy Network, north-east of Germany including Rostock). The organizations cooperate to lobby for the interest of offshore wind in the umbrella-organization Offshore-Wind-Energie-Allianz (OWIA, n.d.).

5.3.3 German government's roles in the export process

With the German sector and its actors introduced, the next part of the chapter will look into the governmental roles in the different stages of the export process. The different stages of the export process are expanded on separately. At the end of the chapter, Figure 18 will show the instruments of the different roles inserted in the framework, and Figure 19 will show the level of prevalence of the governmental roles in the case. A large version of this framework is also presented in Appendix 6.4.

Research and development

Germany has a mix of public and private research organizations. The BMWi has two public executive research organizations active in the offshore sector. The Bundesanstalt für Materialforschung und -prüfung (BAM) performs its own research and development activities on materials, licencing and certification of offshore wind turbines and foundations (Bundesanstalt für Materialforschung und -prüfung, 2015; Bundesministerium der Justiz und für Verbraucherschutz, 2013). The Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) performs research and development activities, and tests instruments for the environmental impact assessments of offshore wind parks (RAVE, 2017).

On a federal level, the German government has released its 6th Energy Research Program (BMWi, 2014). This program is focused on a wide range of energy technologies, of which wind (on- and offshore) is one of the focus areas with funding priority. It provides funding to projects performed by research institutions, programs executed by the wind industry and activities around test locations (Die Forschungsförderung des Bundesministeriums für Wirtschaft und Energie, n.d.). The most important non-governmental research organization for wind energy in Germany is the Fraunhofer IWES, which performs a mix of commercial and public activities and receives part of its funding from the German government (Fraunhofer IWES, 2017).

In addition, the BMWi runs the 'Innovation durch Forschung' program, providing financing to research and development, testing and development of on- and offshore parks, logistics, environmental research, meteorological research and some miscellaneous areas (Bundesamt für Wirtschaft und Energie, 2017; RAVE, n.d.). It hosts the WIPANO program, reimbursing parts of patent application costs for SMEs (BMWi, 2017b). To connect its domestic innovative cluster organization, the German government has the 'go-cluster' umbrella program (BMWi, 2017c).

While each German Bundesland hosts programs for research and development, no programs specifically for offshore wind have been identified (BMWi, 2017c). No sign of governmental funding for innovation programs ran by trade organizations has been identified (EE.SH, n.d.). Regulation around tender criteria solely focuses on cost-reductions, and does not contain additional criteria stimulating innovation (Huebler & Radov, 2017; Norton Rose Fulbright, 2017b).

Concluding, the German government has research organizations which perform research and development activities which are sometimes related to offshore wind. It also hosts research programs which focus on offshore wind as part of broader wind programs, but these are not specifically aimed to connect companies in the sector. It utilizes a wide range of subsidies, but uses little regulative stimulants for research and development.

Testing

Next to the research and development activities, BAM and BGR also perform testing activities. The 'Innovation durch Forschung' program also offers financing to the demonstration phase of technologies.

The main testing and demonstration site for offshore wind in Germany is the Alpha Ventus, Germany's first offshore wind farm. This farm has been built specifically to demonstrate and develop offshore wind technology, and has its own research project (RAVE) (Deutsche Offshore-Testfeld und Infrastruktur GmbH & Co.KG, 2015; RAVE, n.d.). Both electricity generated at the farm and individual research projects are subsidized by BMWi and The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

The Fraunhofer IWES has recently received approval and funding to develop an offshore wind demonstration site for large offshore wind turbines in Bremerhaven (Fraunhofer Institute for Wind Energy and Energy System Technology, 2017), a testing facility for turbine bearings near Hamburg and a test facility for blades near Bremen, financed by BMWi and the respective regional governments (Fraunhofer IWES, 2017). Permits for test locations in the German Economic Exclusive Zone can be requested at and granted by The Federal Maritime and Hydrographic Agency. It is unlikely that permits will be granted outside the tendered preferential areas for offshore wind (Bundesamt für Seeschifffahrt und Hydrographie, 2017).

Concluding, the German government has research organizations which also perform testing activities sometimes related to offshore wind. It utilizes its regulation around its waters to host a large offshore test site and allows the development of additional test sites and other onshore test facilities. While it is not active in networks stimulating testing, it has a wide range of subsidies and funds available for companies that want to develop and test concepts, or that support current test locations.

Domestic market development

The German system on the regulation around offshore wind farms is currently undergoing large changes. The current and future systems will work with a tender system, in which the government will determine the capacity and preferential areas of offshore wind parks to be constructed. In the tenders of 2017 and 2018, companies are free to submit proposals on where in the preferential areas they want to construct the wind farms. In tenders after 2018, the German government will pre-determine the areas where the wind parks will be located. In both cases, the capacity of the farms is determined by the German government (Allen & Overy, 2016; Huebler & Radov, 2017).

The Federal Maritime and Hydrographic Agency performs the preliminary studies of the to-be-tendered parcels, for which it uses a mix of self-owned survey vessels and cooperation with private parties (BSH, n.d.). The costs of these studies are currently paid by the project developers, but will be paid by BMWi from 2025 (Allen & Overy, 2016; PWC, 2017b). Grid connections activities are regulated by national laws. Offshore wind grid connects are constructed and paid for the TSOs, with costs socialized to consumers (BMWi, 2017a; Schittekatte, 2016b). Wind farms who have had their connection capacity allocated before January 2017 are reimbursed with a fixed market premium subsidy, those tendered after January 2017 will receive an auctioned market premium similar to the Dutch system (Watson Farley & Williams, 2016).

The German government offers a range of financial incentives for companies to support them in their development on the domestic market. The earlier mentioned 'Innovation durch Forschung' program is one of the programs. The 'Invest 2.0' program stimulates the availability of venture capital for young innovative enterprises (BMWi, 2016). The High-Tech Gründerfonds (HTGF) invests in technology-

oriented young enterprises that have high-risk high-potential products(BMWi, 2017b). The Zentralen Innovationsprogramm Mittelstand (ZIM) supports SMEs in bringing their ideas to the market by offering a range of funding opportunities which are also available for offshore wind companies (BMWi, n.d.-a, 2017b).

German companies are by law required to be a member of one of the German Chambers of Commerce and Industry (DIHK, n.d.), which provide a range of services supporting the companies in their region, and must be consulted when regulatory changes regarding their sector are implemented. They function in a public-private partnership relation with the German government (Barneveld van, 2014), and play an important role in both regional development and support for exporting firms.

Four of the northern German Bundesländer have their own trade organizations for offshore wind projects, which are often supported by their respective local governments and contribute to regional development of their offshore wind industries (WAB e.V., n.d.; WindEnergy Network e.V., n.d.). No federal funding for these organizations has been found in this study.

Concluding, the German government has organizations which are active in a relatively small part of the offshore wind farms (mainly preliminary studies), and perform contracting, managerial but also physical activities on this part of the farms. Domestic growth is almost completely determined by regulation in the old and the new system. The German government has an active role in the steering of its Chambers, but is not involved in trade organizations. It offers a wide portfolio of subsidies and funds for companies and projects in the offshore wind sector.

Foreign market exploration

In Germany, the activities to support companies in their foreign market exploration are not primarily offered by the embassies, but instead by the German Chambers of Commerce Abroad and the German Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA).

The German Bundesamt für Wirtschaft und Ausfuhrkontrolle, part of the BMWi, hosts the export program 'Exportinitiative Energie', organizing events providing companies with overviews of market opportunities, expert consultation and sector-specific sales potential figures. In addition, the BAFA organizes incoming missions, networking events for domestic companies (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-a) and 'Markterkundungsreise'. These Markterkundungsreise are sector-specific trade market exploration missions for groups of companies, which include training for and information about exporting, and sometimes include opportunities to meet companies or local decision makers (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b). The Exportinitiative also offers SMEs the possibility to participate in highly subsidized community stands at selected fairs and exhibitions, and offers reimbursements for the visitation of symposia (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b).

Germany Trade and Invest offers standardized information to German SMEs of trends and market developments in more than 50 strategic growth markets (Germany Trade and Invest, n.d.-a).

Germany has a network of German Chambers of Commerce Abroad. These Chambers are public-private partnerships with the German government, and are usually locally established companies in the countries in which they promote German companies (Barneveld van, 2014; Deutscher Industrie- und Handelskammertag, n.d.). The Chambers offer a range of services to German companies interested in exploring and entering of foreign markets. These services include the supply of market information, information and support around legal and fiscal issues, translation services and support to companies attending fairs (Barneveld van, 2014). Services offered by the Chambers of Commerce abroad generally have hourly fees for the companies making use of these services, and are partially funded by the Chambers themselves. The BMWi offers funding to some of its Chambers of Commerce Abroad. This funding is channelled through the DIHK, and varies per Chamber of Commerce. Funding depends on the maturity of the Chamber, but is generally only a fraction of the overall budget of the Chambers (Barneveld van, 2014).

No regulative restrictions for foreign market exploration have been found during this study.

Concluding, the German government has a moderate portfolio of instruments available for foreign market exploration and cooperates with its Chambers and local consultants to offers additional services. It hosts no large programs for market exploration. It offers some reimbursements to companies undertaking market exploration activities, but most activities are paid for by the companies or the Chambers.

Market entry preparation

Under the 'Exportinitiative Energie' program, the German foreign trade chambers and BAFA organize 'Geschäftsanbahnungsreisen'. These are trade missions and delegation trips promoting German energy solutions, offering preliminary market analyses and individual appointments with German and foreign businesses and potential partners trip (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b). Additional information on markets and potential partners is offered by the German Chambers of Commerce Abroad (Barneveld van, 2014; Deutscher Industrie- und Handelskammertag, n.d.).

The German BMWi engages in regular dialog with institutions abroad, to both foster bilateral economic relations and promote the activities of German firms abroad (BMWi, n.d.-b). For the offshore wind industry, this has led to a memorandum of understanding between the Taiwanese Ministry of Economic Affairs and the German government's representative in Taiwan, focusing on energy policy for the promotion of clean and renewable energy (Wen-shin, 2016).

The German Federal Ministry of Research and Education has an internationalization program to promote international networking activities (Federal Ministry of Education and Research, 2014). No official branches of this program in the embassies or Chambers of Commerce Abroad have been found in this study. No activities or programs aimed specifically at the offshore wind sector have been found either (BMBF, 2017).

The four trade-organizations in the north of Germany that are members of the Offshore Wind Energie Allianz each host a range of activities to promote and support the companies of their respective regions in exploring and entering markets abroad. While they do work together with local governments, no cooperation or influence from the federal government has been found. Also, no regulative restrictions that have been implemented by the German government have been found that impede foreign market exploration for any of the markets that show potential for offshore wind products. Germany has no centrally / governmentally coordinated branding initiatives for its (offshore) wind industry. No regulative restrictions for market entry preparation have been found during this study.

Concluding, the German government offers a small amount of services stimulating market entry, but relies mostly on the German Chambers to offer these services. Working together with the Chambers it has a large international network and works together with consultants abroad. It is not active in the branding of its sector. It offers little funding to market entry preparation activities or the Chambers. Few examples of regulative cooperation between the German government and other governments concerning offshore wind have been found.

Export

The German government supports exporters financially through its Hermes Cover line of products, offered through a public-private partnership with Hermes Euler (Euler Hermes Aktiengesellschaft, n.d.). The products of this line include export credit guarantees and other similar products insuring companies and potential investors against the additional financial risks when exporting goods. Several projects in the wind industry have used these products (Appendix 1, i & xi). No specific products for offshore wind projects are offered (Hermes Cover, 2017).

The German government also offers 'German Centres' to German companies who wants to operate in certain foreign markets. These centres rent offices (often below market rates), offer advice and can connect German companies that do business in that market. No examples of companies making use

of their facilities operating in the wind industry are found (German Centre for Industry and Trade, n.d.).

No indications of the German government exporting goods or services like tender procedures or research have been found. No regulative restrictions by the German government, BAFA or other organizations are found that have been implemented by the German government for the import and export of specifically offshore wind goods and services. No examples of governmental influence in German networks which support exporters with their actual exporting have been found during this study.

Concluding, the German government cooperates with commercial parties to offer a range of financial products stimulating export which are often used by the offshore wind sector.

Overview

The findings of this case are presented in Figure 18. After having compared and rated the governmental roles Figure 19 represents the prevalences of the governmental roles found in this case.

	Germany			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	BAM researching materials for offshore wind components, BGR researching instruments and EIAs	Commercial freedom research organization	Go-cluster network	Projects financed by the 6th Energy Research Program, Innovation Durch Forschung program, WIPANO program
Testing	BAM testing material concepts for offshore wind components, BGR testing instruments for offshore wind measurements	Alpha Ventus windfarm and attached RAVE project, offshore wind test farm Fraunhofer IWES, possibilities test locations outside EEZ	-	Innovation Durch Forschung program, financing to construction and testing Alpha Ventus including market premium on output, funding to Fraunhofer test facilities
Domestic market development	BSH performing preliminary studies	From allocation of connection to pre-arranged tender system for offshore wind farms, obligatory membership of German Chambers of Commerce, regulatory steering of TSOs	Chambers of Commerce network	From market premium system to tender system for generated electricity, Innovation Durch Forschung program, HTGF program, ZIM program, Invest 2.0 program
Foreign market exploration	BAFA organizing information events, incoming missions and networking events, market exploration missions, Exportinitiative Energy community stands, standardized information GTIA	-	Network and activities offered by Chambers of Commerce Abroad	Reimbursement costs market exploration missions companies, subsidies for companies at community stand, funding of Chambers of Commerce Abroad
Market entry preparation	BAFA and German foreign trade chambers organizing trade missions and delegation trips	Memorandum of understanding with Taiwan	Network and activities offered by Chambers of Commerce Abroad, trade and delegation trips from BAFA and German trade chambers	Funding of Chambers of Commerce Abroad reimbursements costs participation trade or delegation trips
Export	-	-	Cooperation with Hermes Euler for offering export promotion financing, German Centres	Financing of the Hermes Cover line

Figure 18: The research framework applied to the German case

	Germany			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	*Medium*	*Low*	*Medium*	*High*
Testing	*Medium*	*High*	*None*	*High*
Domestic market development	*Medium*	*High*	*Medium*	*High*
Foreign market exploration	*Medium*	*None*	*Medium*	*Low*
Market entry preparation	*Low*	*Low*	*Medium*	*Low*
Export	*None*	*None*	*Low*	*High*

Figure 19: The rated prevalences of the governmental roles in the German case

6. Comparative analysis

The previous chapter has described the prevalences of the governmental roles and the instruments utilized in the case counties, evaluated per stage of the export process. Their prevalences have been rated on the scale indicated in chapter four. An overview of these criteria and resulting ratings can be found in Appendix 6.5. With the prevalences of the governmental roles and the utilized instruments identified and rated, this chapter will focus on the comparative analysis of these findings.

Figure 20 gives an overview of the rated prevalences of the governmental roles across the countries. Before moving to the stage-specific comparison process, some general findings on the prevalences of the governmental roles are presented. A larger version of this framework can be found in Appendix 6.6.

	Executive			Regulative			Networking			Financing		
	Netherlands	*Denmark*	*Germany*	*Netherlands*	*Denmark*	*Germany*	*Netherlands*	*Denmark*	*Germany*	*Netherlands*	*Denmark*	*Germany*
Research and development	Low	Low	Medium	Low	None	Low	High	Low	Medium	High	High	High
Testing	Low	Low	Medium	Medium	High	High	High	None	None	High	High	High
Domestic market development	Medium	Medium	Medium	High	High	High	Medium	None	Medium	Medium	High	High
Foreign market exploration	High	High	Medium	None	None	None	Medium	High	Medium	High	Medium	Low
Market entry preparation	Medium	High	Low	Low	High	Low	Medium	High	Medium	Medium	High	Low
Export	None	Low	None	None	None	None	Low	None	Low	Low	High	High

Figure 20: All the prevalences of the governmental roles in the case studies

6.1 General findings

High utilization of financing role

When assessing the prevalence of instruments in general, the study finds a high prevalence of the financial role in each of the case-countries. The case counties have at the least some financial incentives available for the stimulation of each of their respective export stages. Especially in the commercialization stages of the export process, all governments utilize a wide range of instruments stimulating their domestic industries. More variation in the utilization of financial instruments is found in the later stages of the export process. This could indicate that the opinions on financial stimulation of companies in the later stages of an export process vary more widely then opinions on financial stimulation of the commercialization of technologies.

Variety in executive role

The prevalence of the executive role varies as a result of differences in state ownership of transmission system operators and research organizations. The differences in ownership structure do not seem to have large effects on a sector's ability to export its goods and services. Governmentally executive agencies offer governments tools to strengthen government-to-government cooperation if effectively utilized. The priority on government-to-government cooperation varies strongly between the cases. This could however also be the result of differences in opinion on whether the task of connecting to international sectors is seen as a governmental task or as a task of the sector.

High variety of prevalence networking role

Large differences are found in the utilization of the networking role between the case countries. These differences can be largely explained by the differences of governmental involvement in the organization of research programs and organizations connecting parties in the sector. Variations in the networking seem relatively unrelated to variations in the financing role, indicating that these instruments are not always complementary, but can be applied independently from each other.

Similar pattern of utilization regulative role

Each of the case countries appears to have a relatively similar pattern in the prevalence of its regulative role. Seemingly, the governments have a similar approach to the utilization of regulation. More specific analysis of this phenomenon is performed during the comparative analysis of the specific export stages in the next part of this chapter.

6.2 Comparative analysis per export stage

The next part of this chapter will perform an in-depth comparative analysis of the findings in the case studies. For this it will follow the structure of the case studies, looking at each stage of the export process and discussing the differences and similarities between the cases. At the end of each stage of the export process, possible improvements to the current Dutch approach are suggested.

For each stage of the export process, a table is presented of the governmental roles' prevalences, based on rates case studies in Appendix 3 and 6. In the bottom row of these tables, an indication is given of the recommendation to the Dutch government, which is further explained at the end of comparative analysis of that export stage. 'Increase' and 'decrease' indicates a recommended increase and decrease in the Dutch government's prevalence in that role, adjust means a similar prevalence but a different utilization of instruments. Empty cells indicate no recommended changes to the prevalence or utilized instruments in that role.

6.2.1 Research and development

Each of the governments of the case countries has a unique approach to the stimulation of research and development, but the prevalences of the governmental roles in the countries are relatively similar.

	Research and development			
	Executive	*Regulative*	*Networking*	*Financing*
The Netherlands	*Low*	*Low*	*High*	*High*
Denmark	*Low*	*None*	*Low*	*High*
Germany	*Medium*	*Low*	*Medium*	*High*
Advice to Dutch government		*Increase*	*Adjust*	

Figure 21: The prevalences of the governmental roles in the research and development stage

Minor variations in the prevalence of the executive role exist due to the differences in the roles of governments in relation to their transmission system operators and research organizations. While the ownership structure of the transmission system operators differs, the effects on the companies' ability to perform research and development seems unaffected. What is done with the knowledge gained from research and development of these parties differs, but is discussed under 'export' later in this chapter. Governmentally owned research and development agencies in Germany are seemingly offered the same amount of commercial freedom and funding as independent governmentally funded research organizations present in all cases, and ownership structures do not seem to affect their ability to perform research and development.

The use of regulative instruments stimulating research and development is uncommon and seems to have little impact on the research and development activities in the offshore wind sector. Governments can potentially make more use of regulative instruments in future tender procedures to steer or stimulate research and development on specific topics (e.g. environmental impact or exportability of technologies). Such regulation can however raise the price of the current offshore wind farms. As the governments in the case countries are currently primarily focused on cost-reductions, little utilization of such regulation would be likely until subsidy-free tenders are more common. But as the first subsidy-free tenders have been reached in Germany this year, such regulation is increasingly becoming an interesting option to pursue a broader range of goals.

The cases show different approaches to national research and development programs. In the Netherlands, the government plays an active role in the organization and funding of a research program specifically for the offshore wind sector (Topsector WOZ). This program operates in cooperation with non-governmental actors, connects actors and directs funding to specific focus areas. Denmark has a similar program (Megavind), but this program focuses on both on- and offshore wind and is ran by the sector. This program makes use of general subsidies. Additionally, the Danish sector has a separate cluster organization receiving specific funding for offshore wind research. In Germany, offshore wind

research is part of a large program (6th Energy Research Program) which offers financing but does not aim to connect parties in the sector. Germany has a separate program to interconnect innovative cluster organizations (go-cluster network) but does not actively take part in the creation of such cluster organizations in the offshore wind sector. A government taking a central role in the organization of its sector potentially leads to better university-industry-government cooperation, but quantitative data to verify or benchmark the effectiveness of the Dutch approach is missing (de Witt Wijnen, 2016; Rijksdienst van Ondernemend Nederland, n.d.).

Both the Danish and the Dutch government host an international network to improve cooperation with foreign parties on innovation, but the utilization of these networks and programs related to these networks for specifically the offshore wind sector currently seems limited. The Dutch 'Internationale Innovatie Matchmaking' program could potentially be utilized to stimulate its sector's research and development.

Each of the case countries offers a wide range of subsidies and other financial incentives stimulating exports, but small differences in the utilization of their instruments exist. The Dutch and Danish governments combine subsidies with tax-breaks for research and development activities, the German government only utilizes subsidies or funds (OECD, 2017). The Danish government currently uniquely offers subsidies improving the connection between its universities and companies by offering funding for PhD positions at companies. A similar initiative is currently being launched by the Dutch Topsector WOZ (Appendix 1, viii). The German government uniquely offers reimbursements for SMEs applying for patents.

Improvements to the Dutch approach

Concluding, the levels of prevalence of Dutch government's roles in the research and development stage seem appropriate. The Dutch government should consider increasing its regulative role in the sector to steer research and development towards a broader range of goals once further reductions in costs of offshore wind have been reached. Additionally, it should ensure that relevant actors in the sector are acquainted with the services offered by its international network. Lastly, data on the efficiency of the subsidies and networking approach is currently missing. The Dutch government is advised to explore the possibilities to gather such data and to validate and benchmark its current Topsector Policy and subsidies' efficiency in the offshore wind sector.

6.2.2 Testing

Similar to the research and development stage, the prevalence of the governmental roles in the countries during the testing stage is relatively similar, except for the networking role. The prevalence of governments utilizing the executive role during the testing stage are similar to and based on the same organizations as the research and development stage.

	Testing			
	Executive	*Regulative*	*Networking*	*Financing*
The Netherlands	*Low*	*Medium*	*High*	*High*
Denmark	*Low*	*High*	*None*	*High*
Germany	*Medium*	*High*	*None*	*High*
Advice to Dutch government		*Increase*		*Adjust*

Figure 22: The prevalences of the governmental roles in the testing stage

The governmental presence in networks connecting companies in the sector is also similar to the research and development stage, with the Dutch government taking a central role in the main research and development program stimulating the demonstration of offshore wind technologies, and the Danish and German government solely offering financial incentives. Additionally, the Dutch government is active in connecting domestic large companies with smaller companies (Innovatielink) to stimulate intra-sectoral financing. While an initiative like Innovatielink is missing in Germany and

Denmark, the interconnection between the companies in the sector determines the necessity of such a program. Due to the fragmented and intransparant nature of the current Dutch sector, Innovatielink seems to be an effective program in the Dutch context (Appendix 1, viii).

Germany is currently the only case-country that has an active offshore wind demonstration farm. The Netherlands and Denmark are currently planning on developing their own, respectively with a co-location and open-door policy framework, and Germany has consented to an additional test location. Both Germany and Denmark are theoretically open for proposals regarding the development of offshore wind demonstration farms, while the Netherlands strictly regulates these through its tender procedures. In each country, companies indicate a high demand for more test facilities (de Boek & van der Hem, 2016). Open-door policies like the Danish that allow industry-initiatives for onshore feed-in tariffs prices could open up the possibility for additional demonstration locations at a relatively low cost to the government.

In each of the cases, a wide range of financial incentives are used to stimulate the demonstration of offshore wind technologies: Offering funding to separate projects, subsidies to electricity generated at demonstration farms and financial products to companies in the later stages of developing their technologies. The Danish government however also offers subsidies awarded on the criterium that the subsidized technology has a large potential for export. The German government offers subsidies for research projects related to its offshore demonstration wind farm. Whether the Dutch and Danish government will do the same with their upcoming demonstration farms is currently not publicized.

Improvements to the Dutch approach

Concluding, the levels of prevalence of the Dutch government's roles in the testing stage seem appropriate in the executive, networking and financing role. A different application of the Dutch government's regulative role could provide the sector with additional test locations which it currently is lacking. Next to a continuation of the co-location model in future tenders, the Dutch government is advised to consider implementing an open-door policy similar to the Danish government to open up the possibilities for industry-led development of offshore test locations. Additionally, it is advised to consider the utilization of demonstration-focused subsidies focused on companies which develop technologies with high export potential.

6.2.3 Domestic market development

The prevalence of the governmental roles in the countries during the testing stage is similar for the executive and regulative role, but differs in the networking and financial role.

	Domestic market development			
	Executive	*Regulative*	*Networking*	*Financing*
The Netherlands	*Medium*	*High*	*Medium*	*Medium*
Denmark	*Medium*	*High*	*None*	*High*
Germany	*Medium*	*High*	*Medium*	*High*
Advice to Dutch government				*Increase*

Figure 23: The prevalences of the governmental roles in the domestic market development stage

While the ownership of national transmission system operators differs across the case countries, the tasks of these organizations in the development of offshore wind farms is roughly the same. Compensation of the tasks of national transmission system does vary; in the Danish and German case these costs are socialized on the users of the net, and in the Dutch case these are directly supplied by the Ministry responsible for Energy (which can be seen as another form of socializing the costs). Each of the case countries currently has or is moving towards a system where preliminary studies are performed by national agencies.

Theoretically, the Danish system where Energinet performs the preliminary studies for both its own installations and the wind parcels could lead to a more efficient allocation of resources, compared to the Dutch system where TenneT and RVO separate these responsibilities. Practically, there is close cooperation between TenneT and RVO (Appendix 1, xvi)[3], and Energinet also has to cooperate with the Danish Energy Agency who form the Danish tenders (Appendix 1, vii & iii). As such, differences in efficiency of these systems are expected to be small.

In each of the case countries the development of offshore wind farms works through tender systems. This highly regulated system of domestic growth has proved extremely effective in the lowering of the costs of offshore wind, and is not likely to be changed in the near future. The continuity of the tender system and the time horizon of the schemes differ strongly per case country. Germany's system has a time horizon up to 2030, with a continuous pipeline of projects. This gives a large amount of certainty to the industry, and allows for long-term planning of research and development projects. The Netherlands is expected to publish a planning for wind farms to be constructed until 2030, with a steady pipeline of projects as well. The Danish future roll-out of offshore wind farms is currently highly uncertain, and lacks long term planning or certainty of a domestic pipeline of projects.

Each of the case countries has a range of financial instruments to stimulate the growth of companies in its domestic market. The budgets and variation in subsidies for domestic growth in Denmark are primarily based on national fund programs and in Germany both on funds and subsidies. The Dutch government has some subsidies and tax incentives available, but has remarkedly fewer options for companies wishing to expand their business in the forms of risk-, seed- and venture capital. The Netherlands does host the Innovatielink program linking small companies to large companies which could supply such capital, but even with this program access to capital is lacking. Especially potential upcoming manufacturers of wind turbines (DOT, Lagerwey, 2B Energy, Amphyx) would need large amounts of capital if they want to make the step from a conceptual technology to large scale production of turbines, in order to be able to compete with the established manufacturers (Appendix 1, xii & xiv). The upcoming InvestNL program could solve some of these issues, yet its suitability for offshore wind projects is currently uncertain.

Lastly, a large difference between the German sector with the Dutch and Danish sector is the prominence of the role of the Chambers of Commerce. While in the Netherlands and Denmark these have a mainly administrative role, with some instruments supporting their local companies, the German Chambers of Commerce are a central part of their regional development strategies. They are actively involved in regulation, and offer a wider range of instruments and support. While the role of the Chambers in Denmark and the Netherlands differs, the effects on this difference in roles on the offshore wind sector is unclear.

Improvements to the Dutch approach

Concluding, the levels of prevalence of the Dutch government's roles in the domestic market development stage seem appropriate in the executive and networking role. Its future prevalence in the regulative role will depend on the new plans for tenders up to 2030, but the current agreement of the Dutch government indicates future growth of offshore wind will have a high priority (VVD, CDA, D66, & ChristenUnie, 2017). Its portfolio in the financing role in this stage of the export process is currently lacking. While InvestNL could solve the gaps in this portfolio, both the Dutch government and the Dutch offshore wind sector are advised to actively communicate about the needs of the sector from this program. If InvestNL does not fit with the offshore sector's needs for capital, additional initiatives covering these needs should be launched.

6.2.4 Foreign market exploration

The prevalence of the governmental roles in the countries during the foreign market exploration stage differs slightly across the cases. Note that the relatively low prevalences of the governmental roles in the German case can be partially contributed to the German Chambers of Commerce Abroad, which

[3] The cooperation between RVO and TenneT has also been discussed during the meeting with RVO.

are non-governmental organizations, fulfilling tasks that in the Dutch and Danish case are fulfilled by the embassies of these countries. None of the countries utilizes regulative instruments which fall within the scope of this study during this export stage.

	Foreign market exploration			
	Executive	*Regulative*	*Networking*	*Financing*
The Netherlands	*High*	*None*	*Medium*	*High*
Denmark	*High*	*None*	*High*	*Medium*
Germany	*Medium*	*None*	*Medium*	*Low*
Advice to Dutch government			*Increase*	

Figure 24: The prevalences of the governmental roles in the foreign market exploration stage

In each country, the governmental agencies responsible for export promotion offer a range of instruments to companies in their sector. The instruments offered by governments in foreign market exploration vary slightly in type and method of remuneration of instruments offered. The Dutch and Danish governments' approaches both put a heavy emphasis on the role of their Ministry of Foreign Affairs, coordinating activities with its embassies abroad. The Dutch and Danish government also offer programs for companies or clusters of companies, guiding companies through several steps of market exploration. The German government coordinates her foreign market exploration activities from a branch of its Ministry of Economic Affairs and Energy (BAFA). The portfolio of instruments offered by the German BAFA is less broad than that of the Dutch and Danish foreign services, but the instruments not offered by the BAFA are generally offered by the German Chambers of Commerce Abroad.

The market exploration services offered by the Dutch embassies are free and offer a general overview of the market and its possibilities. The embassies act demand-driven and wait for companies to show interest in the respective markets. After a general introduction to the market companies are expected to find additional information themselves, or hire consultancy services not linked to the embassies. In Denmark, general services are also offered by the embassies, but business specific follow-up services are offered by consultants linked to the embassy. Most of the services offered by the German Chambers and embassies also ask for companies to financially contribute or pay for the services, and external consultants are also recommended for some follow-up services. As companies do not have to spend time and money finding a new party for the next step in their market exploration, this makes the step of going from a basic market exploration to a more specific and in-depth exploration easier to take. Whether the added value of such an approach is worth its costs might be an interesting topic for future research.

Additionally, the Danish and German embassies and Chambers work on hourly rates. As a result, the services they provide are subject to cost-driven dynamics. These serve as a driver to ensure the efficiency of these services. A similar driver from the private sector is missing in Dutch embassies.

Note that while the German Chambers of Commerce play a large role in its sector, the Netherlands and Denmark also have Chambers of Commerce which are connected to international networks. In this study no indications have been found that these networks are currently being utilized by the offshore wind sector. It could be worthwhile to explore the possibilities of utilizing these networks.

Improvements to the Dutch approach

Concluding, the levels of prevalence of the Dutch government's roles in the foreign market exploration stage seem appropriate in all but the networking role. While the Dutch embassies offer a wide range of instruments, additional business-specific paid instruments could help companies in the offshore wind sector with finding follow-up services after initial explorations. A system where the embassies offer these additional paid services would require a change in the functioning of the Dutch embassies in general, which would encompass a much broader discussion. More realistically would be for the

Dutch embassies in a select range of foreign markets which show high potential in the offshore wind sector to find consultancies willing to work together to offer follow-up services which complement the embassies' more general services.

Additionally, the Dutch government and Dutch offshore wind organizations are advised to explore the utilization of the international network of their Chambers of Commerce for the offshore wind sector.

6.2.5 Market entry preparation

The variation of the prevalences of the governmental roles in the countries during the market entry preparation stage is the highest of all stages of the export process. Note that the relatively low prevalences in the German case can again be partially contributed to the German Chambers of Commerce Abroad being considered a non-governmental agency. Denmark is highly active in each role of this export stage, due to an active approach to government-to-government cooperation, branding and services offered by embassies.

	Market entry preparation			
	Executive	*Regulative*	*Networking*	*Financing*
The Netherlands	*Medium*	*Low*	*Medium*	*Medium*
Denmark	*High*	*High*	*High*	*High*
Germany	*Low*	*Low*	*Medium*	*Low*
Advice to Dutch government		*Increase*	*Increase*	*Increase*

Figure 25: The prevalences of the governmental roles in the market entry preparation stage

Similar to the foreign market exploration stage, the governmental agencies responsible for export promotion offer a range of instruments to companies in their sector. However, the range of instruments offered by the Dutch and German government in this stage is smaller than the one offered for market exploration. The Dutch government offers services to establish first contact with foreign companies, but offers no follow-up services. In Germany, most activities for market entry preparation are offered by its Chambers of Commerce Abroad or by consultants working together with the embassies. The Danish embassies offer both a broad range of services for companies wanting to establish in foreign markets and work together with local consultancies for additional services.

The Dutch, Danish and German governments all organize trade missions aimed at connecting domestic and foreign companies. The approach to these trade missions is similar in the three countries; with preparatory briefings and market analyses provided to the participants, and individual company meetings being the core of the trade missions. Each of the countries also finances companies participating in these missions and the Dutch government hosts a program which encourages long-term market development including several missions to specific markets.

Each of the three case countries acknowledges that bilateral relations and cooperation in the development of offshore wind can lead to opportunities for their domestic businesses. The Danish government puts a heavy emphasis on governmental cooperation in the development of offshore wind, while the Dutch government relies on a mix of governmental parties, trade organizations and companies in the offshore sector for formation of memorandums of understanding. Germany's government seems less involved in memorandums of understanding for specifically the offshore wind sector. While both the Danish and Dutch governments have memorandums of understanding with Asian potential markets, the Danish government also has a memorandum with one of the central party for offshore wind in the USA (the BOEM).

The Dutch and Danish government both host governmental executive agencies which have a wealth of knowledge of and experience in tender procedure design and grid connections of offshore wind farms. Denmark actively uses this knowledge to form additional government-to-government

cooperation. The Netherlands currently does not pro-actively utilize this knowledge to strengthen government-to-government cooperation.

The Danish government views branding of the sector as a governmental task, while in Germany and the Netherlands this is viewed as primarily a task of the trade organizations and sector. As a result, Denmark has an excellent branding of its green sector, including its wind sector, under the State of Green initiative. This initiative offers information in a professional, clear and concise format; something currently missing in the Netherlands and Germany.

The Dutch Ministry of Economic Affairs, together with the Dutch Ministry of Foreign Affairs, enterprise association VNO-NCW and association for Dutch SMEs MKB-Nederland are launching a new initiative for the promotion of opportunities of mainly Dutch SMEs in developing markets (VNO NCW, 2017). A Dutch branding initiative backed by companies and government, if realized, could apply to this program.

Improvements to the Dutch approach

Concluding, the levels of prevalence of the Dutch government's roles in the foreign market exploration stage could be changed to better support Dutch companies in their foreign market entry. Similar to the market exploration stage, cooperation with local consultants in specific markets could improve the access to follow-up services for companies wanting to enter new markets. The Dutch government is also advised to actively utilize the knowledge and experience of its executive agencies to reinforce government-to-government cooperation with potential offshore wind markets. Lastly, the Dutch government is advised to work together with the Dutch trade organizations and other parties in the Dutch sector in order to launch a branding initiative to increase the visibility of its offshore wind sector.

6.2.6 Export

While the variation of prevalences of the governmental roles in the framework during the export stage seems high in some roles, this is largely due to the difference of ownership of the organization offering export credit guarantees. None of the governments in the case countries utilizes regulation or is active in organizations connecting exporters.

	Export			
	Executive	*Regulative*	*Networking*	*Financing*
The Netherlands	None	None	Low	Low
Denmark	Low	None	None	High
Germany	None	None	Low	High
Advice to Dutch government				

Figure 26: The prevalences of the governmental roles in the export stage

Each of the case-countries has export credit guarantees and similar financial products available for their offshore wind industries. The Dutch and German export credit guarantee programs do not have specific programs for offshore wind, the Danish program has a program specifically made for wind projects, of which a large part is focused on offshore wind. In the Netherlands and Germany, export credit guarantees and related products are arranged by a private company, under a publicly financed business line. In Denmark, these services are supplied by a governmentally owned company.

While each country has programs available for their companies in the offshore wind sector, the German and Danish programs are commonly used. The Dutch programs have not been utilized by companies in the offshore wind sector. Atradius (NL) has undertaken a campaign to promote the use of their products specifically for the offshore wind sector, but this campaign has yielded little to no results. Dutch companies presumably know about the products offered by Atradius, but do not use them (Appendix 1, i).

A possible explanation for this phenomenon is linked to the nature of the parties in the value chain present in the different countries. During the development of a wind farm, a developer generally makes the choice of the type of turbine before foundations or installation companies are chosen. The Netherlands host few project developers and hosts no large producers of offshore turbines. As Dutch companies are involved later in the process, the export credit guarantees have already been granted to the projects by the governments hosting the companies involved earlier in the process, i.e. the German and Danish government (Appendix 1, i).

The Danish Energinet has a commercial consultancy branch, which exports knowledge about a range of topics including offshore wind connections. While Dutch TenneT has commercial activities, is has no commercial consultancy services in the field of offshore wind.

Improvements to the Dutch approach

While the prevalence of the Dutch government's roles in the export stage is low, it is unlikely that further initiatives promoting the use of export credit guarantees will yield any additional benefits. The government stimulating cooperation between exporters could help exporters lower their costs, but experts in the sector indicated that past organization offering these services in the Netherlands have gone bankrupt in the last years. Consultation with actors in and connected to TenneT indicated that in the current regulatory framework in which TenneT is operating, the founding of a commercial consultancy organ is unlikely. Changes to this regulative framework for a relatively small commercial department are unlikely. As such, the Dutch government is advised not to change its current utilization of its governmental roles in this stage of the export process.

6.3 Conclusions of the analysis

With the comparative analysis concluded, the report will now reflect on the main research question, which read:

> *"What roles should the Dutch government fulfil to effectively stimulate the Dutch export of offshore wind energy goods and services, in order to strengthen the competitiveness of Dutch companies?"*

When assessing the findings in this chapter it is found that the Dutch government should use a mix of governmental roles in each export stage. While some minor changes are suggested, the current general approach of the Dutch government is found to be appropriate across most of the roles in most of the export stages.

In the research and development and the testing stage, the Dutch government is advised to put a heavier emphasis of its regulative role, by respectively emphasizing the steering of research and development projects towards a broader range of goals than cost-reduction and by adding more opportunities for industry-led offshore test locations. The government is advised to increase the prevalence of its financing role in the domestic market development stage by offering risk-, seed- and venture capital to its offshore wind sector. Both in the foreign market exploration stage and market entry preparation stage, the government is advised to increase its prevalence in the networking role by looking for forms of collaboration with local consultants offering follow-up services complementing its embassies. Lastly, the government is advised to increase the prevalence of its networking and financial role in the market entry preparation stage by taking an active role in the formation of a Dutch branding initiative and having a more active approach to government-to-government cooperation with potential future offshore wind markets.

In the next chapter, the results of the study are discussed and reflected on. Additionally, the findings are of the case study and comparative analysis are further developed in the form of policy recommendations for the Dutch government.

7. Discussion and reflection

In the last chapters, the cases have been analysed and compared, and the main research question has been answered. In the following chapter, the results of the study will be discussed and the methods applied in the study will be reflected on.

In the first part of this chapter, the findings of the study and their generalizability are discussed. The second part of the chapter will expand on the positioning of the study and framework in the literature and the implication of this positioning on the results of the study. The third part of this chapter will further develop the findings of this study into policy recommendations for the Dutch government. In this part additional recommendations are also presented which were found in this study, but outside the application of the research framework. The last part of this chapter will reflect on the methodology utilized in this study.

7.1 Findings and generalizability

The analysis chapter finds that governments utilize a range of instruments from each governmental role and that the framework used for analysis is able to identify the differences in the prevalences of these roles across the case-countries. It shows that governments generally apply a mix of instruments from different governmental roles in most stages of the export process. Resulting, the outcomes of the framework generally do not lead to recommendations on the application of a single governmental role, but rather lead to small recommended changes in the prevalence of governmental roles and the application of instruments in these roles.

The framework therefore primarily leads to improvements in the 'policy mix'; a mix of policies and related instruments that are combined into a complementary manner to reach a specific goal (Borrás & Edquist, 2013). This is similar to what Borras aims to reach in his approach to assessing innovation policy. When assessing the findings of the rated prevalences of the roles, some patterns emerge which are discussed hereunder.

7.1.1 Prevalence of the financing role

Each of the case studies shows a high prevalence of the financing role in almost all stages of the export process. The high prevalence of the financing role in the earlier stages of the export process could be rooted in the common conception in the literature that innovation policy should include financial incentives to counter the lack of short-term profitability of research and development activities (Borrás & Edquist, 2013; Smits & Kuhlmann, 2004). The prevalence of the financing role in the later stages of the export process shows higher degrees of variation, but is generally high compared to the other roles of government. Seemingly, the utilization of financial incentives is generally seen as an important governmental activity in export processes.

7.1.2 Specificity of the instruments

In the earlier stages of the export process, instruments applied in the financing role are often specifically tailored for the development of offshore wind technology. When looking at the later stages of the export process, these sector- or technology-specific instruments are rare. This trend is also found in the case countries that put a high priority on networking instruments. It seems that while governments apply specific policy for the development of key technologies, sector- or technology specific policy for foreign market entry is not seen as necessary, and general instruments suffice. When looking at the generalizability of the findings of this study, this could imply that the prevalences of the governmental roles in the earlier stages of the export process (at least for the financing and networking role) are more technology- or sector specific and therefore are likely to not be generalizable to other sectors. The later stages of the export process utilize more general instruments which are suited for a wider range of technologies and sectors. A similar pattern of prevalences in the later stages of the export process is thus also expected to occur when applying the framework to other sectors.

7.1.3 Variations in the regulative role

The regulative role shows high variations in its prevalence across export cases within the case studies. This is partially attributable to the operationalization of the role, which causes the low prevalence in

the foreign market exploration stage. The high prevalence of the regulative role in the testing and domestic role is however strongly linked to the nature of offshore wind technology. As offshore wind is largely developed in seas which fall under the legislative responsibility of national governments, the governmental frameworks regarding the use of these waters determine the growth of domestically installed offshore wind farms. Due to this domestic growth's strong link with the technology's characteristics, a similarly high prevalence of the governmental role is expected to be found in other offshore wind sectors and other forms of maritime energy. However, this pattern of governmental prevalences is not expected to be an inherent characteristic of general export processes.

7.1.4 Expected developments in prevalences

Some of the technology-specific prevalences of the roles can be expected to change with further development of the offshore wind industry; especially developments regarding cost-reductions and economic importance. While offshore wind currently enjoys a wide range of subsidies, governmental financial support can be expected to fall once larger cost-reductions are realized. Governmental regulative steering is however expected to increase to encompass a wider range of goals next to cost-reductions. The government's executive prevalences in the domestic market are currently based on lowering risk and costs and could also be reconsidered and reduced once current legislation on the responsibilities of e.g. national transmission owners expires. Lastly, as a result of increasing economic importance of offshore wind, it is likely that some future export promotion instruments will be further specified to the offshore wind sector.

7.2 Theory, framework and scientific contribution

This study expanded on the literature on the roles of governments by identifying four governmental roles based on their utilized instrumentation. These roles are combined with a novel representation of the export process into a framework which can be used to analyse different approaches to governmental intervention in export processes. In this subchapter, the position of these theories in existing literature and their applicability for other studies and sectors is expanded on.

7.2.1 Governmental roles and their applicability

This study has identified four governmental roles based on different forms of instrumentation applied by governments to stimulate exports. By adding the executive role based on Horner's (2017) work to the roles derived from Borras' (2013) categories of instruments, the scope of the framework now also encompasses a part of the institutional context of the sector, instead of solely offering a classification of instruments.

Two of the governmental roles, the regulative and the financing role, largely coincide with the 'regulatory instruments' and 'financial and economic instruments' categories of Borras (2013). The regulative role is also similar to the role of regulator as described by Horner (2017). Differences in the application of the regulative role in this study, compared to the applications in the study of Borras and Horner, are primarily a result of the operationalization of the regulative role. In this study, this is focused on the utilization on a ministerial level, and thus restricts the scope of the found instruments.

Borras primarily focuses on different means to steer actors in a sector and does not encompass a government's own ability to execute activities. This approach seems highly applicable to studies focusing on only the innovation part of a system in a sector that does not encompass the provision of public goods. Since both the offshore wind sector and the export process encompass situations where the supply of public goods is warranted, Borras' categories do not cover all possible instruments in the stimulation of the export of offshore wind. Therefore, Horner's governmental roles have been used for the expansion of these governmental roles. Horner focuses on a government's ability to execute its own activities, as a 'buyer or producer'. However, Horner's article applies primarily to countries in which privatization of state-owned companies is not prevalent (i.e. China, Russia, some African countries). While elements of these state-owned companies can be found in Europe as well, these are largely focused on the provision of public goods and services, and are otherwise commonly privatized. As such, Horner's strong focus on the function of these state-owned enterprises does not fit with the

methods of governmental support present in Western countries, but elements of its roles are relevant in sectors encompassing public goods and services.

The governmental roles identified during this study thus take into account both the relevant elements from Borras' governmental instruments aimed to steer a sector, and Horner's state-owned companies but then focused on the provision of public goods and services. The roles identified in this study are therefore applicable in systems where the government fulfils primarily a facilitative function for its private sector, but due to the public nature of some of the activities in the sector chooses to execute parts of the provision of these goods or services itself.

Much of the institutional context of the offshore wind sector's governmental agencies is considered somewhat 'fixed' in this study, i.e. the core functions of a state's transmission system operator will realistically not be fundamentally changed to stimulate a single sector's exports. Resultingly, the recommendations made to a government's functioning in its executive role encompass small changes in the utilization of its current instrumentation instead of large changes in the institutional context of the sector.

Separating the executive role of government from the other roles does highlight where a government has made the decision to offer goods or services publicly instead of privately. The reason behind this decision often dictates the shape and utilization of these instruments, for example a transmission system operator's focus on delivering non-commercial domestically oriented services as a part of supplying a public service. By separating the executive role, the framework encompasses some elements of Hisschemöller's (2006) method, which looks at the philosophy of a government's role in a sector. While the framework of this study does not go as far as to look for possible changes in a government's philosophy behind the roles it takes in its sector, it can help to broaden the view on the utilization of instruments in this role. For example, the knowledge gained from the public services provided by a nation's transmission system owners does not necessarily have no commercial value because it cannot be exported due to national legislation. It can be incorporated in government-to-government cooperation strategies leading to opportunities for the domestic sector.

7.2.2 The export process and its applicability

While a vast field of literature focuses on governmental export promotion, this literature generally focuses on individual instruments and their functioning and efficiency (Durmuşoğlu et al., 2012; Kanda et al., 2015) or presents an overview of possible instruments with a short explanation on what these instruments are (Belloc & Di Maio, 2011). However, the literature on governmental support does not specify where in the export process these instruments are to be applied to support a sector. In the literature on companies accessing foreign markets, an identification of different steps that a company has to take to enter foreign markets is common (Gunnarsson, 2011; Root, 1994). In the field of innovation systems, this focus on where in innovation processes different instruments should be applied can also be found (Lund, 2009). This study takes the concept of identifying different steps in a process for governmental support from the field of innovation systems, and combines this with concepts from the literature of businesses entering new markets. It forms a novel representation of the export process which is constructed of consecutive stages which can receive different forms of governmental support.

In the way this process is utilized in this study, it evaluates the governmental roles and instruments in six stages of an export process separately. The approach is therefore suited to identify differences in approaches in specific export stages. However, by assessing the 'instrument mix' of each export stage separately, this method does not analyse the dynamics between the stages and the potential interactions between the applied instruments. Each assessment of an export stage can be seen as a separate analysis, looking at the combination of the mix of policy instruments in that export stage, which does not lead to a systemic analysis of the full export process. A fully systemic approach, while less suited to identify different instruments, could potentially identify different points of improvement for export systems. This could especially be interesting to learn more about the relation between policy on innovation and

policy on export promotion, and how these forms of policy can be more effectively adapted to each other. Such a systemic approach might be an interesting topic for future research.

Due to the importance of innovation and domestic market development for an offshore wind sector's ability to export its goods and services, these stages are included in this study's export process. In sectors that rely less on subsidies, or are more mature, these earlier stages of the export process might be less relevant. In these sectors, it could be interesting to further expand on the later stages of the export process and separate the process into more than three stages for foreign market entry. The market entry preparation stage could for example be separated in the finding of a foreign partner and the founding of a local company in the foreign market. Such an approach could lead to a deeper level of understanding in where to apply these export promotion instruments.

7.2.3 The research framework and its applicability

The research framework combines the governmental roles and export process discussed under the last headers. Its applicability thus relies on the same conditions as those of the governmental roles and export process. The framework should thus theoretically be suited to be applied in sectors in which a government fulfils a facilitative function for its private sector, but due to the public nature of some of the activities in the sector chooses to execute parts of the provision of these goods or services itself. Additionally, the governmental support of innovation and domestic market development should play an important role due to the nature of the technology. Such systems are often found in Western countries in the energy sector; for example renewable energy from wind or solar, (bio)gas and oil. While the framework can be used to evaluate other sectors which show similarities to offshore wind, its operationalization will need to be adapted to fit the level of government analysed and the technological characteristics of these respective sectors.

7.2.4 Prescriptive ability of the research framework

The research framework developed in this study is utilized to evaluate the offshore wind sectors of three countries and to compare the instruments and roles utilized by their respective governments. The framework is suited to identify the differences in the approaches of these countries and to identify where countries currently do not utilize instrument whereas other countries do. While such an identification is valuable to evaluate a country's current approach, the framework does not prescribe which approach a country should implement. In this study, the step to evaluate the suitability of the country's approaches to the Dutch offshore wind sector is performed by discussing the findings with experts in the field. This step does currently not necessarily follow from the research framework. Therefore, the framework currently has an evaluative nature, but not a prescriptive nature.

A next step in the development of this research framework could incorporate a prescriptive step in the research framework. For this step, it would need to be able to identify the conditions in which certain roles and instruments should be applied. These conditions could be linked to the fit of the instruments and roles with current institutional context. It would then be important to find a method to evaluate how to compare or benchmark the effectiveness or efficiency of the instruments and roles applied in the different countries. In the offshore wind sector, quantitative data to perform such efficiency-studies is missing, but in other sectors this data might be available. The development of this next step in the research framework might be an interesting topic for future studies.

7.2.5 Transferability and context

How effective a government's role or its prevalence is, is thus strongly dependent on the context in which these roles function. As the case studies in this study all have their own national context, this makes it hard to transfer the findings of one case to another case. A role which is effective in the Dutch sector does not necessarily have to be effective in the Danish or German sector, as the institutional context between these cases differs.

In future studies it might be interesting to find which context-variables determine the effectiveness of the application of certain governmental roles. If such a link between context-variables and effectiveness can be found, then this could be used to argue in which countries the application of a certain

governmental role would be effective. If strong links between context and effectiveness of roles can be found, these links could also serve to prescribe certain applications of governmental roles to certain countries or sectors with a specific context.

7.3 Policy recommendations

In the case studies and the analysis, several policy recommendations for the Dutch government on the *prevalence of its governmental roles* and the *utilization of its instruments* have been found. Additionally, during the interviews and desk research some *additional results* are found that fall outside of the scope of the framework, which will also be shortly expanded on in this subchapter. Note that in the next chapter the societal relevance of these recommendations and their possible implementation are discussed.

7.3.1 Policy recommendations from analysis

Innovation for export

With current prices for offshore wind energy still being on a level that requires substantial subsidies from the government to be viable, most governmentally supported research programs aim to lower the cost of energy. Cost-reductions in the sector are however opening up the opportunity for policies which focus on a broader range of goals. As the export of offshore wind technology forms a significant part of the Dutch industry's revenues, policies focused on strengthening the Dutch industry's ability to export its goods should be one of the priorities for these new policies.

The Dutch government is therefore advised to identify technologies within the offshore wind sector which show high export potential and utilize specific instruments for the development of these technologies focused on export to foreign markets. An example of such technologies is the development of floating offshore wind foundations. Examples of such instruments are subsidies which incorporate the exportability of the to-be-developed technology in their criteria (similar to the Danish EUDP program) and regulation around future demonstration parcels which prioritizes technologies with export potential.

Opportunities for demonstration

There are currently no locations where offshore wind companies can test their products in offshore conditions. While the Dutch government is planning on making a demonstration parcel at the Borssele V site, this is unlikely to meet the demand for test sites by the industry. A system with industry-led proposals for test sites in Denmark could give the offshore wind sector opportunities to construct additional test location with relatively low costs to the Dutch government.

Therefore, the Dutch government is advised to expand its range of available offshore test locations. This could be done by expanding the current co-location model in upcoming tender rounds, but the Dutch government should also consider an open-door policy similar to the Danish model.

Branding of the sector

The Dutch offshore wind sector hosts many innovative small- and medium-sized enterprises which develop goods and services that could have potential in foreign markets. The Dutch sector is primarily known for its large offshore companies which are internationally renowned, yet the rest of its sector lacks an easy option to showcase its goods and services to foreign parties. A national branding initiative such as the Danish State of Green organization could support these companies in finding foreign partners and opportunities for export.

Therefore, the Dutch government is advised to take a more active role in the branding of its offshore wind sector. It is advised to explore the possibilities of a public-private branding initiative for its offshore wind sector similar to the State of Green organization. Priority should lie on improving the online visibility of the Dutch sector, creating a strong one-liner for the sector and increasing the availability of English information on the Dutch sector.

Follow-up services of embassies

The Dutch embassies currently offer a range of free services to companies wishing to explore or enter foreign markets. The nature of these services is however relatively general compared to their Danish

and German counterparts, and company-specific services following up these general services are not offered. This makes the step for Dutch companies from shallow market explorations and business scans to actual commitment to a market harder to take.

Therefore, the Dutch government is advised to look into the possibilities of cooperation with local consultants working closely with the embassies, which can offer business-specific follow-up services to companies wishing to further commit to exporting to a market.

Government-to-government cooperation
The Dutch government has a lot of experience organizing offshore wind tenders, and its state-owned transmission system operator is the global most experienced organization regarding the grid connection of offshore wind farms. The knowledge and experience of these Dutch agencies can be very valuable for countries with upcoming offshore wind markets. Government-to-government cooperation between the Dutch government and the governments of upcoming offshore wind markets can improve the access Dutch companies have to relevant policymakers, improving their chances of accessing these markets.

The Dutch government is advised to actively look for cooperation with countries that are in the early stages of developing an offshore wind sector. For this, it is advised to utilize the knowledge and experience of its executive agencies as a means to find interesting partners. Examples of such partners are the north-eastern states of the USA: Massachusetts, Delaware, Maryland and the State of New York.

Data and utilization of instruments
Next to the former recommendations, a few short recommendations on the utilization of the current instruments of the Dutch government are presented.

The Dutch government is advised to look, in cooperation with the Dutch trade organizations, into the utilization on both the international network connected to the Dutch Chambers of Commerce and the services offered by the Innovatie Matchmaking Program for its offshore wind sector. Additionally, it should seek to ensure that the funds offered by the upcoming InvestNL program fit with the Dutch offshore sector's needs for risk-, seed- and venture capital. Lastly, since a lack of data on the Dutch sector is preventing the evaluation of the efficiency of the instruments applied to the sector, the Dutch government is advised to launch a study gathering data the sector on parameters like revenues, added value and employment.

7.3.2 Additional recommendations
During the execution of this study, some additional concepts were encountered which do not fit within the framework of analysis of this study, but are nonetheless relevant for the Dutch government or Dutch sector. These findings generally need some more context to be understood. To keep this main report concise these findings are shortly introduced here. Further explanation of these findings can be found in Appendix 5.

Organization of Dutch sector
The Danish sector has one trade- or cluster organization which is responsible for the promotion of export products in its sector (The Danish Wind Export Association), of which the members of its other wind- and export-related trade organization (DWIA and DEA) share their services with. In the Netherlands, two trade organizations (the NWEA and IRO) both undertake their own activities in parallel to the organization focused on providing export promotion for the wind sector (HHWE). A further integration or merger of the Dutch organizations in the sector could improve the transparency of the sector and reduce redundant use of resources.

Export credit guarantees for domestic market
While export credit guarantees offer an option for companies to reduce the risks and costs of capital when investing in foreign markets, not all countries offer similar financial guarantees for domestic companies investing in domestic markets. To level the playing field, Belgium and France (are

considering to) make export credit guarantees also available for domestic companies investing in domestic offshore wind farms. The Dutch government could consider implementing a similar construction.

Option pricing
With the necessity for subsidies for offshore wind farms declining, the financial risks of bidding on a tender are also reduced. Companies bidding on tenders can withdraw their application if developments in electricity prices or technology lead to a situation where constructing a wind farm would mean operating at a loss. Fines for these withdrawals are currently relatively low, while the damage to a country's offshore wind sector and ability to reach its sustainability goals could be substantial. Additional measures in the tender procedures should be considered to avoid the risk of such occurrences.

7.4 Reflection on methodology

The last part of this chapter will reflect on the utilized methodology in this study. For this, it will first look at whether the research framework designed for this study was able to fulfil the objectives set for the study. After that, a reflection on the quality of the framework is presented. Lastly, the study will reflect on if the interviews represent all of the relevant actors in the different case studies.

7.4.1 Adequacy of research framework

After the research framework has been utilized and has led to a range of findings and recommendations, the framework's adequacy for its intended purposes can be evaluated. To evaluate this adequacy, two questions must be answered. To what extent is the framework able to fulfil the research objective? And to what extent are its results relevant? To answer these questions, the study looks back at the research objective of the study, which reads:

"To determine where and how the Dutch government can improve its current role in the promotion of exports of its offshore wind industry."

Looking at the analysis the cases, the resulting findings and the recommendations to the Dutch government, it can be noted that the framework serves well as an evaluative tool for the prevalence of governmental roles in the case studies. However, as these prevalences are often strongly linked their institutional contexts which encompasses systems much broader than just offshore wind, the utilization of this framework is not likely to lead to recommendations encompassing large changes in the prevalences of the roles. Relating this to the main research objective, the framework is more suited for the evaluation of the prevalence of governmental roles than it is as a tool to lead to large changes in a governments utilization of its roles in an industry.

The framework however dictates an approach which assesses a large portfolio of instruments that governments utilize in their respective roles. While a time-consuming process, this allows for a comparative analysis of instruments across different cases which leads to valuable insights in the variations of the utilized instruments. These insights have led to a range of policy recommendations which are seen as very valuable by both the Dutch governmental parties involved in the study and parties in the Dutch offshore wind sector. These policy recommendations are also largely implementable on the ministerial level that this study has focused on. As such, the *where* part of the research is answered by the evaluation of the prevalence of governmental roles in the stages of the export process and the *how* part of the research objective is answered by the recommended changes in the utilization of instruments within these roles.

Concluding, the research framework designed in this study is suited to evaluate a government prevalence of its roles in a sector, which can lead to relevant recommendations for the improvement of its portfolio of instruments. The research framework is thus found to be adequate for its intended purpose of fulfilling the research objective. Its suitability for leading to large changes in the prevalence of its governmental roles is however limited.

7.4.2 Quality of the research framework

Next to the adequacy of the framework, also the quality of the framework can be discussed. While the use of the framework did not lead to large issues during the study, there are two points of the framework that warrant further inspection. The first of these points regards the identified stages of the export process and the overlap some instruments have in these stages. The second point looks specifically at the significance of memorandums of understanding as an indicator of government-to-government cooperation.

Export stages and instruments

With the separation of the export process in six different stages, some of the instruments found in the study showed overlap between these stages. The primary stages showing overlap in instruments were the *research and development* stage showing overlap with the *testing* stage, and the *foreign market exploration* stage showing overlap with the *market entry preparation* stage. The research and development and testing stage generally also identified many instruments which uniquely fit with their respective stage. The instruments of the foreign market exploration and market entry preparation stages were harder to specify to their relative stage. The separation of these stages in this study did highlight how far in the export process governments were active in supporting their sector. However, a combination of these stages could ensure a less disputable fit between some of the instruments and these respective stages.

The instruments that were hardest to pinpoint to a specific export stage were the governmental-to-government cooperation and its related memorandums of understanding, and the government's role in the branding of the sector. In this study, these instruments were located under the market entry preparation stage, as their ultimate goal is generally to ensure contact between domestic and foreign companies. However, both of these activities also somewhat contribute to opening up opportunities for foreign market exploration, and could have also been shared under this stage.

Memorandums of understanding

In the regulative role of the government, the presence of memorandums of understanding and the parties involved with these memorandums were compared to assess and compare the activeness of the three selected countries in regulating foreign trade. While memorandums of understanding can show a formal declaration of willingness to cooperate on a government-to-government level, the significance of these documents differs strongly with the nature of the signing country and the countries in/with these documents are signed with. Memorandums between companies generally carry more weight than memorandums between countries. Additionally, memorandums signed with some Asian countries such as China are easy formed and show a positive attitude towards cooperation, but do not carry much weight to enforce cooperation (so-called 'paper tigers'). Memorandums signed with Japan are more difficult to establish, but the signing of such a memorandum will more likely lead to action[4]. As such, the significance of the analysis of the regulative role in the entry preparation phase could be questioned. However, no better qualitative parameter to measure this phenomenon was found during this study.

7.4.3 Representability of interviewees

During the study, a large number of interviews was conducted with a wide range of actors. While this was a time-consuming process, this method of data gathering led to various valuable insights and a level of understanding which would likely not have been gained by solely utilizing other data gathering methods like desk research. The feedback of the interviewees on the summaries of the interviews helped to further improve the quality of the material, and follow-up contact with the interviewees was extremely valuable in the validation and potential future implementation of the findings of this study.

However, the time-consuming nature of the interviewing method did limit the number of interviews possible during the study. There are some parties which could have potentially added to a deeper understanding of the case studies which were unfortunately not available for interviews during the

[4] These conclusions were drawn as a result of the expert verification sessions at the Dutch Ministry of Economic Affairs and the session at NWEA

duration of this study. Most notably, interviews with the German BMWi and the Danish Ministry of Foreign Affairs as central parties in the respectively German and Danish government could have potentially provided new insights in the utilization of the instruments of these countries.

Another criticism to the selection of interviewees could be that the variation of companies interviewed in the sector leans towards larger companies rather than small- and medium enterprises. While these larger companies generally have more experience with a wider range of instruments supporting their respective sector, taking in account the position of a small- to medium enterprise regarding the availability, suitability and application process for several forms of governmental support could have led to additional recommendations specifically in the utilization of some instruments. Note that some of these points have partially been covered by the interviews of the trade organizations representing these small- to medium enterprises.

8. Conclusions

This study has been executed in cooperation with the Dutch Ministry of Foreign Affair's 'Directorate-General for Foreign Economic Relations' department. It has looked at *where* and *how* the Dutch government can improve its current role in the promotion of exports of its offshore wind industry.

In the following chapter, the conclusions of the study are presented. The first part of this chapter will walk the reader through the report, focusing on the findings and conclusions of the study. The second part of the chapter will present the recommendations of the study and their practical implementation. The third part of the chapter will present suggestions for future research and conclude this report.

8.1 Conclusions

The global offshore wind market is expanding rapidly, driven by increasing global interest in low-carbon sources of energy and the recent substantial reductions in offshore wind's levelized cost of energy. These developments offer export opportunities for countries with offshore wind industries and several countries involved in offshore wind are adopting policies promoting the development and export of their domestic offshore wind industries. Governments with leading industries are therefore looking into how they can support their domestic sector to take advantage of opportunities in foreign markets. The literature on which roles governments play in the support of export processes and especially where governments should support their sector in export processes is however scarce. This study therefore has evaluated what roles governments should play in the support of export of their offshore wind industry, taking the Dutch government as its main case for evaluation. The following main research question has been formulated for the study:

"What roles should the Dutch government fulfil to effectively stimulate the Dutch export of offshore wind energy goods and services, in order to strengthen the competitiveness of Dutch companies?"

To answer this research question, the following research approach has been developed.

8.1.1 Research approach

After introducing the reader to the goods, services and markets in the offshore wind sector, a theoretical framework is developed for the analysis of the government's roles in the offshore wind sector. Using literature from the fields of international trade and economics, international development, and governance processes and instruments, the study identifies four governmental roles applicable to the offshore wind sector and their respective sets of instruments. By looking at the literature on commercialization- and export processes, a six-stage export process is constructed. The export process and governmental roles are combined into a framework in which the prevalence of the governmental roles can be evaluated for each stage of the export process. This framework is presented in Figure 27.

	Executive	*Regulative*	*Networking*	*Financing*	--->	*Policy advice*
Research and development						
Testing						
Domestic market development						
Foreign market exploration						
Market entry preparation						
Export						

Figure 27: The research framework designed to evaluate the prevalence of the governmental roles in the various stages of the export process.

With this framework a comparative case study is performed, analysing the prevalence and utilization of governmental roles in three of the leading countries in the offshore wind sector; The Netherlands, Denmark and Germany. This comparative case study focuses on the differences in approach between the export promotion of the different governments and on the identification of possible improvements to the current approach of the Dutch government. For each of the case-countries, a short introduction to its industry and its most relevant stakeholders in its sector is presented. After that, the instruments

that the government of the respective case-country utilizes in each step of the export process are identified. Based of the availability of these instruments, the prevalence of the governmental role in that stage of the export process is determined and given a rating of *none, low, medium or high*.

Data for the case studies is gathered by a combination of semi-structured interviews with experts in the government and sector, and by performing desk research. The findings are presented in three case studies. The case studies are then used for a comparative analysis which evaluates the differences in governmental approaches for each export stage and identifies possible improvements to the application of the roles and instruments of the Dutch government. Figure 28 shows a high-level overview of the findings of the case studies, which forms the base of this comparative analysis. The results of the analysis are verified using expert validation by interviewees, central actors in the Dutch sector and personnel at the Dutch Ministry of Foreign Affairs.

	The Netherlands				Denmark				Germany			
	Executive	*Regulative*	*Networking*	*Financing*	*Executive*	*Regulative*	*Networking*	*Financing*	*Executive*	*Regulative*	*Networking*	*Financing*
Research and development	Low	Low	High	High	Low	None	Low	High	Medium	Low	Medium	High
Testing	Low	Medium	High	High	Low	High	None	High	Medium	High	None	High
Domestic market development	Medium	High	Medium	Medium	Medium	High	None	High	Medium	High	Medium	High
Foreign market exploration	High	None	Medium	High	High	None	High	Medium	Medium	None	Medium	Low
Market entry preparation	Medium	Low	Medium	Medium	High	High	High	High	Low	Low	Medium	Low
Export	None	None	Low	Low	Low	None	None	High	None	None	Low	High

Figure 28: The prevalences of the governmental roles in the stages of the export process across the case-countries

8.1.2 Results of the comparative analysis

The comparative analysis is performed by first looking at general findings regarding the prevalences of governmental roles. This is followed by a comparison of the prevalences of the governmental roles and the utilized instruments per stage of the export process.

General findings

A relatively high prevalence of the financial role is found across the case studies in almost all of the export stages, especially in the commercialization stages. A higher variation in the prevalence of the financial role in the later stages of the export process could indicate a more widely varying opinion on the government's role in the support of the later part of the export process. While the prevalence of the government's executive role varies across the cases, this is mostly a result of differences in ownership structure in the case-country's offshore wind sectors. These differences seemingly have little effect on a sector's ability to export its goods or services.

Large differences in the prevalence of the networking role relate to differences in governmental participation in the organization and steering of research programs, and in programs promoting intra-sectoral collaboration. Little correlation with the prevalence of the networking and financing role suggests that these roles are not necessarily always complimentary.

Instruments in the earlier stages of the export process are more often specified to support offshore wind technologies, while instruments in the later stages of the export process are more general but can be utilized by the offshore wind sector. This could indicate that the pattern of prevalences of the governmental roles in the earlier stages of the export process is more technology-specific and not generalizable to other sectors. The pattern of prevalences in the later stages seems more inherent to export processes.

Similar patterns of the prevalence of the regulative role across the governments of the case countries could indicate similar ideas on the application of regulation in the promotion of exports. The regulative role might become more prevalent and the financial and executive role less prevalent once further cost reductions in offshore wind technology are realized.

Findings in the research and development stage

While differences in the private or public ownership of agencies performing research and development activities in the sector exist, these do not seem to have relevant effects on these agency's funding, commercial freedom or ability to perform research and development. Regulative steering of research

and development is currently rare, but with cost-reduction becoming less important, regulation steering research and development towards a broader range of goals becomes an interesting option. Large variations in governmental involvement in research programs are found. While governmental involvement in research programs could lead to better cooperation and coordination between the government, industry and universities, quantitative data to confirm this theory is missing.

Findings in the testing stage

The same governmental agencies involved in the testing of technologies are also involved in the research and development stage. Governmental influence stimulating intra-sectoral collaboration is only found in the Dutch case, within its Topsector and Innovatielink platforms. Availability of offshore test locations is lacking in the Dutch and Danish case. The Dutch government strictly regulates the construction of new test locations, while the Danish government leaves open the opportunity for industry-led test locations with an open-door policy. While each case-country offers a wide range of financial subsidies for testing, the Danish government uniquely offers a subsidy which specifically focuses on technologies with high export-potential.

Findings in the domestic market development stage

Variations in the ownership and responsibilities of national transmission system operators and agencies performing preliminary studies on the upcoming offshore wind parcels are found to have little effect on the sector's ability to export goods and services. Each of the case-countries strictly regulates the growth of its domestic offshore wind industry, but the time-horizon on this regulation varies, causing uncertainty in mainly the Danish market. The Dutch government is uniquely active in organizations stimulating intra-sectoral cross-financing. However, its portfolio of financial incentives is lacking in risk-, seed- and venture capital for domestic firms compared to the Danish and German case. Lastly, the German Chambers of Commerce play a central role in the German sector, but are less relevant in the Dutch and Danish sector.

Findings in the foreign market exploration stage

Variation in the prevalences of the governmental roles between the German and the Dutch and Danish case in the foreign market exploration stage primarily occur as a result Germany's network of non-governmental Chambers of Commerce Abroad. Services offered to the industry by these Chambers are similar to services offered by Dutch and Danish embassies. The Dutch embassies focus on offering free general services, while the Danish and German embassies and chambers additionally offer business-specific services which are not free for companies using them. The Danish and German embassies and chambers also collaborate with local consultants offering follow-up services; a practice not utilized by Dutch embassies for the offshore wind sector.

Findings in the market entry preparation stage

Denmark has a remarkedly high prevalence of its governmental roles in this export stage compared to the other case countries. Each of the case-countries organizes and supports trade missions. The Danish government has a higher priority than the Dutch and German government on government-to-government cooperation, manifesting into relevant memorandums of understanding for the offshore wind sector. In the Dutch case, knowledge of executive agencies on tender procedures and grid-connection solutions is currently not utilized as leverage for government-to-government cooperation with potential offshore wind markets. The Danish government actively promotes national branding of its wind sector; similar initiatives in The Netherlands and Germany are missing.

Findings in the export stage

The study finds little governmental intervention in the last export stage. The primary means of supporting companies in the export stage are export credit guarantees and similar financial products. The portfolio of these available financial products is similar when offered in cooperation with private organizations, or when offered by governmentally-owned organizations. Differences in the utilization of these instruments by the sector are likely to be a result of the nature of the companies in the sector.

8.1.3 Conclusions

After the comparative analysis is concluded, the resulting findings are used to advise the Dutch government on *where and how it should improve its current role in the promotion of exports of its offshore wind industry.*

The study finds that the Dutch government should use a mix of governmental roles in each stage of the export process. While minor improvements are suggested, the study finds that in general the current approach of the Dutch government to effectively support its offshore wind sector can be considered largely appropriate. The outcomes of this study do not lead to the recommendation of the application of a single governmental role, but rather lead to small recommended changes in the prevalence of governmental roles and the application of instruments in these roles, i.e. changes to the Dutch government's policy mix.

Advice to the Dutch government

In the research and development and the testing stage, the Dutch government is advised to put a heavier emphasis of its regulative role, by respectively emphasising the steering of research and development projects towards a broader range of goals than cost-reduction and by adding more opportunities for industry-led offshore test locations. The Dutch government is advised to increase the prevalence of its financing role in the domestic market development stage by offering additional risk-, seed- and venture capital to its sector. Both in the foreign market exploration stage and market entry preparation the government is advised to increase its prevalence in the networking role by looking for forms of collaboration with local consultants that offering follow-up services to the embassy's services. Lastly, the Dutch government is advised to increase the prevalence of its networking and financial role in the market entry preparation stage by taking an active role in the formation of a Dutch branding initiative for the offshore wind sector, and by having a more active approach to government-to-government cooperation with governments of potential future offshore wind markets.

In addition to the findings resulting from the use of the research framework, the study finds that the further integration of the export promotion activities of the Dutch trade- and export organizations could improve the transparency of the sector and reduce the redundant use of resources. The Dutch government should also consider the possibilities of the application of export credit guarantees for domestic offshore wind projects. Lastly, it and should incorporate additional measures into its tender procedures to avoid the withdrawal of the winners of tenders.

The findings of this study have been discussed with and presented to relevant experts in the Dutch offshore wind sector, and are further developed to policy recommendations. These policy recommendations can be found after the 'scientific contribution' part.

Scientific contribution

Next to the recommendations developed for the Dutch government, this study also offers a relevant contribution to the fields of literature on governmental roles and export processes.

The four governmental roles identified in this study allow for the evaluation of a government's role in systems where the government fulfils primarily a facilitative function for its private sector, but due to the public nature of some of the activities in the sector chooses to execute parts of the provision of these goods or services itself. By encompassing a part of the sector's context in the evaluation of a government's role, the identified roles support a re-evaluation of the possible utilization and value of the instruments used by governmental agencies.

A novel representation of export processes has been constructed in this study, which connects governmental support to stages of an export process. This process offers a methodological approach to evaluate a government's utilized instruments and roles in the export process. The utilization of this approach can lead to a better understanding of especially *where* governments support their domestic sectors in export processes. This can lead to the identification of points-of-improvement for currently utilized methods of support. The export processes encompass the research, development and demonstration of technologies as relevant export-promotion instruments. Therewith it encourages a

broader view on the utilization of instruments for the stimulation of research, development and demonstration, which could account for more than only the development of technologies used in the domestic market.

The framework developed by combining these governmental roles and stages of the export process is highly suited to evaluate a current government's utilization of export-promotion instruments and assess its utilization of different governmental roles. However, the framework in its current form is not suited for prescribing governments of which roles it *should* use, or which context-variables determine the effectiveness of a government's role, both which could be interesting topics for future studies.

8.2 Recommendations and implementation

The study has led to a number of recommendations for the Dutch government and the Dutch offshore wind sector. While these recommendations on itself can advise the Dutch government and sector in which ways it can improve its approach, some additional measures have been taken to improve the chances of their practical implementation and therefore the study's practical impact. The first part of this section will present the recommendations of this study, the second part will expand on their practical implementation.

8.2.1 Recommendations

In the following part, the recommendations to the Dutch governmental agencies and sector are presented. The numbers in their titles are used for referencing in the practical implementation section.

Innovation for export (1)
With prices of offshore wind falling, the priority on cost-reduction as the primary goal for subsidies and regulation is declining. The Dutch Ministry of Economic Affairs and the Topsector Wind op Zee are therefore advised to consider implementing subsidy schemes which prioritize technologies with high export potential for the Dutch sector. An example of such technologies could be floating wind technologies. Additionally, the Dutch Ministry of Economic Affairs is advised to include criteria on the exportability of the to-be-tested technologies in their tender procedures for upcoming demonstration parcels for offshore wind.

Opportunities for demonstration (2)
The Dutch domestic market currently lacks sufficient opportunities for the testing of offshore wind technologies in offshore conditions. The Dutch Ministry of Economic Affairs is advised to continue implementing co-location parcels for demonstration in upcoming offshore wind tenders. It is also advised to consider implementing an open-door scheme similar to the Danish sector which gives room for industry-led development of offshore wind test farms.

Branding of the sector (3)
The Dutch offshore wind sector currently lacks a branding initiative, showcasing and promoting its offshore wind technology and companies to foreign parties. The Dutch Ministries of Economic Affairs and Foreign Affairs are advised to cooperate with the trade organizations in the Dutch offshore wind sector to set up a national branding initiative for the offshore wind sector. The Danish State of Green can serve as an example for such an initiative.

Follow-up services embassies (4)
The Dutch embassies currently offer a range of free and general services for companies wishing to explore or enter foreign markets. The Dutch Ministry of Foreign Affairs is advised to look into possibilities of cooperation with local consultancies, which would work together with embassies to offer paid follow-up services making the next step of entering foreign markets for Dutch companies easier to make.

Government-to-government cooperation (5)
The Dutch government owns organizations and agencies which have world-class knowledge and experience on respectively offshore wind grid connections and offshore wind planning and tender design. This knowledge and experience should be utilized to actively pursue government-to-

government cooperation with upcoming offshore wind markets. This could open up possibilities for Dutch companies to get in contact with foreign policymakers, improving their chances of accessing these markets.

Organization of the sector (6)
Several trade organizations in the Dutch sector (NWEA and IRO) undertake export promotion activities in parallel to the organization focused on providing export promotion for the wind sector (HHWE), increasing fragmentation and redundancy of resources in the sector. These organizations are advised to further integrate their export promoting activities and consider potential mergers.

Availability of data and utilization of instruments (7)
A lack of data on the Dutch sector is preventing the evaluation of the efficiency of the instruments applied to the sector. The Dutch Ministry of Economic Affairs is advised to launch a study, gathering data the sector on parameters such as revenues, added value of and employment in the sector. Additionally, it should seek to ensure that the funds offered by the upcoming InvestNL program fit with the Dutch offshore sector's needs for risk-, seed- and venture capital. The Dutch Ministry of Foreign Affairs is advised to look, in cooperation with the Dutch trade organizations, into the utilization of both the international network connected to the Dutch Chambers of Commerce and the services offered by the Innovatie Matchmaking Program for its offshore wind sector.

8.2.2 Practical implementation
For the practical implementation of a selection of these recommendations, the author has, in cooperation with the Dutch Ministry of Foreign Affairs, identified their respective main stakeholders and approached them for further discussion. The following section will present an overview of where these recommendations are presented, and whether these have led to practical follow-up activities or have been purely advisory. Numbers indicate the action's relation with the previously presented recommendations.

The Dutch Ministry of Foreign Affairs
The recommendations of this study have been formulated in cooperation with the responsible policy advisor on the export promotion of offshore wind in the ministry's directorate of international enterprise. They will serve as input for the future activities of the department on offshore wind and have been presented to the staff of the department and head of the department.

The department is currently looking into the possibilities of strengthening government-to-government cooperation during a Masterclass on the Dutch tender system for upcoming offshore wind markets. A one-pager on the positioning of TenneT and its possible contributions to the stimulation of export of the Dutch sector has been formulated and forwarded to relevant policymakers (5). Furthermore, the department and HHWE are looking into the possibilities of utilizing the Innovatie Matchmaking Program to organize a future innovation-focused trade mission for the Dutch offshore wind sector (7).

The Dutch Ministry of Economic Affairs (and the Netherlands Foreign Enterprise Agency)
The recommendations of this study have been presented in the working group of the Dutch Ministry of Economic Affairs responsible for the future offshore wind tenders, and the working group responsible for policy on offshore wind developments.

The results of the meetings served as input for future policy on the offshore wind tenders and industrial development of the offshore wind industry in the Netherlands.

Export offshore wind meeting 'Exportplatform Offshore Wind'
The recommendations of this study have been presented in the six-weekly public-private export meeting of the Dutch offshore wind industry, which is attended by the Dutch Ministry of Economic and Foreign Affairs, the Netherlands Foreign Enterprise Agency, TenneT, HHWE, NWEA, IRO and Topsector Wind op Zee. Individual follow-up meetings were planned with IRO and HHWE to further discuss the 'Organization of the sector' recommendation.

The Dutch trade organizations, in cooperation with the Dutch Ministry of Foreign Affairs, are currently looking into the possibilities of filing an application for the upcoming public-private 'Werkplaats' initiative for a branding platform for the Dutch offshore wind sector (3) (VNO NCW, 2017). Furthermore, the Dutch trade organizations and export promotion organizations are exploring opportunities for closer collaboration and integration of their export promotion activities (6). In support of this last recommendation, the author has presented the advantages of the recommendation at the general member assembly of HHWE.

Project developers meeting 'Commissie Wind op Zee NWEA'
The recommendations have been presented in the Dutch offshore wind sector's meeting between trade organizations and major project developers, which was attended by NWEA, IRO, Topsector Wind op Zee and the sector's main project developers. This meeting was primarily meant to inform and receive feedback on the recommendations.

Further practical implementation
The recommendations of this study have been presented to and discussed with a representative of the Topsector Wind op Zee and GROW program. Parts of this study have been included in a policy paper for the Exportplatform Offshore Wind. The recommendations have been presented at a meeting for small- and medium enterprises in the offshore wind sector in December, and copies of the report will be sent to companies and agencies that were involved with or contributed to this study.

8.3 Recommendations for future research

The design, utilization and evaluation of the framework and the results of this study have led to the identification of a range of interesting topics for future research. These are presented in the following section and conclude this thesis.

Systemic approach to export process
This study has performed a separate comparative analysis on each export stage. While this approach is suited to compare currently applied instruments by governments, interactions between the stages of the process and systemic improvements to the export system as a whole fall outside the scope of this study. A study applying a systemic approach to evaluate export processes, similar to Smits' (2004) study on innovation policy, could lead to valuable additional insights regarding the promotion of a sector's exports.

Context and effectiveness roles
The current framework of this study lacks a prescriptive nature due to the strong relation between the context of a government's role and its effectiveness. A possible interesting topic for future research could be the link between the institutional context of a country and the effectiveness of the utilization of its governmental roles. If certain context-variables could be linked to the effectiveness of the utilization of governmental roles, these could be used to prescribe the use of governmental roles in countries with similar institutional contexts.

Technological development for export
The Danish government utilizes instruments which specifically stimulate the development of technologies showing large export potential. For the application of such instruments, a government has to be able to identify which technologies show high export potential. A potentially interesting area of future research could be the development of a method that links a country's strengths in an industry to opportunities and market barriers in foreign markets and global technological developments This method could be applied to indicate where and which support mechanisms can optimally support the export specific technologies with high export potential in an industry or sector.

Quantitative research
While this study has identified different approaches to a government's involvement in research and development programs and differences in the instruments offered by embassies, the efficiency of these approaches was difficult to compare. Quantitative data on efficiency and benchmarking studies on these approaches are missing. Future studies that gathering data on the efficiency of these instruments

and benchmark these approaches could provide valuable insights on the application and efficiency of these approaches.

Expansion study

The framework developed in this study has been used to analyse the export promotion of the Dutch, Danish and German government in the offshore wind sector. The framework is however theoretically also suited to be applied to other sectors where the government takes an active role in the sector. Such sectors can for example be found in other fields of sustainable energy technology, such as onshore wind, large-scale solar power and other forms of maritime energy. Additionally, the study could be expanded to encompass or compare other countries. During the interviews, some respondents pointed towards interesting approaches utilized by The United Kingdom's government for its offshore wind industry, which could be an interesting case-country for future expansions of this study.

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Appendix 1 – Interviews

The following appendix contains the summaries of the expert interviews performed during the study. Table 8 shows and overview of the interviews. The interviews are presented in alphabetic order arranged on the name of the interviewed organization. Confidential interviews can be found in Appendix 7.

Appendix (#)	Company / organization	Name	Function	Type of contact
i	Atradius	Victor Hoek	Head of project finance	Phone Interview
ii	Damen	Peter Robert	Director business development & market intelligence	In-person Interview
iii	Danish Energy Agency	Rasmus Zink Sørensen	Special advisor	Phone Interview
iv	Danish Wind Energy Association	Camilla Holbech	Chief Consultant	Phone Interview
v	DNV GL	Joris Truijens	Senior consultant wind energy	Phone Interview
vi	Dutch Ministry of Foreign Affairs (Japan)	Luite Douma	Senior trade officer	Phone Interview
vii	Energinet	Aksel Gruelund Sørensen & Jens Christian Hygebjerg	Head of Department Projects & Chief Project Manager Kriegers Flak	Phone Interview
viii	GROW / TKI-WOZ	Ernst van Zuijlen	Director	Phone Meeting
ix	HHWE	Arjen Schutten	Managing director	In-person Interview
x	Lagerwey	Sjoerd Sjoerdsma	Director licensing and ventures	Phone Interview
xi	Siemens-Gamesa	Rob Kuilboer	Technical Sales Manager	Phone Interview
xii	NWEA	Hilbert Klok	Offshore wind specialist	In-person Interview
xiii	OffshoreEnergy.dk	Mikkel Juul	Head of internationalization	Phone Interview
xiv	Roland Berger	Maarten de Vries	Project director offshore wind	In-person Interview
xv	State of Green	Anette Brænder	Senior Project Manager Wind Energy	Phone Interview
xvi	TenneT	Saskia Jaarsma	Senior Advisor Offshore NL	In-person Interview
xvii	The Netherlands Trade and Invest Office	Cindy Chang & Stephanie Hsieh	Economic advisor & economic advisor	Phone Interview
xviii	Van Oord	Dolf Elsevier van Griethuysen & Dirk Katteler	Manager Business Development & Business Development Manager	In-person Interview
xix	Wind Minds	Hans Rijntalder	Co Owner Wind Minds	In-person Interview
xx	WindEurope	Tom Remy	Offshore Wind Analyst	Phone Interview

Table 8: List of interviews stating the organization, interviewee and method of contact

i. Interview Atradius

Time and date: 15:00 – 15:45, 10-08-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewee(s)

Victor Hoek – Head of project finance

Summary of Interview

General information Atradius

Atradius is a worldwide operating commercial company that offers credit insurance and debt collection services. The Dutch branch of Atradius has a mandate to offer services for the Dutch government through its Dutch State Business program. For this, it receives a budget from the Dutch Ministry of Finance. The Ministry of Foreign Affairs also plays a role in the products offered through the Dutch State Business program. These services are aimed at promoting the exports of Dutch companies. The services under the Dutch State Business program are meant to cover their own costs, and are not aimed to make a profit.

What kind of services does Atradius offer for the Dutch offshore wind sector?

One of the main services Atradius offers is export credit insurance.

Export credit insurance offer banks (and other suppliers of finance) security, by guaranteeing them that in the case of a borrower not being able to pay back its loan, the missing money will be paid by Atradius. This protects financers from the risk of default. This risk is taken by the Dutch state through Atradius. As the Dutch state has an AAA credit rating (the highest rating possible), this substantially lowers the risks for financers. These are thus able to charge lower rates for these investments, and might be inclined to offer larger volumes of finance to a project. This AAA rating offers Dutch exporters an advantage compared to countries exporting from a country with a lower rating.

Export credit insurance is in theory available for all exports. There is a country-specific ceiling to the maximum risk exposure Atradius is willing to take.

The rates that Atradius charges are determined by a premium model of the OECD. These rates should be conforming to market rates when offered in the OECD zone. Outside of the OECD zone, rates do not need to be in conformity with market pricing but must at least be cost effective.

Atradius has no sector-specific policy for the offshore wind sector, although the OECD rules on officially supported export credits do allow for more relaxed (longer and more flexible) repayment profiles for the renewable energy sector when compared with other sectors. For the offshore wind sector, the same kind of services are available as there are for other technologies that generate electricity. The offshore wind sector has not used many of the services offered by Atradius yet.

Other services Atradius offers are working capital coverage, guarantees for parties importing, and contra-guarantees.

What is the reason the offshore wind sector doesn't use the services of Atradius yet?

There are some possible explanations for this.

Offshore wind projects often start with choosing the type of turbines. The manufacturers of turbines are mostly located in Germany and Denmark. The Dutch parties, which usually take care of the installing of the wind turbines, enter the process later on. At the time of this later entry, discussions with the German (Hermes) or Danish (EKF) export credit agencies may already be in an advanced stage or may even be concluded.

Atradius has been actively campaigning some time ago, to the parties in the offshore wind industry, about the opportunities and products that Atradius can offer them.

Atradius is also present in other countries. Does it offer export credit guarantees here as well?

No. Export credit guarantees in Germany and Denmark are offered by the national export credit agencies of those countries. These are respectively Hermes and EKF.

Are there any instruments used in other countries, which are not used in the Netherlands, that could be used to support the Dutch offshore wind industry?

In France and Belgium, export credit guarantees can also be used for investments in their domestic economic exclusive zone for the offshore wind industry. In countries not offering this system, foreign companies in offshore wind projects can have an advantage over national companies, as they are able to use export credit guarantees whereas national companies cannot. Such a system could give support to Dutch companies in the offshore wind industry if applied in the Netherlands as well.

ii. Interview Damen

Time and date:	10:00 – 11:00, 02-06-2017
Address:	Avelingen-West 20, Gorinchem
Interviewer:	Youri Nijsse

Interviewees

Peter Robert – Director Business Development and Market Intelligence

Summary

General information Damen

Damen builds and designs ships, which can be used in the offshore wind market. Vessels suited for the offshore wind sector are for example crew-transfer vessels, cable laying vessels and transport vessels. Damen has founded offshore XL, which will focus on the offshore market, both in conversion and building of offshore vessels.

Are the current ships Damen makes suited for the growing size of wind turbines?

Damen's current ships are suited for the current wind turbines in the market, but larger designs will be needed for new generations of (larger) turbines. New ranges of ships that entered the market around 2013 – 2014 will have a limited time of use (around 8 years), before size increases in wind turbines make the ships unsuited for the market. These ships might be of use in markets outside of Europe, but these markets are likely to also apply the new generation of turbines relative quickly.

Does Damen produce ships for the Asian markets in the Netherlands

Shipyards operate on heavy cost considerations. As making ships in Asia is cheaper than it is in Europe, it would make little economic sense to produce the ships for these markets in Europe.

As the offshore wind market is a subsidy-driven market, governments often their tax-money to result in industrial development in their country. Therefore, local content requirements are often part of a wind tender. Damen can choose to make their ships in foreign shipyards, or sell the licenses to companies to produce the ships, adapting to the wishes of their customers. The shipyard is usually the customer in these cases. Foreign shipyards do still have steps to take in the fields of safety and quality.

Does Damen have any problems accessing the USA market?

In the USA, the Jones Act makes operation difficult. Ships have to be produced in the USA to operate in the USA market. In this market, Damen cooperates with USA companies, and supplies the design for ships in that market.

Does Damen cooperate with embassies of the Dutch government?

Damen has participated in trade-delegations and missions, which are useful to contact local parties. This is especially true when local parties have been approached before the mission. These mission facilitate entry to foreign markets.

How does Damen hear about upcoming trade missions?

It does through many channels, e.g. RVO, IRO and HHWE. There is much overlap between these organization, and the Dutch sector is very fragmented. Having one trade organization for renewables could be an option to make the sector more transparent.

Does Damen profile itself as a Dutch company?

Damen profiles itself as a family company with a strong focus on quality products. While it is well aware of its Dutch roots, it is large enough to stick to its own image. At conferences, it usually has its own stand. The Holland stand can be a low-effort way to participate in conferences.

Does Damen participate in GROW or the TKIs?

Damen is not a member of GROW, but is a member of TKI-Water and sometimes participates in events of TKI-WOZ. TKI-WOZ is currently strongly focused on energy, but offshore wind energy can be interpreted in a broader perspective, also encompassing aspects form the water sector. Cooperation between the different TKIs is limited, which might be a possible point of improvement for the industry as a whole.

What forms of cooperation or support applied in other countries could the Netherlands learn from?

The Netherlands tries to stay away from any form of industrial politics, something that other countries do apply. When correctly applied, this could stimulate the Dutch offshore wind sector, and with that the Dutch economy. Closing deals on a ministerial level with countries is also something that the Dutch government doesn't do often, and other European countries do, which can damage the competitiveness of Dutch companies.

iii. Interview Danish Energy Agency

Time and date: 16:00 - 16:30, 10-08-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewees

Rasmus Zink Sørensen – Special advisor

Summary

General information

The Danish Energy Agency is an executive organ of the Danish Ministry of Energy, Utilities and Climate. It is responsible for the legislation, dialogue and for the offshore wind tenders, and manages contracts with the winners of the tenders.

The Danish offshore wind market seems to be slowing down. Are the Danish waters saturated?

The Danish waters still have a lot of potential for new offshore wind parks. The current slow in the rollout of Danish offshore wind parks is a political decision. The amount, and the size of, the Danish wind tenders is politically chosen. The last agreement for offshore wind parks is from 2012, and this plan for tenders ends at wind parks that will be built in 2021. The Danish government will make a new plan later this year / at the start of next year, which is expected to include new plans for offshore wind turbines. It is unlikely that this plan will contain offshore wind parks that will be constructed before 2025.

Generally, procedures for new offshore wind parks (such as Environmental Impact Assessments) are started around 8 years in advance of the delivery of the wind parks. There will most likely be a gap between 2021 and 2025 where no new offshore wind parks will be built in Denmark.

Is the Danish Energy Agency also responsible for the permits of pilot project?

It is. The Danish Energy Agency has recently finished a tender procedure for one offshore wind test park. There are no further specific test sites for offshore wind turbines. There is a test site in the west of Denmark near the shore, where turbines and technologies are tested that can also be used offshore.

Some existing parks have possibilities to add turbines for testing purposes. Companies are also able to propose their own testing locations.

Seeing the increasing importance of export for the Danish industry, do tenders for offshore wind parks take in account promotion of export and development of exportable technology?

Not specifically. The parks are aimed at cost reductions. If these cost reductions are reached, this will lead to larger chances of export for Danish producers.

Is the Danish Energy Agency also involved in Research and Development projects?

Yes, the Danish Energy Agency is involved in Research and Developments. It does so through its Energy Technology Development and Demonstration Program, which supports private companies and universities to develop and demonstrate new energy technologies.

iv. Interview Danish Wind Industry Association

Time and date: 13:00 – 13:30, 15-08-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewees

Camilla Holbech - Souschef, chefkonsulent

Summary

General information DWIA

The Danish Wind Industry Association (DWIA) is a trade and network organization for the Danish Wind Industry. It is a non-profit organization that advocates the interests of the industry to the government, connections companies in the industry and helps innovation groups in the wind sector in Denmark. Its funds are coming from membership fees and project finance for projects it is involved in. DWIA categorizes its members, and adjusts the membership fees according to the category of the company.

Which innovation projects is DWIA involved in?

DWIA hosts Megavind; Denmark's national research partnership for wind energy. This Megavind's goal is to strengthen public-private cooperation between the state, private enterprises, knowledge institutions and venture capital. It aims to accelerate innovation processes within several areas of technology (from website DWIA). Megavind aims to identify priority areas for innovation in the Danish wind sector.

Magevind is a.o. looking into the necessity of additional (onshore) testing facilities for wind turbines. Most of the components of offshore turbines can be tested onshore in Denmark. DTU is operating several testing facilities for wind turbines. Some of these are owned by turbine producers, leased based on long term contracts, other are rented out.

How does DWIA cooperate with other organizations, such as OffshoreEnergy.dk?

DWIA and OffshoreEnergy.dk have separate innovation programs, but coordinate their activities to ensure a minimum of redundancy. It also cooperates with The Danish Wind Turbine Owners' Association. This association is for wind turbine owners, DWIA is for industrial parties.

Cooperation with foreign trade organization goes mainly through WindEurope, although direct contact also happens. It is interesting for DWIA to try to influence the shaping the framework of foreign wind markets in a way that Danish companies can operate there as well.

What is the relation between DWIA and DWEA?

The Danish Wind Export Association was founded some years ago, together with the Danish Export Association, to offer the Danish Wind one point of contact for export promotion activities. Members of either the DWIA or the Danish Export Association are automatically members of the DWEA. Participation in the activities of the DWEA costs money, which is partially refunded by the Danish Export Council to companies participating in e.g. exhibitions

What are the challenges in the Danish market that DWIA is lobbying for (offshore wind)?

The Danish Energy Agreement ends in 2020. Talks for the formation of a new energy agreements are starting this year/early next year, but the lack of clarity about the contents of this agreement generates a large amount of uncertainty in the market. Issues being discussed prior to the energy agreement are new support schemes for onshore wind and solar PV, and the level of ambition the Danish government has in the next agreement.

DWIA is promoting wind energy to not only be seen as a source of renewable energy, but also one of economic growth and creator of local jobs. A potential gap between the roll-out of new offshore wind farms presents a risk to the sector and the potential for LCoE reduction.

Maintaining a home market is important as a show-case to the rest of the world when promoting Danish green energy products. Research and development, as well as sufficient testing facilities, are also needed to make sure the Danish wind industry stays competitive.

v. Interview DNV GL

Time and date: 10:30 – 11:30, 10-07-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewees

Joris Truijens – Senior Consultant Wind

Summary of Interview

General company information

DNV GL is an originally Norwegian company, that supplies engineering, consultancy and certification services to the offshore wind sector. It operates globally in e.g. the energy, maritime, oil and gas industry.

Is the knowledge of DNV GL has in the offshore wind sector globally applicable?

The service that DNV GL supplies in consultancy and engineering are globally applicable, but sometimes need local info. DNV GL cannot operate as a consultant and certification company in the same (part of a) project.

What kind of certification standards does DNV GL supply?

DNV GL supplies its own standards, which are recognised by the industry, and can make use of general standards (e.g. ISO norms). Some countries also have their own standards, which DNV GL can check. These standards are often sector specific.

Does DNV GL ever face problems regarding the use of Local Content Criteria in foreign markets?

Local content criteria usually span over the whole width of a project, especially in the building sector. This means that the engineering part of the project, which is only a relatively little part of the total value of a project, usually doesn't face any problems in this regard.

Some countries (example, Taiwan) do have specific requirements regarding the development of local knowledge and expertise, imposing mandatory technology transfer practices in the projects.

Does DNV GL provide any services to strengthen the offshore wind sector?

DNV GL offers advice to companies to come to certification standards. These standards and certifications help to ensure investors to trust the companies, lowering risk and thus the costs of these investments.

vi. Interview Dutch Ministry of Foreign Affairs – Embassy Japan

Time and date: 09:30 – 10:00, 20-06-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewees

Luite Douma – Senior Trade Officer

Summary of Interview

What is the current state of offshore wind in Japan?

Japan currently only has a small market for offshore wind projects. It has no commercial offshore wind farms yet, but has a couple of pilot projects. Following the crisis at the Fukushima nuclear power plant, Japan aims to increase the share of renewable energy, including wind energy, but much remains unclear about the timeline and concrete actualization of these ambitions. Three planned projects for wind farms in Kitakyushu, Kashima and Akita will most likely be the first larger scale farms to operate. However, actual construction for these sites is still at least five years away. A revision in the ports and harbour law has made it possible to conduct tenders with designated areas for off shore wind development close to shore.

A pilot project in Fukushima experimented with floating turbines.

Local governments have a high degree of influence on the development of harbour areas, and thus on the development of offshore wind farms near these harbours.

Do companies need to have a joint-venture or similar form of cooperation to enter the Japanese market?

Joint-ventures are legally not necessary, but are practically highly recommended. Companies entering the Japanese markets will face large language barriers, and will have a hard time finding partners in Japan. To participate in certain tenders, you do need to have an office in Japan. Having a partner, or an agent, can greatly help with accessing the market.

Are Dutch companies already working in the Japanese market?

Some Dutch companies are already working together with Japanese companies. SIF is for example working together with Sato Tekko. Dutch companies like GustoMSC and Huisman have also already received orders in Japan. While the offshore wind market is still small, these orders already add up to several millions of Euros worth of exports.

What kind of services or programs exist to support Dutch companies that want to export to Japan?

One of the most important programs has been the Partners for International Business programs. HHWE makes regular use of this program to strengthen cooperation in Japan and South Korea, but

the PIB program organized by HHWE in Japan and South-Korea ended this year after a three-year run time

Embassies can perform a business partner scan, and actively contact companies to introduce Dutch companies. Additionally, they hand out information about the local market, and stay in touch with local governments, where they can also promote Dutch technology.

Do other embassies operate differently from the Dutch embassy?

The Danish, Spanish and Norwegian embassies are very active. The Norwegian embassy organizes seminars in Japan.

There is some cooperation between embassies, through EU delegation and the EU business council. Competition between European countries limits this cooperation.

vii. Interview Energinet

Time and date: 10:00 – 10:45, 15-08-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewees

Aksel Gruelund Sørensen - Head of Department Projects
Jens Christian Hygebjerg - Chief Project Manager, Project Execution

Energinet document 14/11186-55 (for Energinet's internal documentation)

Summary of Interview

General information Energinet

Energinet is the Danish TSO, and is the owner, operator and developer of the transmission system for electricity and natural gas in Denmark. It is an independent public enterprise, owned by the Danish Ministry of Climate and Energy. Energinet's rights and functions are described in the Danish 'Law on Energinet.dk' ('lov om Energinet.dk').

What is Energinet's role in the Danish offshore wind parks?

Energinet is responsible for transmission lines and substations with a voltage above 100 kV. In offshore wind parks, this means they own and operate the export cables connecting the substations in the offshore wind parks to the onshore electricity grid. They also own and operate the substations, but these substations have room for the concessionaire (winner of the wind farm tender) to place their equipment transforming electrical power from the turbines to the appropriate voltage.

Energinet must maintain a high level of security of supply, integrate renewable energy and promote optimal conditions for Denmark's electricity and gas markets. This includes ownership, operation and maintenance of the interconnectors linking the Danish energy system to other countries.

Next to the responsibility for grid connection of the wind farm, Energinet is responsible for the Environmental Impact Assessment, EIA for both wind farm and grid connection. Also geotechnical and geophysical studies are performed for the wind farm area. Energinet has an internal team of experts on these studies, who cooperate with consultancy and engineering firms conducting these studies, as well as with national authorities approving these studies. The winner of the tender pays for the studies conducted on their part of the offshore wind farm.

Energinet mainly plays the role of project manager and contractor. It also takes care of electricity protection systems. For their project it makes use of a multi-contract approach. It will assess the project and the supply chain, and then accordingly makes a range of contracts for different parts of the system.

Energinet owns no testing facilities, and is not involved in the Danish wind turbine test site at Østerild.

Do foreign companies also participate in these studies?

Yes, the studies are tendered, and open to foreign companies. Especially the geotechnical and geophysical studies attract foreign bidders.

What are most important factors for Energinet to lower the costs of offshore wind energy parks?

The most important factor to lower costs is to take away risks and uncertainty from the wind farm. This is done by performing the EIA and geotechnical and geophysical study, presenting the findings, authority requirements and the Energinet interface (specs on platform conditions etc.) before the parties hand in their bid on the wind farm tender. Strong cooperation between Energinet and the winner of the tenders also reduce risks, and promote cost savings. By having an internal team of experts on the required studies for offshore wind parks, unnecessary studies can be avoided.

Additionally, Energinet is looking into methods of standardization of transmission assets lowering costs.

In optimizing the costs for grid connections of offshore wind farms, Energinet is looking on the full life-time costs of the assets. Energinet is liable for any outage or reductions in grid capacity and this is taken into account in the design (redundancy of some equipment).

There is a strong degree of cooperation between Energinet and the Danish Energy Agency during the development of the wind farm tender. Potential bidders are invited to discuss interface to Energinet and the conditions of the tender. It is important that Energinet and Danish Energy Agency are aware of the risks, which are considered by companies participating in the tenders and assign risk to the party who can handle the risk most efficiently.

How are the offshore grid connections financed?

The costs of the offshore grid connections are incorporated in the transmission tariffs, and are ultimately payed by the electricity consumers. For each wind farm, the grid connection solution and cost has to be approved by the Ministry of Energy and Climate.

Does Energinet also perform commercial activities?

Energinet has a commercial branch called 'Energinet Energy Consultancy', which offers paid-for consultancy services such as planning and operation of energy transmission systems, and the grid connection of on- and offshore wind farms. These services are usually sold to other TSO in different parts of the world. (A list of countries / projects can be found in the brochure on the website)

Next to the sale of knowledge, Energinet also exchanges knowledge with other TSOs for mutual benefit. Energinet has joined a couple of trade missions, usually when asked by the Danish Energy Agency.

Which important developments in technology are interesting for Energinet?

Developments in grid codes can be interesting for Energinet. Newer models of turbines often have possibilities to modify their power output and have possibilities for voltage control. As such, they could serve as instruments used to add security to the grid. As almost every new wind farm uses new turbines, Energinet has to be able to work on the cutting edge of technology to make use of these new functions.

viii. Meeting GROW / TKI-WOZ

Time and date: 12:00 – 12:40, 01-06-2017
Method: Phone call
Interviewer: Youri Nijsse

Interviewees

Ernst van Zuijlen – Director of GROW, Director of TKI Wind op Zee

Summary

General information about GROW

GROW is a consortium of ~20 leading players in various parts of the Dutch value chain of offshore wind. Following up on the goals of the FLOW research program, it initially aimed to continue to work to reduce the levelized cost of energy (LCoE) of offshore wind. As large cost reductions already were achieved in a series of tenders held in 2016 and 2017, GROW has broadened its goals to not only focus on future cost-reduction, but also encompass goals creating value for the energy system as a whole and for society. These goals will look further into the role that offshore wind will have in the future Dutch energy system (interconnection, cooperation with oil and gas, marine energy), as well as strengthening the industry and positioning the Netherlands as a market-leader in the global offshore wind market, enhancing exports. Also options to combine food production (fishery, sea weed), tourism and for instance nature development or restoration are considered.

Summary of findings

The Netherlands is currently lacking a manufacturing industry in the offshore wind sector. There are possibilities to start such an industry. The Netherlands does have a lot of parties active in the supply chain for the manufacturers. There are possibilities to have one of the large European manufacturers establish a factory here (GE, Siemens, MHI Vestas) or to attract one of the Chinese (Asian) manufacturers. The Netherlands has large harbours with excellent accessibility, which could have the space to attract such facilities. Dutch harbours are currently profiling themselves to become hubs for offshore wind energy. The Netherlands does have manufacturers of onshore wind turbines (Lagerwey, EWT, a.o.), and also start-ups (2B- Energy and Delft Offshore Turbine) for specific offshore application.

The role of the national and local governments is mostly that of a facilitator of the industry. An important aspect for this is the availability of testing and demonstration facilities for technology developers.

Next to facilitation, subsidies for research, development and innovation are also important for the industry. The current Dutch subsidies are largely coming from the SDE+ fund. With a broader portfolio of goals, the government has to make sure that current subsidy programs still match projects trying to reach these goals. This means that subsidy-programs should also start looking towards methods of subsidizing, and offer the funds, for programs that focus on broader goals than just cost-reduction.

GROW / TKI-WOZ are also looking to attract more personnel to the sector. For this, they have founded the CAREER program, which stimulates national and regional cooperation between research, education and companies in the offshore wind sector. This program aims to attract sufficient well-educated personnel on all educational levels to the sector. Further activities to facilitate Small and Medium Sized Entities (Offshore Wind Innovators), and to stimulate fundamental research needed for the scale-up of the market (PhD@Sea) are initiated.

ix. Interview HHWE

Time and date:	10:30 – 11:30, 20-06-2017
Method:	Interview at the Ministry of Foreign Affairs
Interviewer:	Youri Nijsse

Interviewee

Arjen Schutten – Managing director HHWE

Summary interview

General information on HHWE

Holland Home of Wind Energy (HHWE) is founded by a group of companies that wanted to focus on exporting to upcoming markets in the wind sector. Most of its efforts are currently focused on offshore wind projects. It aims its efforts on the countries that its members express interest towards. Over the last years these have been China, Japan, South-Korea and Taiwan, the USA and France. Possible future markets encompass Indonesia, Vietnam and India. These are generally markets where companies experience barriers when entering the market, often in the form of cultural barriers or protectionist measures of the target country. HHWE organizes both incoming and outgoing missions. It facilitates companies to get in contact with foreign partners, it is up to the companies itself to close the deals resulting from these contacts.

How does HHWE organize its trade missions?

Trade missions are prepared in active collaboration with governmental organs. Main collaborative partners in the Netherlands are the RVO, The Ministry of Economic Affairs and The Ministry of Foreign Affairs. This cooperation is in the form of public-private partnership.

To organize a mission, HHWE takes initiative to find appropriate partners for its members. It cooperates with the embassies in creating a list of potential partners. It sometimes makes use of financial resources of the Partners for International Business program. The participation of embassies offers a lot of status and trust, especially in Asian cultures, which is very useful. Additionally, HHWE is actively in contact with local Wind Energy Associations.

What are current interesting developments in upcoming offshore wind markets?

In Japan, some Dutch companies have already closed multi-million-euro contracts (e.g. GustoMSC and Huisman). Taiwan seems to developing rapidly, and foreign investors have bought shares in upcoming parks there. Taiwan is presenting itself a hub from which companies can start to explore other Asian markets. Korea seems to be progressing slowly. China is the biggest market, but very difficult to enter, because the Chinese government likes to develop offshore wind farms with local companies.

The USA can be a difficult market to enter too. Its developments are unclear, yet its potential is large. The Jones Act makes it difficult for installation companies to operate in this market, but offer possibilities to other companies, e.g. companies who have experience designing new ships. The process to build wind parks in the USA is very bureaucratic, which is not likely to change in the upcoming years. The Americans are very interested in the Dutch tender model, with the government taking responsibility for large parts of the exploration / grid connection. There are currently no MOUs between the NL and America in the offshore wind sector.

Are there other organizations in the market that look to promote offshore wind exports?

NWEA has also started to focus on exports, mostly focused on large conventions in cooperation with WindEurope. IRO has also broadened its focus, from oil and gas to offshore energy resources also including offshore wind. IRO's companies are largely in the manufacturing-industry. HHWE focuses on upcoming markets, IRO and NWEA usually focus on more on mature markets.

The sector is generally highly fragmented. Regional organizations like the Groningen Energy Valley and the Noord Northern Netherlands Offshore Wind also have their own agenda.

Cooperation between IRO, NWEA, HHWE and the Ministries is improving a lot, and there are 6-weekly meeting to update and coordinate their activities. There might be possibilities for further future cooperation forms.

The fragmentation of the sector poses little problems to large (offshore) companies, who have enough internal resources. It can prove hard to new or small parties, who don't have the expertise, network and capacity to keep up to date with the whole playing field. In this case, a one-stop shop, one organization that takes care of all aspects, could be a possible improvement to the market.

Are there parts of the offshore wind industry that are hard to export?

Asian countries are less inclined to pay for advice / consultancy. Knowledge transfer is often expected in the deal with suppliers of larger parts of the project. Engineering skills are acknowledged, so consultancy profiling as an engineering firm might be more successful in exporting to these markets.

Current trade missions are usually aimed at B2B settings. PIB programs are possible to focus on research institutions (such as Marin, ECN, TNO). A lot of research is focusing on Operations and Maintenance (O&M) solutions atm. Upcoming countries don't have the expertise in O&M services yet, so O&M can be a valuable field of exports.

What does the government do in terms of export promotion?

In the past, RVO has organized very successful technology matchmaking missions, which explored the possibility for doing business in emerging markets. State-visits from the royal house and visits from the Minister (Kamp) are great opportunities to combine with trade-missions.

These kinds of visits are generally only useful if they are combined with follow-up meetings, within 6 weeks to 2 months of the initial missions. HHWE also facilitates these follow-up meetings. Without a plan for a follow-up meeting, these missions usually don't have much value. The PIB programs ask for a multi-year strategy, which forces companies to think about these kind of follow-up meetings. The PIB programs are now focused on a certain country. A sector-broad PIB in offshore wind could be an effective approach, but is not yet possible with the current set-up of the PIB.

Are there any possibilities for a future Dutch manufacturing industry?

Many Dutch companies selling components/hardware in the wind power sector are internationally quite successful. The Netherlands has a couple of companies that are trying to enter the manufacturing market for wind turbines (Lagerwey, 2-B Energy, DOT). Lagerwey is currently also selling licenses. The manufacturing sector is a hard part of the industry to enter, as many countries want to establish their own supply chain. Floating wind will become more interesting in the future. Although some Dutch companies are active in this sector (SBM Offshore, Vryhof Anchors, Blue H Engineering, Gusto MSC and Mecal), the Netherlands doesn't have a supply chain developed for this yet.

The lack of big wind turbine manufacturers in The Netherlands can hamper the image Dutch wind power industry abroad by not being viewed as a fully capable industry. The image of the Netherlands has improved the last few years especially in Asia due to the activities of HHWE and the Dutch government. Offshore capabilities, marine engineering, installing, manufacturing of special handling systems and O&M is increasingly respected abroad. In these, the Netherlands is a very important stakeholder.

What lessons can the Netherlands learn from other countries?

The Danish government supports its sector a lot. Not necessarily in terms of finances, but cooperation seems to work very well. In the Netherlands, a lot of support is focused in the PIB projects. In these PIB projects, large offshore companies don't always participate, as they have their own resources. This can make the PIB projects less effective, because without participation of the Dutch champions such as Van Oord we do not represent the whole value chain in offshore wind.

x. Interview Lagerwey

Time and date: 14:00 – 14:30, 13-06-2017
Method: Phone call
Interviewer: Youri Nijsse

Interviewees

Sjoerd Sieburgh Sjoerdsma – Director Licensing and Ventures

Summary interview

Lagerwey is the largest Dutch onshore wind turbine manufacturer. They also develop technology (i.e. the climbing crane) that can be used in the offshore wind sector. They are part of the GROW consortium. The company has recently closed a large deal the Russian company OTEK, regarding the license of their onshore turbines, and is growing rapidly.

How does Lagerwey currently access new markets?

Lagerwey receives little support from the government, compared to other country's wind turbine manufacturers. To enter new markets Lagerwey mostly makes use of its own network. In some markets it is in contact with local embassies. These can greatly help in introducing a company to the right parties. Additionally, in cooperation with RVO, market studies can be performed for markets which might have potential.

Embassies would be especially useful if they could introduce companies to agencies that directly work together with the company. Contacts from embassies, but also from other parties such as ECN, can help greatly in entering new markets.

Does Lagerwey face country-specific problems when exporting its technology or licenses?

Some countries do not offer protection for licenses or patents. Doing business in these countries can result in unwanted technology-transfer, which makes Lagerwey lose its competitive edge. For this reason, Lagerwey does not sell its technology to some specific countries.

Most countries outside of the EU have local content requirements. The LCR vary per country.

What can the Dutch government do to improve the business climate in the Netherlands for wind turbine manufacturers?

One of the major points of improvement would be raising the availability and accessibility of testing-fields for manufacturers. There are currently relatively little testing facilities available, and some of the fields currently available are not accessible for small(er) players in the market. While this reduces the risk government carry when offering testing fields, it also reduces the opportunities for the small(er) players in the market to grow.

Next to that, the Netherlands offers little to no co-financing or subsidies for companies to grow their production facilities. Building large production facilities for windmills is extremely costly, and can be a major barrier for growth. Especially in offshore wind, where the costs are even higher than the onshore turbine's costs due to their larger size. Small to medium sized companies who are strongly growing also have a high risk to be bought by the largest players in the market.

Are there any other subsidies that Lagerwey can get, for example for R&D?

There are subsidies available for R&D, but the process to access these subsidies is difficult and rather slow.

What are Lagerwey's thoughts about kite-energy as an upcoming competitor for windturbines?

Kite-energy seems more like a niche market, which has yet to prove itself as a technology.

xi. Interview NWEA

Time and date: 13:00 – 14:00, 19-06-2017
Location: Arthur van Schendelstraat 550, Utrecht
Interviewer: Youri Nijsse

Interviewees

Hilbert Klok – Branche specialist offshore wind energie

Summary interview

General information on NWEA

NWEA is the Dutch wind sector's trade organization. It represents the interests of the stakeholders in the sector, and lobbies at the government to see these interests being taken into account when policy is formed. Additionally, it facilitates as a network for its members, and has several working groups working towards specific goals in the sector. These also define what message the group should send out when lobbying.

What are the key interests that NWEA lobbies for?

The lobby is mostly aimed to affect rules and laws concerning the sector. For example, how can policy be optimized in the roll-out of the new tenders to take in account the interests of the sector. It advices the government on how to form its policy in a way that it enables companies to do their work effectively.

What other things can the government do to support the sector?

NWEA supports its members to find the right partners / clients, the government can play a role here as well. Especially in foreign markets, it can facilitate networking possibilities and enhance transparency of these markets.

Additionally, the government can choose to reduce the risks of starting or growing companies, by underwriting these risks themselves. It can offer room for companies to grow, importantly also in harbours.

Does NWEA think the Netherlands should attract more manufacturers for wind turbines?

Having manufacturers in the Netherlands could be positive for the sector. The government could help current small parties that have innovative ideas for new turbines to kick-start their products by taking away some of their risks. Additionally, the government plays a role in R&D and demonstration of the products. Proving / testing products is a very capital-intensive process. For testing, a place and a supporting framework of regulation is necessary. Currently, the Netherlands only has the offshore testing parcel at Borssele, this can potentially be improved by adding more testing facilities.

What steps can the government take to promote export of its companies?

Small companies can have troubles identifying which foreign markets have potential for their product. The government can help identifying this, share their information about these markets and offer advice on how to operate in these markets. It can also help to find local partners, which are often needed to start doing business abroad. Embassies could look into the chances certain product can have in foreign markets.

Additionally, governments can help to find relevant investors for new technologies.

Does NWEA also promote exports of the wind sector?

NWEA has a working group (Werkgroep Exportbevordering en events) focused on promoting exports. To promote exports, NWEA is looking for more coordination between the different organizations in the Netherlands (e.g. TKI-WOZ, HHWE, IRO, FME, RVO and NMT). On their website, they give an oversight of trade missions and events relevant for the sector.

What is NWEAs view on the upcoming roadmap and the possibilities to add more than 1 GW per year?

Generally, NWEA prefers to have as much capacity added per year as possible. It is important to have a steady perspective for the future, to ensure the possibilities of investments in innovation. A larger sector enjoys scale-advantages, and gives possibilities to more parties entering the market, stimulating competitiveness. More competitiveness in the market would improve the competitive position of the Dutch market as a whole.

Are there any other points that the government could improve its support of the sector?

The sector is growing rapidly, and will require a sufficient number of new personnel to fill the upcoming jobs. The government could pay more attention to ensure that enough qualified personnel for the sector is educated in time.

If looking at other countries, we can see that the wind sector is actively involved in the decision-making process for the future of the national market. In the Netherlands, the sector plays a more advisory role. Giving the sector more influence in the decision-making process gives it more security and certainty, which reduces risk and strengthens the sector.

Innovatielink, NWEA and TKI WOZ have just started Offshore Wind Innovators, a platform which links large companies to small and medium sized firms. The government can help by financing these new innovations and the work that is done by the platform.

It could look towards a shared vision of the harbours in the Netherlands.

xii. Interview Offshoreenergy.dk

Time and date: 10:00 – 10:45, 07-08-2017
Method: Phone meeting
Interviewer: Youri Nijsse

Interviewees

Mikkel Juul – Head of internationalization

Summary interview

General information Offshoreenergy.dk

Offshoreenergy.dk is a Danish cluster organization for offshore oil, gas, wind and wave / marine energy parties. The main focus areas of the organization are innovation and internationalization. It uses a triple-helix approach (university, industry, government).

In which ways does Offshoreenergy.dk support its members?

Offshoreenergy.dk helps small and medium-sized enterprises (SMEs) to export their products to foreign markets, by helping them to find partners and companies to work together in these markets.

Offshoreenergy.dk has a three-step approach to identifying opportunities in new markets. Search areas and potential markets are identified by the organization's members. For this, it has an advisory board consisting of members of companies, universities and governmental stakeholders. First, contact with local networks or trade organizations in these markets is made. Secondly, the local value chain of the potential market is mapped out. And third, gaps in the value chain are identified, which can offer opportunities for Danish businesses.

Offshoreenergy.dk focuses on long terms opportunities, and establishing networks. It doesn't focus on methods for short term opportunities, such as actively visiting fairs, conventions or trade missions.

What is the division of roles between Offshoreenergy.dk, and other cluster or trade organizations in the Danish sector (such as DWIA, Danish Export Association)

Offshoreenergy.dk has a strong focus on innovation and internationalization, DWIA has a stronger focus the legislation. industry framework and is lobbying the industry's interests. The Danish Export association is a private organization, focusing on export promotion for its own members, and is focused on fairs and trade missions. The organizations are members of each other's organizations.

Which areas of the industry are especially important for the Danish wind sector's exports?

Exports are extremely important for the Danish offshore wind sector. 60 to 70 percent of the sector's revenue comes from exports. Offshoreenergy.dk has innovation projects which focus on Operation

and Maintenance. Danish O&M companies have large opportunities to export goods as well as installation.

Which parties supply financing to Offshoreenergy.dk?

Offshoreenergy.dk is financed by its members (~20-25%) and the national government (~40%). Other sources of financing are the regional governments of the five regions of Denmark, and specific funds for innovation programs such as the EU's Horizon 2020 project. The Danish regions have specific focuses for the development of their local industries. The Syddanmark (South-Denmark) region is strongly focused on offshore developments.

Which regions are currently interesting for the Danish offshore market?

In the European market, Offshoreenergy.dk is currently focusing its attention on the Hall area (UK), and the German Baltic sea, as these areas have an offshore wind sector that lacks competences which the Danish can potentially fill by exporting their goods and services. In the USA, they are in contact with the consulate of Denmark (in Chicago). The market there is not ready yet, but it is expected to pick up in a couple of years. In east Asia, China is a huge market. It has very high costs to enter the market as a foreign company, which makes market entry difficult for small SMEs. Taiwan has recently seen a tender won by DONG. As Danish companies have a track record working for DONG this offers opportunities to them as well.

With which ministries does Offshoreenergy.dk mainly collaborate?

Offshoreenergy.dk works together closely with the Danish Ministry of Foreign Affairs, including its embassies and consulates abroad. It organizes common activities and workshops with the ministry.

Does the Danish market have enough potential for domestic growth?

The Danish offshore market can be seen as a mature market. While there are still offshore wind parks being installed, these upcoming parks are becoming smaller. Wind farms coming up are the Horns Rev 3 (owned by Vattenfall) and Kriegers Flak (also owned by Vattenfall). There are currently political discussions in Denmark about new offshore wind parks, which might have visibility issues affecting local tourism, that could hinder domestic growth.

What is the division of roles considering the grid connection of Danish wind parks?

Energinet (TSO) is responsible for the connection to the grid and the substations of the wind parks, as well as the grid balancing. Developers are responsible for the array cables. Denmark uses a tender system for their parks, bidding on the height of the subsidy necessary. This licensing system is becoming more similar to that of oil & gas tendering, and could be a driver for why more oil & gas companies are stepping into the offshore wind sector.

Are there any notable areas where the Dutch and Danish industry could cooperate in the future?

Future collaboration would be possible in the decommissioning of old wind turbines. In this segment, the Dutch have expertise in installation of offshore turbines.

xiii. Interview Roland Berger

Time and date:	14:00 – 15:00, 06-06-2017
Address:	Strawinskylaan 581, Amsterdam
Interviewer:	Youri Nijsse

Interviewee

Maarten de Vries – Senior Associate

Summary of Interview

What kind of studies does Roland Berger perform in the offshore wind sector?

Roland Berger advises individual companies in the fields of market entry and strategy, market studies and core business advising. In the Netherlands, Roland Berger assists consortia of companies and knowledge institutes to develop joint R&D programs. Roland Berger has thus been involved in the development of the FLOW and GROW programs. Knowledge of the technology of the offshore wind sector is necessary, especially when participating in the development of R&D programs.

Roland Berger published a 'think act' in 2016 which sketches the developments and potential of offshore wind around the globe. Have these predictions changed in 2017?

Some important changes have occurred. Australia has announced that it will develop a 2 GW windfarm. The plans of China have changed, from a goal of 20 GW in 2020 to 5 GW. Signals indicate that this goal might possible be exceeded. Taiwan has also announced significant volumes of offshore wind.

How about offshore wind developments on small islands, like Mauritius?

Small islands have only a limited need for capacity, but as they are often reliant on expensive imported fuels for power generation, offshore wind might be economically viable. For these islands, smaller turbines might also make sense economically. An example of this can be seen in Block Island (USA).

What kind of difficulties or barriers do companies face when entering these markets, and how can these be overcome?

It generally helps if a company has experience / a footprint in the market it wants to enter. It is sometimes also possible to join a customer to enter new markets. As a globally active consultant, entering a market is less difficult for Roland Berger due to the contacts / experience / footprint in these market.

Some offshore wind projects have Local Content Requirements (LCR). As consultancy services often only comprise a small percentage of the content, LCR are usually not a problem for Roland Berger.

Furthermore, some companies might face challenges operating in both Taiwan and China, due to political tensions between these countries.

The Dutch government has announced the possibility of a growth of 2 GW per year of offshore wind capacity in the new roadmap to 2030. Would in this scenario de financing of the sector run into troubles?

The financial sector currently has plenty of low-risk capital available which can accept low interest rates. Offshore wind energy is more and more seen as low risk investment opportunity. Therefore, it is becoming more interesting for funds investing in this low risk capital, for example pension funds. Due to the technology maturing, its risk profile has lowered in the last years, especially during the construction phase.

The last tenders in Germany have produced outcomes that don't require subsidies. What would this do to the market?

A switch from a subsidy based industry to an industry based on merchant risk will increase the riskiness of the project, as the investments become dependent on varying electricity prices. This might make offshore wind comparable to gas and coal investments in terms of risk profile.

The farms from the last round of German tenders will have their Final Investment Decision in 2021, and the farms should be delivered in 2023. For the tender, the bidding parties have assumed a significant growth in turbine capacity and electricity market price. In 2021 they will have more clarity on the growth in turbine capacities, market price might still be unsure looking two years in the future. The winning parties can exit the process if they don't feel like their earlier predictions will come true, for a relatively low fine. The winning of these tenders can be seen as buying a relatively cheap option, where countries and not companies carry most of the risk of these tenders.

What kind of methods do governments use to support the offshore wind sector?

The Netherlands has a lot of support focused on stimulating innovation, such as the WBSO and TKI-subsidies. It focuses less on supporting individual companies when they start investing, compared to other countries. Denmark has an elaborate export insurance and financing approach, which helps Danish companies to realize projects in foreign countries. This helped the Danish turbine industry to develop. The Netherlands generally avoids strong support to individual companies. Sentiment against a strong industrial policy in the Netherlands can be related to the RSV inquiry case of 1983.

Much of the technology of wind turbines stems from the Netherlands, but has been bought by Danish companies.

Are there still possibilities to start a manufacturing industry for offshore turbines in the Netherlands?

The current manufacturing industry (in Europe) is dominated by a few large players (Siemens, MHI Vestas, GE). Attracting one of these companies, or possibly one of the Chinese manufacturers, is an option. Another option might be a leap-frog approach towards one of the Dutch technologies that have an inherently cheaper technology compared to current wind-turbine designs. However, such an approach is very costly in the offshore wind sector, and requires a lot of investment in testing and demonstration. The government can play a role in helping with initial investments or offer additional testing facilities.

xiv. Interview Siemens-Gamesa

Time and date:	16:30 – 17:00, 10-08-2017
Method:	Phone
Interviewer:	Youri Nijsse
Interviewee:	Rob Kuilboer – Technical Sales Manager

Summary of Interview

General information

Siemens Gamesa Renewable Energy is a merged company between the wind power division of Siemens AG and Gamesa Technologica. It produces turbines in the on- and offshore wind market.

Does Siemens Gamesa produce offshore wind turbines in markets outside of Europe?

Siemens Gamesa produces wind turbines in several countries in the world. Examples of countries with production facilities are China, Morocco, USA, India and Brazil. It has also recently opened a factory in Hull, UK, where it produces offshore wind turbine blades. Most of the turbines for the European market are produced in Denmark and Germany.

Are the turbines that Siemens Gamesa produces transportable to foreign markets, or does this make no economic sense?

Turbines produced by Siemens Gamesa can be, and are, transported to other markets. For example, turbine blades produced in Morocco are transported to Europe. It only makes sense to start a local production facility if the outlook of this market promises several gigawatts of capacity available for new turbines of Siemens Gamesa.

Transporting the turbines can be costly, especially because of their large volume. Due to this volume, specific methods of transport need to be utilized, which are more costly than standard methods such as a standard shipping container.

Does Siemens Gamesa produce all parts of the wind turbines, or does it sometimes only produce parts of the turbine for a project?

Siemens Gamesa produces the full turbines. It can produce most of the parts itself. Specific components like the transformers, converters or generators are produced by other Siemens divisions. Only a small part of the components are bought from external suppliers. Bearings, nacelle-canopies, towers, cables and foundations are examples for this. Small parts are often produced in China.

Is Siemens Gamesa also active in new types of turbines, such as floating turbines?

Siemens Gamesa is partnering with Statoil in building the first commercial floating wind project 'Hywind Scotland', which is currently under construction. The turbines used in the current Scottish floating wind farm are supplied by Siemens Gamesa.
(see http://www.4coffshore.com/windfarms/first-hywind-turbine-arrives-off-scotland-nid6167.html)

Does Siemens Gamesa make use of governmental export promotion products, like export credit guarantees?

Siemens Gamesa does make use of export credit guarantees, mostly from Germany (Hermes) and Denmark (EKF).

Does Siemens Gamesa face problems with Local Content Requirements when entering foreign markets?

Local content requirements differ from country to country. It may require specific arrangements to cater for local content requests, such as local production of towers or blades. In a lot of cases local companies are also involved in construction work and project execution. The workforce for O&M in most of the projects is also recruited locally.

xv. Interview State of Green

Time and date: 10:00 – 10:30, 09-08-2017
Method: Phone interview
Interviewer: Youri Nijsse

Interviewees

Anette Brænder – Senior Project Manager Wind Energy

Summary of Interview

General information State of Green

State of Green is a Danish public-private partnership, which was founded in 2008 for the 2009 United Nations Climate Change Conference in Copenhagen. It was founded by a mix of Danish governmental parties and trade / cluster organizations of the Danish Industry. Its aim is to improve Denmark's branding in the green sector. After its initial success at the COP, the project was extended and renamed to State of Green. It currently has 10 employees, and 5 student assistants running the organization. State of Green is a (non-profit) foundation, which is funded by the industry and government (~50/50), having a yearly budget of […].

What is the general goal of State of Green?

State of Green's offer marketing and communication services to promote the Danish green sector. Its goals are to both attract foreign investment and promote the export of Danish green products and technologies. The direction and goals of the companies are determined by the board of the organization, which consists out of a mix of actors from the private and public sector, with an independent chairman. It can offer extra services to industrial parties that contribute financially to the organization.

What kind of services does State of Green offer for the Danish offshore wind industry?

State of Green offer 6 kind of services to all green sectors. These are:

State of Green tours: State of Green hosts tours for incoming delegations of decision makers, connecting them to companies and organizations in Denmark. These tours are free of charge. With these tours, it accommodates around 2000 people every year, with around 10 to 15 delegations focused on (offshore) wind. The tours are very popular, and as such, applications are screened for relevance

for the companies facilitating the delegates, with around 2/3rd of the applications being refused due to lack of relevance or capacity limitations.

State of Green is present at events such as trade missions and conferences, promoting the Danish green sector.

State of Green has a website which functions as a portal for foreign companies to find and connect with Danish companies, and get information about the Danish green industry sector.

State of Green has a physical location, called House of Green. House of green is an interactive showroom and visitors' centre in Copenhagen, introducing visitors to the Danish green sector.

State of Green publishes articles and white papers in national and international papers and on its website. The white papers are writing in cooperation with governmental and industrial partners.

State of Green has 'Green hubs', foreign offices that promote the Danish green sector.

Which companies can join State of Green as members, or can use its services?

State of Green work together with companies and organizations that have a Danish presence. These can be companies with a main office abroad. Companies joining State of Green do have to be in possession of a Danish VAT address.

xvi. Interview TenneT

Time and date:	14:00 – 15:00, 17-05-2017
Address:	Utrechtseweg 310, Arnhem
Interviewer:	Youri Nijsse

Interviewees

Saskia Jaarsma – Senior Advisor Offshore NL

Summary of Interview

General information TenneT

TenneT is responsible for the electricity grid connection of the Wind op Zee project's wind parks for the next ten years. Regarding offshore wind energy, it is responsible for making a connection platform at each wind site, connecting this platform to the land-based TenneT network, and balancing the corresponding loads. The jurisdiction of this responsibility is based on the Dutch "Elektriciteitswet (reviewed in 2016)". The tasks related to this responsibility are delineated in the "Ontwikkelkader Windenergie op Zee (2016)".

Q: How does TenneT reach its cost-reductions in the offshore wind sector?

A: TenneT receives a subsidy from the Ministry of Economic Affairs for its work on the offshore wind grid, which is used for the investments needed to construct the connections to and platforms in the wind areas, and the operation and maintenance of these connections and platforms.

Parts of the cost reductions are reached by the favourably (low) interests on the current capital markets and low material costs (Steel price). Further cost reductions are primarily being reached by standardizing the platforms for the upcoming five wind areas, lowering investment (by reducing development costs for the platforms), operation and maintenance costs. TenneT has procurement strategies aimed at lowering the costs of their subcontractors.

Q: Is this standardization also applied in wind parks in Germany or Denmark?

A: Wind parks in Germany are further offshore, and as such use different technologies. While they are working towards more standardization, the Dutch designs are not suited for these platforms. The German system is currently in a transition towards a more balanced pace of installing platforms,

compared to the initial scheme. TenneT uses this as an opportunity to introduce further standardization for HVDC platforms/project for far offshore as well.

Q: What is done with the technological knowledge TenneT is acquiring while developing these wind parks.

A: TenneT is not a commercial company, so the knowledge TenneT gathers is not sold. Projects teams are typically temporary organizations within TenneT, with a mix of participants which rotate through different projects / organizations. The project teams are typically staffed by a mix of internal and external staff. Much of the knowledge will therefore transfer from project to project, internally in TenneT, but due to the amount of temporary hires also within the industry. During the design and initiation phases, TenneT also asks consultancy firms for studies for their projects. E.g. environmental impact analysis is typically provided externally and consultancy firms provide second opinions to certain design choices. TenneT is generally open to sharing their knowledge with other TSOs, e.g. within knowledge bodies as Cigre or ENTSOF.

Q: Is there a difference in the role TenneT has related to offshore wind in the Netherlands and Germany?

A: The tasks TenneT has in the Netherlands and in Germany are largely the same. The policy side differs though, affecting the relations between parties.

In the Netherlands, TenneT works in closer cooperation with other parties in the wind industry. The Netherlands focusses more strongly on lowering the total cost of energy, with tight budgets, according to the planning of the Energy Agreement. The government focusses on de-risking the offshore wind development by preparing the sites for project development, inducing permits and technical investigations.

The German government had a stronger focus on on-time delivery, with a mandatory project duration. Germany has also switched to a competitive tender system with a more balanced pace. Germany does not prepare the wind sites like the Netherlands do.

Q: Which parties fulfil TenneT's role in other countries?

A: Denmark has Energinet. England works with a different system, with OFTOs. Belgium has Elia. Germany has 50Hertz (next to TenneT) for the Baltic Seas. Furthermore, European TSO organizations such as CIGRE further facilitate knowledge exchange.

Q: What is TenneT's relation to these companies. Are they competition, or partners for cooperation?

A: Other TSOs are seen as partners for cooperation. The area on which they can operate is legally determined by their respective national regulatory framework. TenneT has worked together with Elia in offshore wind, and has started a consortium with Energinet for a possible further interconnection / an energy-island in the North-Sea in the future. Participation of the UK in this consortium is currently uncertain due to the Brexit negotiations. With National Grid (UK), TenneT is exploring opportunities for an interconnector combined with an offshore wind farm.

Q: How does TenneT see the role of the government in offshore wind?

A: In the current role assignment the ministry of Economic Affairs (EZ) is responsible for legislation, regulatory framework and supporting subsidy schemes. There is a good consultation structure between EZ and TenneT. In Germany, the legal and regulatory framework is different, resulting in different incentives.

The current roll-out and pre-investments for the offshore grid in the Netherlands are on a good pace. TenneT needs around 7 years to develop a project of the current size and standard, so would like to see a plan for the roll-out after 2023 as soon as possible.

The current pace of roll-out of offshore wind is challenging but doable. In the future it will be necessary to look into further land inward connection of offshore wind and possible connections with HVDC cables instead of the current AC cables (due to the distance to shore of new wind areas). It will require

time to develop a new offshore grid concept, which will probably be required for the new wind areas for development after 2024.

Q: Is there a difference between the roles of TSOs in Europe? Do some have commercial goals?

A: TSOs are all regulated monopolies. They differ in how far they have been subject to unbundling measures though. In some countries, the government has a closer relation to their TSO than in the Netherlands.

xvii. Meeting The Netherlands Trade and Invest Office

Time and date: 9:00 – 10:00, 13-07-2017
Location: Phone call
Interviewer: Youri Nijsse

Interviewees

Cincy Chang – Economic Advisor
Stephanie Hsieh – Economic Advisor

Summary call

General information NTIO

The Netherlands Trade and Invest Office is the formal representation of the government of the Netherlands in Taiwan, and performs functions similar to an embassy.

Information about the Taiwanese market

Taiwan has, according to the statistics announced by 4C offshore consultancy, identified 36 zones of potential for offshore wind on the west coast of Taiwan, with a technical possible capacity of up to 23 GW. Of these zones, 22 zones of potential are currently open for bids and are under environmental impact assessment (EIA). These zones will be released in stages, ranging from 500 MW to 2GW per stage. The plan of the Taiwanese government is to have 520 MW of installed offshore wind capacity by 2020, and 3 GW by 2025. In this plan, domestic industrial development plays an important role.

A range of foreign investors have applied for these zones. Notable examples are DONG Energy (Denmark), Copenhagen Infrastructure Partners (CIP, Denmark), Northland Power (Canada), Macquarie (Australia) and some German companies. Danish companies usually enter the planning process of these zones on a consultancy-basis. Dutch offshore dredging companies and energy companies have also shown interest to operate in these zones, possibly in a joint-venture setting. Dutch dredging companies have already participated in the construction of previous Taiwanese demonstration projects. To participate in these project, joint-ventures or partnerships with local companies are often necessary.

In the region, China is the most experienced country when it comes to producing offshore wind turbines and parts. In previous tenders / demonstration parts, Chinese manufacturers have supplied parts of the projects, as Taiwan didn't have the expertise or facilities to supply these themselves yet. In future projects, Taiwan will try to keep most of the manufacturing local, driven by the will to develop domestic industry, but also by political reasons.

Heavier parts of the turbine need to be produced locally, for transport / technological reasons. Taiwan is thus looking for projects that offer technology transfer, or offer licenses. Consultancy firms are also looking for foreign expertise, in the form of partnerships, as Taiwanese consultants have little experience with offshore wind projects yet.

What NTIO does for Dutch companies

In order to receive support from NTIO, a company has to be a Dutch company. NTIO takes inquiries from Dutch companies, and arranges a first point of contact for these companies in the Taiwanese

market. Additionally, it looks up core businesses and partners. These services are available for companies of all sizes. For big parties, usually equivalent partners are sought for cooperation. For companies designing technology, the government agency research institute is an interesting partner.

On the Chinese – Taiwanese situation

Due to political tensions between China and Taiwan, companies might face difficulties operating in both countries. China offers a larger offshore wind market potential, but has large protectionist measures. The Taiwanese market is more open for foreign companies and investments. Companies can choose to operate in China or in Taiwan as a stepping stone to enter the Asian market. Choice of which country to start in is mostly a strategic choice.

How the Danish and German promote exports in Taiwan

The Danish embassies and similar offices offer free market research at initial phases of entering a market. Once initial market access has been concluded, they switch to a paid-for consultancy service, which offers more specific information to companies making use of this service. The Dutch system always offers general promotion. The Danish focus more on the promotion of individual companies, which are charged a fee for these services. Danish companies are in general more inclined to invest in the earlier stages of market development, whereas Dutch companies aim their decision more on cost effective investments, which have a tendency to avoid high risk investments. The Danish approach has proven to be very successful in Taiwan, with Danish companies being involved in 7 of the current zones.

The German approach is more like the Dutch one, where they use their position as a governmental party to stimulate dialogue and offer general promotion services. The German bureau works together with a consultancy branch. After general promotion, companies have the choice to work with this consultancy branch for more customized support and information. The Netherlands does not have such a consultancy branch, Dutch companies arrange their own partnerships with consultants.

xviii. Interview Van Oord

Time and date:	11:00 – 12:15, 02-05-2017
Address:	Schaardijk 211, Rotterdam
Interviewer:	Youri Nijsse

Interviewees

Dirk Katteler – Manager Business Development and Markets at Van Oord
Dolf Elsevier van Griethuysen – Business Development Manager at Van Oord Offshore Wind Projects

Attending

Pim Fischer – Business Development Manager at Ministry of Foreign Affairs of The Netherlands

Summary of Interview

Q: Is Van Oord currently looking at offshore wind projects in countries that they are currently not operating in yet?

A: Through Van Oord's dredging activities they are experienced in operating globally. Current activities are focused on Europe, but there are other interesting markets developing, in which Van Oord is interested in as well.

Q: Some countries have regulations that limit the entry to their markets, such as Local Content Criteria. Does Van Oord face problems entering markets because of these, for example France?

A: France will have abolished their LCR in the third round of their bids. However, some other market barriers possibly still exist. Bretagne and Normandy will probably have their own goals, which might differ from the country's central coordination from Paris.

This phenomenon can be seen in other countries as well. Understandably countries want to see advantages for their own country in these projects, often in the form of local activity. Therefore, they can be hesitant with accepting foreign contractors. A balance has to be sought between the goals of the company and the goals of the country that the project will take place in.

Additionally, there is a risk that as a foreign company, you could be used as a price-breaker for local market parties.

Q: Does this hamper the development of wind-energy in the countries that choose to use these Local Content Criteria?

A: Many of the countries that have these Local Content Criteria don't have the full experience or capacity yet to develop offshore wind energy. These countries also sometimes favour companies from countries that speak the same language. It is however hard to know whether these barriers will be influential in newly developing markets and upcoming projects.

Companies in the sector will have to make their own decisions on whether they want to participate in markets that restrict their access with these barriers.

Q: What kind of restrictions exist in the USA?

A: The USA has the "Jones Act" as a long existing law, which makes it illegal to transport goods between two places in the USA with a non-American vessel. The USA does not have the ships suited for offshore wind farms (yet). This makes logistics there more expensive. Exemptions to the "Jones Act" are however possible. This law has been the topic of much political discussion, and under Trump this law is not likely to change or become less strict.

Additionally, several rounds of permits in the USA are needed for an offshore wind project, which is very time consuming. The BOEM party is an important stakeholder in these matters.

Q: Does Van Oord participate in trade missions? And what does Van Oord expect to gain as a result of the participation in these trade missions?

A: Van Oord does participate in trade missions, and receives information about these through several channels.

A trade mission's main function is that of a first step into the entering a market. After that, a company has to find its own way in these markets. Exhibitions cover approximately the same function.

Q: Are there specific parts of the value chain that Van Oord prefers to export, and is this country dependent?

A: Van Oord is able to do participate in all parts of the value chain of offshore wind, with the exception of the production of the turbines. Van Oord bases its participation in projects on the wishes of its clients.

Q: How does Van Oord see the role of the Dutch government in the entry to new foreign markets? (As a collaborative party, a necessary party, a useful party, not useful?)

A: The role of the Dutch government in the entry of new foreign market is mostly a facilitative function. This is most importantly the building of (local) networks. Another function can be a signalling function for opportunities in these markets. For these activities, local employees on embassies are very valuable.

Q: Is there also a role for the Dutch government in lowering Local Content Criteria, or making Memorandums of Understanding?

A: All of these previously mentioned options help Dutch companies. They especially function as an embedded infrastructure promoting trust in Dutch companies. Visits by the King or the Minister can also be useful. Additionally, ambassadors that actively contact Dutch companies about opportunities abroad are seen as very useful.

Q: So does Van Oord then prefer a Dutch government that takes a more active role, or a more passive role in facilitating companies?

A: That again depends per country. The Dutch government could, and if possible on European level, put as much as possible diplomatic pressure in reducing protectionist measures. Giving examples on how things work (well) in the Netherlands might work as well in opening new markets.

Q: Does Van Oord know of any export-promoting cooperation between foreign governments and companies that are interesting to look at?

A: The German system functions somewhat the same as the Dutch system does. The WAB in Bremen might be an interesting stakeholder. The investments in the Bremen region are an interesting example for governmental industrial policy. Bremerhaven is now the 'blue collar' hub while Hamburg is the 'white collar' hub in Germany for offshore wind, but whether this last fact is a result of governmental activities is not sure.

Denmark has invested in offshore wind energy very early, which is partially due to Danish governmental policy. In the Netherlands, industrial policy is often not used, but could in certain cases have some potential benefits.

Miscellaneous

In the water-branch the Netherland does have a very strong image / branding. Rotterdam is also profiling itself a hub for sustainable energy and offshore wind. Some more coherence for the Dutch sector might be useful to promote more strongly to foreign stakeholders.

Next to that, it might be very useful to try to obtain some companies in the Netherlands that fill the missing links in the supply chain, turbine manufacturers and cable manufacturers (or perhaps a turbine assembly factory). Creating a business environment promoting these companies to establish a factory in the Netherlands should be seen as an investment, as it will most likely pay itself back easily.

In comparison, France and the UK are getting companies to establish local production facilities, by putting demands on projects in these countries. The Netherlands could possibly try to get a factory from one of the bigger companies in the manufacturing part of the offshore wind sector.

Cooperation with turbine manufacturers like Siemens or Vestas is already happening.

Having a strong one-liner for the industry in the Netherlands might work very well in the promotion of the Dutch sector. Showing what the Netherlands can do, but also what they have done.

xix. Interview WindEurope

Time and date:	10:30 – 11:15, 18-07-2017
Method:	Phone
Interviewer:	Youri Nijsse

Interviewee(s)

Tom Remy – Offshore Wind Analyst

Summary interview

General information WindEurope

WindEurope is the European wind sector's overarching organization, that promotes, coordinates and analyses the European wind sector. It offers information about the sector, and organizes events connecting and promoting the sector.

What is the role of national governments in the offshore wind sector?

Governments / states are owners of the sea, and thus can decide on where offshore wind can take place. They play a role as a financer, often in the form of subsidies. They also finance networks in their sectors, and function as a network party themselves, connecting the parties in their sector.

Are there any export promoting instruments or agencies on a European level?

There are no European instruments promoting the export of offshore wind. There are several national export promotion agencies active in Europe. The Commission's Directorate-General for International Cooperation and Development (DG DEVCO) designs European international cooperation, which might touch the export of offshore wind.

Is there any regulation inhibiting or promoting export of offshore wind?

As the European Union has its internal market policy, offshore wind products and services are freely exportable between member states. However, goods aren't readily being shipped around, with the exception of floating wind turbines being transported from Norway to Scotland. Services might have more potential for exports.

Wind is struggling with local content criteria (LCR) in several of its export markets. Onshore wind is for example facing high LCR barriers in Ukraine, Turkey, Brazil and Canada. Attempt to facilitate increase in trade of services have yielded little results.

There have been attempts to liberalize the trade of green goods and services. This plan fell through during COP21, as attending countries couldn't agree on the list of goods to be liberalized. Trade liberalization in general has lost momentum, and is currently mostly addressed in the form of bilateral trade agreements.

Requirements for offshore wind parks are often in the form of required local industrial development, incorporated in the selection criteria of the tender processes. These requirements are technically not Local Requirement Criteria if implemented this way. A.o. France has applied this system in its tenders.

The UK is also considering implementing LCRs. It is currently still under the internal market regime of the EU. Whether the Brexit will impact this decision process is currently unknown.

Which parts of the European offshore wind industry are likely to stay competitive?

All parts of the European industry can potentially stay competitive. Turbines are having an increasingly shorter time of being marketed, as they are rendered obsolete by new generation of larger turbines. This requires the full value chain to constantly keep innovating to keep up with these fast developments. With these quick developments, it is hard to know when components will start getting standardized. Once parts start being standardized, Europe might start losing a competitive edge.

Is it possible for new manufacturers to enter the market in Europe?

The offshore wind market has been consolidating as off lately. Siemen and Gamesa have merged, GE has bought Alstom to become a big player in the European turbine market, and Vestas and Mitsubishi Industries have set up MHI Vestas together. New manufacturers would need to be backed by a strong industrial partner. There might be a possibility that one of the Chinese manufacturers will enter the European market.

Which changes or improvements in the sector does WindEurope really want to see happen?

Member states should factor in offshore wind when making future plans for their industries. Current plan of member states are often relatively short term. The industry would benefit if member states

could start forming longer-term plans, guaranteeing industrial growth of offshore wind up to 2030. This will require proper planning processes, design of effective auctions, and effective support mechanisms.

Coordination between European countries is currently lacking in the offshore wind market. WindEurope would like to see countries coordinate their tenders, which is currently not happening yet.

Will the Brexit have an impact on the development of offshore wind?

The Brexit is not expected to have a big impact. Even after the Brexit, the UK has signed agreements on cooperation in the North Sea. Coordination and cross-connections between countries are not an EU thing, but intranational.

xx. Interview Wind Minds

Time and date: 09:30 – 10:30, 15-06-2017
Method: Phone
Interviewer: Youri Nijsse

Interviewees

Hans Rijntalder – Co Owner Wind Minds

Summary of Interview

General information Wind Minds

Wind Minds is an engineering and consultancy company that works in the offshore wind sector. It is active in several European and Asian markets.

Are both engineering and consultancy services exportable, or does Wind Minds find specific problems with the export of one of its services?

In general, both engineering and consultancy services are exportable. For some of the services, cooperation with local partner is required.

Is Wind Minds not operating in some of the current / upcoming offshore wind markets? And why?

Wind Minds is currently not operating in France and Poland. The decision to not operate in these markets was a strategic choice. One of the reasons to not operate in certain other markets is the high risk of corruption. The added value of the front-end of a project, which is where consultancy and engineering practices usually take place, is more present at upcoming markets.

Does Wind Minds also face difficulties operating both in China and Taiwan?

It can be difficult operating in both markets, due to the political tensions between these countries. Doing business in China has a higher risk of ideas being copied.

Generally, local parties in Asia take care of the engineering. Wind Minds usually works in cooperation with these parties.

Does Wind Minds work together with the Dutch government when exporting its services?

Wind Minds works together with embassies and HHWE. It shares experiences and contacts, which can be useful when entering new markets. The degree in which the support of an embassy is useful and available strongly depends on the people working in the embassy. Contacts with local trade organizations can be very useful when accessing new markets.

Indonesia is an interesting future market, as it has a high technical potential for offshore wind. RVO has performed an explorative market investigation in this market recently.

Does Wind Minds see differences between the Dutch approach to promoting export of its offshore wind sector and other country's approaches?

At exhibitions, the Danish pavilion is usually larger and more professional looking than the Dutch pavilion. As Danish stakeholders / companies are growing, they more often have their own stands at these exhibitions, not participating in the national pavilion.

Does Wind Minds see possible point of improvement for the Dutch sector?

The Dutch sector is very fragmented, but cooperates quite closely as well. A merger between NWEA and HHWE could be a logical step to make the sector less fragmented.

Appendix 2 - Global opportunities and markets

While offshore wind is currently still largely situated in Europe, it has the potential to be implemented in a range of countries outside of Europe as well (GWEC, 2017). There is currently only a limited amount of countries that are directly involved in offshore wind, but many are planning their first parks, or are identified to have a large growth potential in the long term. In this appendix, the countries which show potential for offshore wind or are already developing offshore wind are discussed. The appendix will discuss their current and future capacity, strengths of the industry and opportunities for the Dutch industry. Germany and Denmark are not discussed in the appendix, as an elaborate description of their sectors is found throughout chapter two and the case studies in chapter five. Note that the data of this Appendix regards the offshore wind situation of August 2017, later developments are not taking into account.

Countries currently active in offshore wind

There are six countries that currently have commercial-scale offshore wind parks with a total of over 250 MW of capacity: Belgium, China, Denmark, Germany, the Netherlands and the UK. Of these countries, the Netherlands, Denmark and Germany will be expanded on in the case studies later in this report. Additionally, there are five countries that show a high potential for offshore wind in the short- to medium term (2020-2025): France, Japan, Taiwan, South-Korea and the USA.

The countries not discussed in the case studies are shortly expanded on below. This chapter will look at their current installed capacity, and the predictions of their capacity in the 2017 – 2030 period. Projects in the period 2017 – 2021 generally are in various stages of construction, and can be predicted rather precisely. Prediction after 2021 are harder to make and have a larger margin of error.

Furthermore, the country's strengths of their domestic industry, openness for foreign companies, technical, legal or cultural barriers for market entry, and opportunities for Dutch firms are shortly discussed when applicable.

Belgium

As of July 2017, Belgium has 712 MW of installed offshore wind capacity (WindEurope, 2017), and has consented another 914 MW of capacity until 2021 (Dickson, 2017), with plans to increase total capacity to 2.25 GW (Pearson Education, 2016; PWC, 2017b). Plans after 2021 are uncertain. The country has a relatively short coastline (~65 km), and a sea area (territory plus economic exclusive zone) of ~3600 km^2, which is only 0.5 percent of the total area of the North-Sea. Additionally, many important trade routes run through this sea, rendering them unsuitable for offshore wind development. This limits the long-term prospects for offshore wind expansion in Belgium.

Belgium is currently discussing whether it should switch to a tender system or stick with its current support mechanism. This discussion is causing a large amount of uncertainty in the market and could delay the roll-out of offshore wind parks in the near future (VWEA, 2016).

Belgium's offshore wind industry is specialized in the installation and exploitation of offshore wind parks. It hosts two of the world four largest dredging companies (DEME and Jan de Nul), which are active in the offshore wind energy, and has several other companies that provide to the wind energy sector. The Belgian market is open for international companies to participate in the construction of their wind parks, and several foreign companies have aided in the construction of their previous parks (G. Lewis, 2016).

China

As of January 2017, China has 1627 MW of installed offshore wind capacity (GWEC, 2017), and is planning to reach 5 GW of installed capacity in 2020. This target has been adjusted in the last few years from 30 GW in 2020 (Renewablesnow.com, 2015), to 10 GW in 2020 (Reuters, 2016) to the more realistic number of 5 GW (InnovatieLink, 2017). There is still much uncertainty on the developments of the market, but parties in the Chinese market indicate that it is likely that China will reach its 5 GW targets before 2020 (Bloomberg, 2017). A recent report indicates an estimated 6.8 GW of installed

capacity in 2021 (PWC, 2017b). The Chinese government is seeing this development of the first 5 GW as a way to initiate and develop the technology, "paving the way for a massive surge in installations after 2020" (Bloomberg, 2017). While predictions vary widely, a strong growth of the Chinese offshore sector is expected. Capacity in China is expected to exceed 10 GW after 2021, and be up to 40 GW or higher in 2030 (Bloomberg New Energy Finance, 2017).

Despite the large growth in the market, China continues to be a market which is hard to access for foreign firms. The Chinese market is dominated by domestic players, and non-domestic players are required to work together with local partners that own at least half of the joint projects (PWC, 2017b). The Chinese government has a strong preference to work together with domestic players (Appendix 1, ix). Additionally, entry costs to the market, in the form of finding partner firms, establishing local offices and language and cultural barriers, are extremely high. These points form a burden especially for SMEs (Appendix 1, xiii). Technology-based firms looking for opportunities abroad face problems with China's non-acceptance of European patent law, which causes unwanted technology transfers (Appendix 1, x). Governments can play an important role in connecting Chinese and domestic companies and negotiating forms of cooperation between these parties.

For Dutch companies interested in installing offshore turbines in Chinese waters technical difficulties exist. China's current offshore wind farms are mostly placed in intertidal or nearshore waters with low water depths. The ships of most Dutch installation companies are unable to operate in these water-depths. Once China will start developing offshore parks in deeper waters (expected to happen between 2020 and 2025), possibilities for Dutch installation companies might present itself (Appendix 7, v).

The UK

As of January 2017, The United Kingdom has 5.156 MW of installed capacity and has consented another ~12 GW of projects. This makes it the country with the highest current capacity, and likely to have the highest capacity of installed offshore wind globally in the coming ten years (GWEC, 2017; WindEurope, 2017). It currently has 4564 MW of offshore wind under construction (which is likely to be commissioned by 2021), which would raise its offshore total capacity to 9718 MW in 2021. Additionally, it has 10.227 MW already tendered, and another 11.014 MW planned. While some of the tendered plots have not seen much progress as of late, it is likely that the UK will have between 20 and 25 GW of installed capacity by 2030 (EWEA, 2015; PWC, 2017b).

The UK is one of the leading countries in research and development in the offshore wind industry. Much of this research and development is related to the Offshore Renewable Energy Catapult program. The Dutch TNO and the German Fraunhofer research organizations cooperate with the English Catapult project, and innovation missions between the Dutch and English industry have taken place in 2015 (RVO, 2015). Further opportunities for collaboration between Dutch and English knowledge institutions might be possible.

The UK currently has relatively few large domestic companies, compared to the Netherlands, Germany and Denmark, but it is starting to catch up. The UK industry mainly has companies that install turbines and foundations and hosts some active TSOs and energy companies active in offshore wind (Westra & Agterberg, 2016). While it has no traditional domestic supply chain, the UK is looking to establish a local supply chain supplying at least 50 percent of the CAPEX of tier 1 suppliers (RVO, 2015). Manufacturers like Siemens-Gamesa and MHI-Vestas have set up local manufacturing facilities to comply with these wishes (REVE, 2017). While the UK market will stay open for innovative technologies and solutions, it is expected to be increasingly hard to access for companies offering goods or services that can be supplied by UK's domestic companies (RVO, 2015).

Several interviewees have indicated that the UK's exit from the European Union (the Brexit) is unlikely to have a large impact on the development of offshore wind in the UK. Changes in market access are not likely, but the Brexit does cause some market uncertainty (Appendix 1, xix).

France

France current has no installed offshore wind capacity but shows great potential for future growth. It has currently tendered 3.540 MW of offshore wind and is planning to tender more capacity. Regulatory uncertainty is high in France, but with the acceptance of the new energy law in 2015, France is bound to double its energy generated by renewable energy sources by 2030. France has announced to tender or construct another 7 GW towards this goal before 2030, but formal consent to these wind farms are still missing (Dickson, 2017; PWC, 2017b).

As France has been slow in the adaptation of offshore wind, its industry is in a poor position to compete with foreign companies. Because of this, France has chosen to focus much of its investments in forms of marine energy that are less developed, like algae, tidal energy, but also floating wind turbines (RVO, 2015).

While France is part of the European Union and its internal market, Dutch companies find it difficult to enter the French market (Appendix 1, xv). Central decisions are taken in Paris, but coastal regions want to profit from developments in offshore wind as well and impose additional criteria for the development of local industries. Forms of local content criteria were present at the first tender rounds of offshore wind parks in France (called 'Patriotisme écologique'), but new tender rounds have promised to not impose these criteria (Appendix 1, xviii). As a result of these criteria, the companies managing and manufacturing the wind farms of the first tender rounds are mainly French, or have set up French factories (RVO, 2015).

The French offshore wind market does offer opportunities for Dutch companies, especially in the form of installation and O&M solutions. As the Dutch companies operating in installation have their biggest competitors located in Belgium, theoretically they might be at a disadvantage due to larger language and cultural barriers (Appendix 1, xviii).

Taiwan

Taiwan currently has two test turbines online (8 MW total), and another ~230 MW under construction (4COffshore, n.d.-b). The Taiwanese government has identified 36 zones off their coast for the construction of offshore wind farms, with 23 of these sites being open for bids or already tendered (Appendix 1, xvii). These zones amount to a technical potential of ~23 GW (Hu, 2017). The Taiwanese government has a 500 MW goal for offshore wind in 2020, and 3 GW in 2025.

Taiwan is very open for international companies to participate in their offshore wind projects, and several Danish and Dutch companies have already participated in the currently installed demonstration projects and bids for the tenders (Appendix 1, xvii). The Taiwanese government does intend to build up a local industry, and companies operating in Taiwan have to usually do this in the shape of a joint-tender or partnership with local companies. Technology transfer measures are also often mandatory (Hu, 2017). Taiwanese companies have little experience with consultancy and installation of turbines and are looking for companies from specifically Europe to work together (Appendix 1, xvii).

Taiwan can be seen as a stepping stone for companies to enter the Asian market. Its geographical location, promising domestic offshore wind potential and open economy make it suited as a first base of operations (Appendix 1, xvii). Due to political tensions between Taiwan and China, some companies might face issues operating in both countries (Appendix 1, xiv & xvii). The Taiwanese government prefers not to use Chinese components in their installations.

Technically, the Taiwanese seas and winds are well-suited for offshore wind. In the future, floating wind concepts will be necessary for further expansion of the market. The Taiwanese west coast, where most developments in offshore wind are taking place, is also prone to seismic activity and typhoons, which puts extra technical specification on the turbines that have to be developed (RVO, 2015).

The United States of America

The USA currently has only 30 MW of offshore wind installed (at Block Island) (GWEC, 2017), but the market is expected to pick up in the coming year (Appendix 1, xiii). The USA has no federal-level

goals for offshore wind, but several states bordering the coast or large lakes have shown interest in offshore wind, with some of them setting formal goals for the development of significant volumes of offshore wind. Developments are primarily taking place on the east coast, but California, Oregon and Hawaii are also evaluating opportunities for offshore wind (Bureau of Ocean Energy Management, n.d.). As of May 2016, there were 11 active commercial leases in the Atlantic Ocean which have the potential to support the deployment of ~ 14.6 GW of offshore wind (U.S Department of Energy & U.S. Department of Interior, 2016).

Most notably, Massachusetts has approved regulation which demands 1.6 GW of offshore wind by 2027, with further areas identified for offshore wind with a total capacity of 4 – 5 GW (Serreze, 2017). Maryland has awarded offshore renewable energy credits to offshore wind farms with a capacity of 368 MW, to be commissioned between 2020 and 2022 (AWEA, 2017). The State of New York is forming a master plan for the deployment of 2.4 GW of offshore wind before 2030 (State of New York, 2016).

However, developments in the USA have been slow. The bureaucratic process around the approval of offshore wind farms is extremely lengthy and can take up to 10 years. With the installation of the first offshore wind farms the pace of installation is expected to pick up (Appendix 1, xiii), but predictions of growth numbers vary (from 10 GW to 36 GW in 2030) (U.S Department of Energy & U.S. Department of Interior, 2016).

The USA market is relatively open to foreign players, but the regulation varies per state. Generally, the manufactory of components has to be performed on American soil, but foreign companies are allowed to build their own factories in America. Non-American project developers are welcome to bid on offshore wind parks, with DONG being the most successful one in gaining concessions for parks so far (4COffshore, n.d.-b).

A large legislative barrier present in the USA is the Jones Act, which requires that all goods transported between American 'ports' have to be transported on US. ships, owned by US. parties, manned by US. citizens build in the USA. A wind turbine being installed in US waters counts as an established 'port', and as such European ships cannot transport and install wind turbines with the same ship. U.S. support vessels have to transport the turbines if European ships want to install these turbines. This system adds large logistical costs and makes companies which use ships that are unsuited to work with support vessels (i.e. some of the Dutch installation companies) unable to operate on U.S. wind farms. Dutch ship designers and builders can use this as an opportunity to build ships, or sell designs of ships, to the USA market. However, with large amounts of uncertainty in the growth of the USA offshore wind market, companies so far have chosen not to build ships there (Appendix 1, ii & xvii & 7, iv & v).

Technically, many of the USA's waters on the east coast are relatively deep, and exploitation of offshore wind will depend on the development of floating offshore wind technology. Tropical storms and hurricanes frequent the east coast, which will require technical adaptations to deal with extreme weather (U.S Department of Energy & U.S. Department of Interior, 2016).

South-Korea

South-Korea currently has 35 MW of offshore wind installed, in the form of two demonstration projects. It is planning to install a total of 2.5 GW of offshore wind, in three phases. The first phase of demonstration projects has already started and will continue with the commissioning of a 97 MW offshore wind park in 2018 (Offshorewind.biz, 2017). The second phase of the offshore wind plan is expected to install another 400 MW before the end of 2022 (GWEC, 2017). The last phase of the plan is to install a 2 GW farm, using the knowledge gained in the first two phases of the project (GWEC, 2017). While no formal concessions for the last two phases have been made, the project is expected to be completed before 2030 (GWEC, 2017). Regulatory uncertainty is high in Korea, and external factors like low oil prices have lowered the country's priority for renewable developments (RVO, 2015).

South-Korea is a relatively closed market, which is focusing on the development of its own supply-chain in offshore wind products. As it has little experience with onshore wind, and even less with offshore wind, companies in South-Korea are interested in strategic partnerships with companies that

do have the experience and knowledge they require (RVO, 2015). Development of offshore wind farms in Korea currently takes shape in the form of public-private partnerships, where the Korea Electric Power Corporation will be the main project developer. Projects developers will therefore have fewer opportunities in the Korean offshore wind sector.

South-Korea's domestic offshore wind potential is relatively low (due to low wind speeds and geographical limitations), but the country is interested in developing itself to an exporter of offshore wind products and services (RVO, 2015). While this presents possibilities for strategic partnerships with European companies, South-Korea could become a competitor of European companies in the long run (2025 and later). South-Korea has a strong maritime industry, which offers opportunities for cooperation but also potential conflicts in the form of competition for the Dutch offshore installation industry (RVO, 2015).

Japan

By the end of 2016, Japan had 60 MW of offshore wind capacity installed (GWEC, 2017). Japan has a large number of projects in the pipeline, for a total of 2.5 GW of capacity, in different stages of development. The first of these farms (60 MW) is likely to be commissioned in 2018. The Japanese Wind Energy Association, together with the Japanese government, has made a roadmap which envisions 700 MW of offshore wind installed in Japan by 2020, and 10 GW in 2030 of which 4 GW will be floating offshore wind (GWEC, 2017). However, heavy regulatory and grid barriers are currently present which will have to be removed for a successful growth of offshore wind in Japan (RVO, 2015).

The potential of offshore wind in Japan is high. The country has a long coast-line with favourable wind conditions and a large part of the Japanese population lives close to the sea. After the Fukushima nuclear disaster, the country is phasing out much of its nuclear power generation, and becoming more dependent on expensive imported fossil fuels (Matanle, 2015). Offshore wind can offer a cheaper alternative for energy generation.

Japan has limited experience with offshore wind, but a large industry of heavy technology companies which are very interested in developing offshore wind farms. For this, they are actively looking for partnerships with European companies. As the Japanese market is slow to develop, some Japanese companies (most notably Mitsubishi) have started to invest in European projects and companies (RVO, 2015).

European companies are able to set up their own offices in Japan, but cultural and language barriers are high. As such, most companies choose to work together with Japanese companies in joint-ventures or other forms of partnerships (Appendix 1, vi).

Other countries

Apart from the countries discussed before, there are some other countries that show potential for offshore wind, but have high degrees of uncertainty, limited growth potential or are not expected to develop offshore wind in the next 10 years. These are shortly mentioned below.

The *Australian* government has recently announced that it is investigating the possibilities for a 2 GW offshore wind park off the coast of Victoria. If preliminary studies prove successful, and the projects progress as expected, the offshore wind farm could be operational by 2025 (Corsetti, 2017; Davey, 2017).

Estonia is planning to construct two offshore wind parks with a total capacity of 1.4 to 1.7 GW. The projects are currently in the final stages of environmental impact analysis approval and are expected to be commissioned around 2020 (OffshoreWIND.biz, 2017a; Renewablesnow.com, 2017).

Finland will have its first offshore wind park commissioned before the end of 2017. The relatively small park (40 MW) serves as a demonstration of offshore wind parks in icy conditions (Greiner, 2016). Conditions for offshore wind are promising at Finish shores, but developments are uncertain. Some articles state a 2 GW pipeline up to 2030 (Steel, 2016), but no official plans have been found in this study.

India is exploring the opportunities for offshore wind with its LiDAR program, which is expected to install some test installations in 2017. These test installations will be used to draw up a road map towards offshore and a development plan up to 2032. Further development is uncertain (GWEC, 2017; OffshoreWIND.biz, 2017b).

Poland is planning on installing a total of 6 GW of offshore wind before 2030. The environmental permits required for the installation of the first offshore wind farms have been granted to companies interesting in constructing the farms (McKinsey&Company, 2016). However, the Polish renewable energy sector is facing an oversupply of green certificates, making investments in green energy less lucrative. This has largely halted the growth of the Polish onshore wind sector and creates large uncertainties in the development of its offshore wind sector (Polish Wind Energy Association, 2015).

In *Russia,* the Chinese Simonec has signed an agreement with the Russian region of Karelia, about the construction the first offshore wind farm in Russia. This farm will be a 60 MW offshore wind farm in the White Sea, which could be operational by 2020 (Gerden, 2017; PWC, 2017b).

Lastly, small island nations like *Mauritius* are evaluating the possibilities for offshore wind (Mauritius Research Council, 2017). As these islands are typically reliant on expensive diesel-generated energy, fed by imported fuels, small-scale offshore wind development might take shape after 2020, but the author is not aware of any definite plans.

Countries with small offshore wind capacities that are not listed are Ireland, Norway, Portugal, Spain and Sweden, since no clear information about any significant growth of offshore wind in these countries was found.

Appendix 3 – Links between interviews and parts of the report

In this appendix, the link between the interviews and various parts of the study is presented. An x in Figure 29 means that the interview has contributed to the study's results in this part of the report.

		Atradius	Damen	Danish Energy Agency	Danish Wind Energy Association	DNV GL	Dutch Ministry of Foreign Affairs (Japan)	Energinet	GROW / TKI-WOZ	HHWE	Lagerwey	NWEA	OffshoreEnergy.dk	Roland Berger	Siemens-Gamesa	State of Green	TenneT	The Netherlands Trade and Invest Office	Van Oord	Wind Minds	WindEurope
Governmental roles	Executive role	x		x			x	x													
	Regulative role	x	x	x	x			x		x	x	x					x		x		x
	Networking role	x	x		x		x		x	x	x	x	x	x		x		x	x	x	x
	Financial role	x		x			x		x	x	x	x	x	x	x	x	x	x			
Other parts study	Value chain chapter two		x			x		x	x	x	x	x	x	x	x		x		x	x	x
	Case Netherlands	x	x			x	x		x	x	x	x		x	x		x	x	x	x	
	Case Denmark	x		x	x		x	x				x	x	x		x		x			
	Case Germany	x				x	x					x		x	x		x	x			

Figure 29: Links between interviews and parts of the study

Appendix 4 – Full case studies

In this Appendix, the extensive versions of the case studies are presented which form the base of the case studies presented in chapter five in the main report. An overview of the findings of the case studies in a table can be found in Appendix 6.1, an overview of the ratings and criterium used for rating the prevalence of governmental roles can be found in Appendix 6.5 and an overview of all the ratings of the prevalence of governmental roles in the countries can be found in Appendix 6.6.

4.1 Case: The Netherlands

The Netherlands is a country in the north-west of Europe with a population of ~17 mln. It is the world's 18th largest economy (International Monetary Fund, 2017), and is the world's 8th largest export economy (OEC, n.d.-c).

The Dutch offshore wind industry has a market share of around 25 percent of the European market (measured in industrial revenue, not power generated). It employed over 2000 FTEs in 2014 and is expected to employ 10.000 FTEs by 2020 (Bais, 2015), which is expected to further increase after 2020 with future growth in the industry (NWEA, SER Energieakkoord, 2016). Of the 2000 FTEs, 600 to 800 FTEs are working on national projects, the rest is employed in international projects (Jager et al., 2014). The Dutch offshore wind industry had a turn-over of approximate €1 bln in 2014, and this number is expected to grow to €6 bln in 2020 (Jager et al., 2014; NWEA, SER Energieakkoord, 2016).

4.1.1 Domestic market

History in offshore wind

The Netherlands has been operating small-scale offshore wind parks since 1994, with the first installation being the 2 MW Lely wind park (which has since been decommissioned) (Nuon, 2016). It has since installed a five more offshore wind farms (see Table 9). This brings the Dutch offshore wind capacity to just under 1 GW (4COffshore, n.d.-b).

Domestic market developments

In 2013, over 40 organizations in the private and public sector agreed to the Dutch Energy Agreement for Sustainable Growth, which aims amongst others to increase the share of renewable energy in the Dutch economy to at least 14 percent in 2020, and 16 percent in 2023. An important pillar of this agreement is the expansion of offshore wind energy (Sociaal-Economische Raad, 2013b). The plans to expand offshore wind energy capacity have been presented in the Offshore Wind Energy Law (Kamp, 2017a), and a roadmap for the expansion of offshore wind has been published in the document 'Offshore wind energy in the Netherlands' (Netherlands Enterprise Agency, 2015a). The roadmap describes yearly tenders for the grants of the assigned parcels in 2015 to 2019, which will add 700 MW of wind capacity per year, to be commissioned within 4 years of the tender procedure (Netherlands Enterprise Agency, 2015a).

Year	Name	Capacity (MW)
1994	Lely (decommissioned)	2
1996	Irene Vorrink	17
2008	Egmond aan Zee	108
2008	Princes Amalia	120
2015	Eneco Luchterduinen	129
2017	Gemini	600
	Total	974

Table 9: Offshore wind farms in the Netherlands

In 2015 and 2016, tenders of the Borssele parcels (2 x 700 MW) have been held, which have led to large cost reductions in offshore wind (Roland Berger, 2016). Following recent developments in Germany, where tenders have led to subsidy-free bids, the Minister of Economic Affairs has announced a preliminary tender round for the 2017 tender for parties willing to place a subsidy-free bid (Kamp, 2017).

Additionally, in the Dutch province of Frisia, a group of citizens working together with the province are planning an offshore wind park in the Dutch Ijsselmeer, a large lake in the Netherlands, which is expected to be operational in 2020/2021, with a capacity of 320 MW (Windpark Fryslân, n.d.).

The Dutch Ministry of Economic Affairs is currently working on the next version of the roadmap for the tenders in 2020 to 2027 (Appendix 7, ii). These tenders are expected to tender 1 to 2 GW of offshore capacity per year[5]. The decision on the exact amount of new yearly added capacity between 2023 and 2030 will be made by the Dutch Minister of Economic Affairs. These plans are expected to be published after negotiations regarding the formation of a new Dutch parliament have finished, following the Dutch parliamentary elections in early 2017.

The Netherlands currently has the fourth most installed capacity of all European countries, after Denmark, Germany and the UK (and fifth most of the world, including China) (GWEC, 2017). With its current plans, it is expected to become the third largest European market by 2023, exceeding Denmark. The Netherlands is expected to have a total installed capacity of 11 to 18 GW of offshore wind in 2030, dependent on the outcomes of the new roadmap for offshore wind (Dickson, 2017).

4.1.2 Organization of the Dutch sector

The Dutch offshore wind sector comprises of a wide field of actors, with varying responsibilities. Figure 30 gives a simplified representation of the sector and the relations between its actors. Key actors are shortly expanded on below.

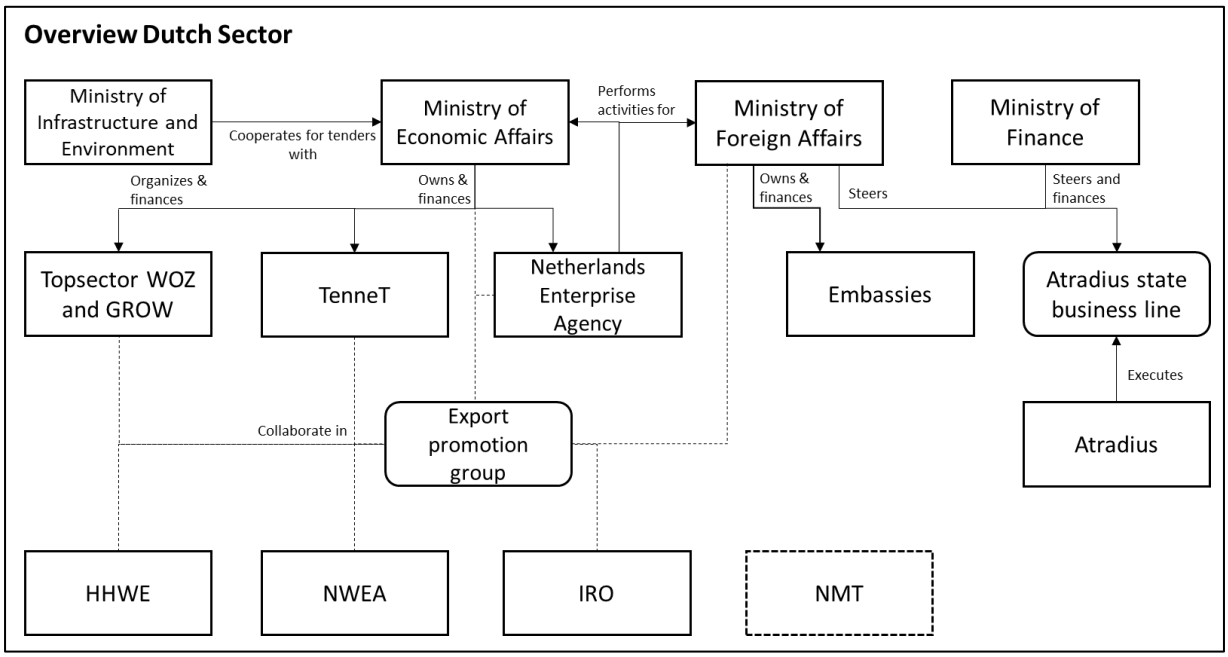


Figure 30: Overview of the Dutch sector, the most important actors and their relations

Governmental parties

On a governmental level, the two main responsible ministries involved in offshore wind, its domestic rollout and its exports are the Ministry of Economic Affairs, and the Ministry of Foreign Affairs (Appendix 7, ii). Additionally, the Ministry of Finance shares responsibility with the Ministry of Foreign Affairs on export promoting financial products supplied by Atradius' Dutch State Business line (Appendix 1, i), and the Ministry of Infrastructure and Environment cooperates with the Ministry of Economic Affairs in the creation of tender procedures and usage of marine areas in the Netherlands (Ministerie van Infrastructuur en Milieu, 2013).

The Dutch Ministry of Economic Affairs is responsible for the energy policy of the Netherlands, which it bases on the Dutch Energy Agreement on Sustainable Growth (Sociaal-Economische Raad, 2013a). This includes the plans for the offshore wind part of the Dutch energy system. The Ministry of Economic Affairs is responsible for the development of the roadmap for the rollout of new tenders

[5] As presented during the Borssele offshore wind tender workshop on 18-04-2017 by the Netherlands Enterprise Agency.

and their subsidy schemes, including demonstration parcels. The Ministry is also responsible for the innovation policy of the Netherlands, for which it has several programs and subsidies available (Appendix 7, ii). To stimulate innovation in specific sectors that the Dutch economy excels in, it has developed the 'Topsector' program (discussed later in this chapter). This policy includes the Topsector Offshore Wind (TKI-WOZ) and its innovation program GROW (TKI Wind op Zee, n.d.). The Ministry of Economic Affairs also subsidizes TenneT to perform its function in the connection of offshore wind parks as the Dutch Transmission System Operator (Appendix 1, xvi).

The Dutch Ministry of Foreign affairs is responsible for the economic diplomacy of the Netherlands, which includes responsibility for the Dutch embassies abroad (Rijksoverheid, n.d.). The Ministry of Foreign Affairs stimulates Dutch companies to export their services and goods. For this, it has subsidies available, mainly in the form of the Partners for International Business program (Netherlands Enterprise Agency, n.d.-c). Embassies offer a range of services for companies that want support with exporting, and The Ministry of Foreign Affairs is active in the organization of trade missions (Barneveld van, 2014).

Both the Ministry of Economic Affairs and the Ministry of Foreign Affairs cooperate closely with the Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland, (RVO)), which is part of the Ministry of Economic Affairs. This governmental agency is, in the offshore wind sector, mainly responsible for the execution of the policy formed by the ministry of Economic Affairs and Foreign Affairs (Appendix 7, ii). For the Ministry of Economic Affairs, it performs and outsources the preliminary research on the parcels for offshore wind that are selected by Ministry of Economic Affairs. For Ministry of Foreign Affairs, it is active in the organization of trade missions and incoming delegations. RVO is responsible for the attribution of the subsidies to parties in the sector and plays an important role in the communication between the government and the sector (Nederland, n.d.).

Semi-government

TenneT is the Dutch Transmission System Operator (TSO) and is responsible for the electricity grid connection of the offshore wind projects wind parks in the Netherlands. Regarding offshore wind energy, it is responsible for making a connection platform at each wind site, connecting this platform to the land-based TenneT network, and balancing the corresponding loads. The jurisdiction of this responsibility is based on the Dutch 'Elektriciteitswet' (revised in 2016 to include details on offshore wind) (Appendix 1, xvi). The tasks related to this responsibility are delineated in the 'Ontwikkelkader Windenergie op Zee (2016)' (Rijksoverheid, 2016). TenneT is a state-owned company, owned by the Dutch Ministry of Economic Affairs. TenneT hosts commercial activities, but none are related to offshore wind farms (TenneT, n.d.-c).

Topsector program

The Dutch government's main method to stimulate research and development in the offshore wind sector is through its topsector program. The topsector program connects science, industry, NGOs and government in nine sectors in which the Dutch industry excels (Rijksdienst van Ondernemend Nederland, n.d.). These sectors have subsectors, and Offshore Wind (In Dutch 'Wind op Zee', 'WOZ') is one of the five subsectors of topsector Energy (TKI Wind op Zee, n.d.). The topsector 'Energy' is managed by a team consisting of a representative of the industry, academic world, a senior governmental official and a representative from the SMEs active in the sector (Topsector Energie, n.d.-b).

Non-governmental organizations

In the Dutch offshore wind sector, there are three more organizations which play an important role in offshore wind in the Netherlands; The Netherlands Wind Energy Association (NWEA), Holland Home of Wind Energy (HHWE) and The Association of Dutch Suppliers in the Oil and Gas Industry and Offshore Renewable Industry (IRO). These organizations work together in an offshore wind export group, joined by the Ministries, RVO and The Netherlands Maritime Technology (Appendix 1, ix & xii).

The Netherlands Wind Energy Association is the Dutch wind sector's trade organization. It represents the interests of its 300+ members, which are stakeholders in the sector, and lobbies towards the government to see these interests being considered when policy is formed. Additionally, it plays a networking role for its members and has several working groups working towards specific goals in the sector, of which one is focused on exports. It is active for both the onshore and offshore wind companies. It cooperates with other trade organizations, mainly through the European organization WindEurope (Appendix 1, xii). Its export activities are mainly focused on established markets (Appendix 1, ix).

Holland Home of Wind Energy is an export association focused on (primarily offshore) wind products and services. It aims to facilitate its 36 members in exporting their goods and services to markets which are difficult to enter. It does so by organizing incoming and outgoing trade missions and by facilitating contacts with relevant foreign organizations and companies. Its services are also available for non-members, at a higher fee. HHWE makes use of the Partners for International Business subsidies to organize some of these trade missions (Appendix 1, ix).

The Association of Dutch Suppliers in the Oil and Gas Industry and Offshore Renewable Industry (IRO) is the Dutch trade organization which represents the interest of 450+ companies active in the offshore industry. Originally focused on oil and gas, it has recently switched its focus to also contain offshore renewable, with the emphasis on offshore wind. IRO organizes trade missions, pavilions at exhibitions, MOUs with relevant partners and aids members that want to export their goods (IRO, n.d.). Its export activities are mostly focused on mature markets (Appendix 1, ix).

Other organizations

There are some other parties that are in a lesser amount relevant for the Dutch offshore wind industry and are shortly discussed below.

The Netherlands Maritime Technology (NMT) is the trade organization of the Dutch maritime industry, which also operates in offshore wind (NMT, n.d.). The organization works together with the other trade organizations in the Dutch export promotion group.

The Netherlands Foreign Investment Agency, which is an operational part of the Dutch Ministry of Economic Affairs, attracts foreign investments to the Netherlands. It can play a role in attracting companies operating in offshore wind to the Netherlands, filling up gaps in the Dutch value chain (Netherlands Foreign Investment Agency, 2017).

Topsector 'Maritieme Technologie' and Topsector Gas work together with Topsector 'Wind op Zee' on offshore wind activities and research projects (TKI Energie, n.d.-b). Topsector 'Maritieme Technologie' is coordinated by NMT (Krikke, n.d.).

Northern Netherlands Offshore Wind is the offshore wind trade organization for the northern part of the Netherlands and the Noord-Holland province. It offers promotion and networking services for the 80 companies that are members of the organization (NNOW, n.d.).

4.1.3 Dutch government's roles in export process

With the Dutch sector and its actors introduced, the next part of the chapter will look into the governmental roles in the different stages of the export process. The different stages of the export process are expanded on separately. Some stages show some overlap in the instruments as some instruments are applicable for several stages. In that case, these instruments are mentioned several times in their respective applicable stages. In the text indicators in *italics* are placed to indicate which governmental role is identified. At the end of each export stage, the prevalence of the governmental roles is shortly summarized and presented in *italics*.

At the end of the chapter, Figure 31 will show the instruments of the different roles inserted in the framework, and Figure 32 will show the level of prevalence of the governmental roles in the case. A table of the ratings and motivation behind giving that specific rating is also presented in Appendix 6.5,

an overview of the ratings is presented at the end of the case, and an overview of the ratings of all cases combined is found in Appendix 6.6.

Research and development

Research and development activities in the Netherlands are generally not executed by governmental parties. An exception to this is research and development activities performed by TenneT. TenneT performs research and development activities on parts of their offshore grid connection activities (*executive role)*. It does so by developing and testing several cable- and cooling concepts internally (TenneT, n.d.-b), and by cooperating with other TSOs in the European projects 'Project Migrate' (on grid stability and security) and 'PROMOTioN' (on HVDC interconnections) (TenneT, n.d.-e). The projects that TenneT executes are usually in cooperation with consultancy firms. These consultancy firms perform parts of the research or offer second opinions on design choices made by TenneT (Appendix 1, xvi).

The Dutch government additionally has an internal team in the Ministry of Economic Affairs that develops the plans and legislative frameworks for the roll-out of offshore wind parks and tenders (*executive role)* (Appendix 7, ii). While these plans and frameworks are not developed as a commercial good or service, they do have value for the Dutch government as leverage during negotiating with other governments. The knowledge can be used to expand the network with other policymakers, connecting to offshore wind sectors abroad and boost the image of the Netherlands as an innovative offshore wind country, which is expanded on under market entry preparation.

Through its innovation attaché network, the Dutch government connects Dutch companies performing research and development activities with foreign potential partners (*networking role)*.

To stimulate research, development and testing of offshore wind products and services, the Dutch government has founded the Topsector Wind op Zee (WOZ) (Topsector Energie, n.d.-a) (*networking role)*. Next to financial support to innovation, this Topsector also connects companies that are interested to work together in the development of innovations. In its main research program, GROW, the Topsector WOZ aims to find parties in each part of the value chain of offshore wind. By bringing these parties together, and stimulating them to work together, innovations mainly aimed at the reduction of costs of offshore wind are realized (Zuijlen, 2016a).

The Dutch government has a range of financial incentives available for companies and organizations in its sector which stimulate research and development in the offshore wind sector. The main support mechanisms for the commercialization of the technology are offered in cooperation with the Topsector Energy. The topsector Energy has a yearly budget of €100 mln (*financing role)*. Of this budget, €4.7 mln (in 2017) goes directly to projects of WOZ, €1 mln is allocated to cooperation between the TKI-Gas and TKI-WOZ, and other forms of subsidy are open to all Energy related topsectors, including Offshore Wind. The TKI-WOZ budget is for R&D projects in offshore wind energy, aimed at the development of technology with lower readiness levels. This subsidy is aimed at projects that reduce the cost-price of offshore wind technology, and is not available for fundamental research (TKI Wind op Zee, 2017).

For the stimulation of research and development the Dutch government finances several institutions. Three of the most relevant institution sponsored for research in offshore wind energy are NWO, ECN and TNO (*financing role)*. These institutions received respectively €23 mln, €16.5 mln and €8.9 mln in 2017 for research related to the Topsector Energy. An unspecified part of this money is spent on research concerning offshore wind (TKI Energie, 2017). Other institutions receiving governmental funds for research and development related to offshore wind are Marin and Deltares.

General subsidy programs applicable to offshore wind projects are the MIT-program, which offers SMEs funds to have external research institutions perform research or market studies for them. The SBIR program (Netherlands Enterprise Agency, n.d.-d) works in the form of a competition, and gives funding to technologies that show the most market potential. This competition is accessible to both

SMEs and big companies. Lastly, the WBSO program and coupled RDA program lower the taxes paid on employees' wages for companies that innovate (Pienter, n.d.) *(financing role)*.

Little regulative instruments have been utilized to stimulate innovation in offshore wind. In some of the past tenders for offshore wind parks, the Dutch government made innovative concepts aimed at reducing the costs of offshore wind farms an obligatory part of the bids (e.g. in Lichterduinen) (de Boek & van der Hem, 2016) *(regulative role)*. The former tenders of the Egmond op Zee and Borssele parks have not had this obligation. The tenders for upcoming wind parks do take in account societal costs and the quality of the parks, yet costs are still a leading measure to determine the winners of the parks. Environmental aspects do have to be taken in account when constructing the upcoming wind parks, but it is currently unknown whether these rules will be tightened (Netherlands Enterprise Agency, n.d.-g).

Not solely focusing on offshore wind, note that some governmentally funded research agencies like TNO are allowed to perform commercial services to the industry, in additional to government-funded research programs (TNO, 2017) *(regulative role)*. Some other governmentally funded research agencies (such as ECN) are not allowed to or choose not to perform commercial activities. The author is not aware of any offshore wind-related commercial activities performed by TNO or ECN (ECN, 2014).

No indications have been found that general patent laws apply differently to the offshore wind sector.

Concluding, the Dutch government has some governmental agencies that perform research and development activities but only as an extension of their core activities. It is highly active in the organization of research programs and cross-sectoral cooperation, and offers a wide range of financial instruments stimulating research and development, both in general and specific to the offshore wind sector. It makes little use of regulation to steer innovation.

Prevalence: [Executive, Regulative, Networking, Financing]:[Low, Low, High, High]

Testing

Similar to research and development activities, testing activities in the Netherlands are also generally not executed by governmental parties, with the exception of tests related to the grid concepts developed by TenneT (TenneT, n.d.-b) mentioned in the previous subchapter *(executive role)*.

The Dutch government is in charge of the planning of offshore wind farms, local governments usually supply the permits for onshore parks. The Netherlands currently has no offshore test locations for the construction and operation of offshore wind turbines, but is planning a test site at the Borssele offshore wind location with a capacity of 20 MW *(regulative role)*. The tender procedure, where requests are processed for investment grants, operating grants, permits and connection to the TenneT offshore grid will take place between October 2017 and January 2018. The innovation site is said to also involve SMEs and research institution in the development of the wind farm, and will take the innovativeness and exportability of the tested concept as selection criteria for the tender (Netherlands Enterprise Agency, n.d.-a).

The co-location innovation parcel will also supply an SDE+ subsidy to the winners of the tender for the parcel, which will refund the testing party based on the electricity delivered to the grid (Kamp, 2016), and an additional subsidy on electricity supplied to the grid to compensate for the innovative nature of the technologies applied *(financial role)*.

Next to the planned offshore test location, the Netherlands allows the hosting of a couple of onshore test locations, which can sometimes be used to test concepts or turbines for offshore. Note that some of these test locations (e.g. the location hosted by ECN) have selection criteria that restrict small parties from testing their turbines (in order to reduce risks), which can render the relatively small Dutch upcoming turbine producers unable to test their turbines there. Practically, this means that the turbines tested on these locations are made by non-Dutch companies (Appendix 1, x).

For the testing of Energy-related technologies, the DEI-arrangement can subsidize technology projects who are in their technology-demonstration phase. While the budget is the DEI-arrangement is high (>€40 mln in 2017), the latest overview of projects that have used DEI-arrangements (from 2015) only has one project that is somewhat related to offshore wind (Lagerwey's climbing crane) (Netherlands Enterprise Agency, 2017) *(financing role)*.

Another available subsidy, which can be used development but is focused on testing, is the 'Hernieuwbare Energie' arrangement offered by the Topsector Energie. This arrangement has a budget of €50 mln in 2017, and is available for all energy-related technologies that will lead to a lower necessity for the SDE+ subsidies in the future (for SDE+, see domestic market development below). This subsidy is mostly focused on large-scale projects, which can be interesting for the offshore wind industry *(financing role)*.

The Dutch organizations Topsector Wind op Zee and Innovatielink are also active in the connecting and support of offshore wind companies, next to their other functions *(networking role)*. These organizations are further described under respectively the previous and next header.

Concluding, the Dutch government has some governmental agencies that perform testing activities, but only do so as an extension of their core activities. It does utilize regulation to stimulate testing, yet testing is often a secondary goal. It is very active in the organization of research programs that include testing and cross-sectoral cooperation, and offers a wide range of financial instruments stimulating testing to take place, both in general and specific to the offshore wind sector.

Prevalence: [Executive, Regulative, Networking, Financing]:[Low, Medium, High, High]

Domestic market development

The domestic market development in the Netherlands is mostly performed by commercial parties, with again the exception of the offshore grid development done by TenneT *(executive role)*. TenneT plays the role of project manager in this part of the wind farm. The activities like the production of substation and cables and the installation of these parts are performed by commercial parties which are contracted by TenneT (Appendix 1, xvi) (TenneT, n.d.-d). Development of the offshore grid and substations is fully paid by TenneT (which is then reimbursed for this by the Ministry of Economic Affairs).

The Dutch Enterprise Agency (RVO) is responsible for the preliminary studies of the offshore parcels. It performs a project manager function in the execution of these studies. The actual studies are typically performed by commercial consultancy and research firms (like DNV GL), and are combined, analysed and published by RVO. The preliminary studies for the parcels are financed by the Dutch Ministry of Economic Affairs (through RVO) (Bruijne, 2017; Splunder, 2017).

The Dutch Chambers of Commerce are governmentally owned bodies, that offer information about doing business in other countries (Kamer van Koophandel, n.d.-a). This information is usually provided in cooperation with the Netherlands Enterprise Agency. The author is not aware of offshore wind projects making use of the services of the Dutch Chambers of Commerce.

When looking at domestic market growth, the Topsector program that supports innovation also supports market parties in the growth of their companies domestically. This is done by activities like connecting these parties with potential customers. Compared to the trade organizations, the governmentally led organizations are less focused on domestic market development and more on innovation *(networking role)*.

Trade organizations such as the Netherlands Wind Energy Association (NWEA) and IRO also play an important role in this aspect. In the Netherlands, the trade organizations function separately from the government; no governmental officials are members of the boards of these organizations, nor are governmental parties members of these organizations.

Next to the Topsector, Dutch governmental agencies (the Netherlands Enterprise Agency and several of the topsectors) are partners in the InnovatieLink organization *(networking role)*. InnovatieLink aims

to assist SMEs in the development and furthering of their products, services or technologies. One of the important aspects to this is to connect them with potential partners. InnovatieLink and TKI-WOZ are also cooperating in the Offshore Wind Innovators agency, which performs a role similar to InnovatieLink, but is focused on the offshore wind sector (Appendix 1, viii).

In terms of possibilities for domestic development of offshore wind farms, the Dutch government does not allow any offshore wind turbines or testing areas outside the parcels that it selects in the Dutch territorial seas and the Dutch economic exclusive zone (Kamp, 2013) *(regulative role)*. This means that governmental plans on roll-out of new parks directly control the growth of offshore wind in the Dutch seas. Offshore wind parks in the sea are only possible in designated areas, by participating the tenders described in the roadmap for offshore wind published by the Netherlands Enterprise Agency (Netherlands Enterprise Agency, 2015a). Offshore wind in lakes or rivers is not included in this law *(regulative role)*, which means that there are possibilities to develop offshore wind in the IJsselmeer outside the scope of the road-map for offshore wind. This is currently done in the Province of Frisia (Windpark Fryslân, n.d.).

For domestic market development, the government offers an SDE+ subsidy to the winners of the tenders of the parcels for offshore wind. The SDE+ subsidy ('Stimulering Duurzame Energie') awards the winner of a tender the difference between the market price and a price that the bidding parties report to need (per unit of electricity) for the feasibility of the construction of the wind park for a set period (Netherlands Enterprise Agency, n.d.-f). Subsidies vary per tender, depending on the winning bid of the tender *(financial role)*.

The Netherlands offers support in the form of guarantees to bank for investment done by SMEs serving to replace collateral (Borgstelling MKB Kredieten, up to €250.000 per firm) (Rijksdienst voor Ondernemend Nederland, n.d.-a) and medium- to large companies (Garantie Ondernemingsfinanciering, up to (the risks of) €75 mln, €1.2 bln in guarantees since 2009) (Rijksdienst voor Ondernemend Nederland, n.d.-b) taking up to 50 percent of the risk of a loan *(financial role)*.

The 'Innovatiekrediet' program can finance a promising innovation project aimed at start-ups of at least €150.000, and has a total budget of €40 mln for technical projects in 2017. This financing has to be paid back, but is waived if the project is not successful (Rijksdienst voor Ondernemend Nederland, n.d.-c). Another program supporting start-ups in developing their idea to the market is the 'seed-business angels' program, which offers financial support to 'angel' investors interested in investing in start-ups (Rijksdienst voor Ondernemend Nederland, n.d.-d) *(financial role)*.

The Dutch government is currently planning the foundation of InvestNL. InvestNL aims to provide more risk-capital (in the form of loans or co-investments) to a range of technologies to stimulate start-ups, scale-ups, and the exports of products and services which contribute to sustainable development. The stimulation of export focused on sustainable technologies will likely focus on smaller-scale products in developing countries (although the final decision on the direction of InvestNL has not been made yet), and therefore is less likely to apply to offshore wind products. The additional risk-capital can be very valuable to SMEs in the offshore wind industry to develop their products (Octas.nl, n.d.). Current plans indicate that the InvestNL will receive €2.5 bln in 2018 (Kamp, 2017c) *(financial role)*. It might be important for the Dutch offshore sector to ensure that the funds available from InvestNL fit their specific needs.

Concluding, the Netherlands has governmental agencies that are responsible for significant part of the offshore wind farms, yet these agencies are primarily focused on managerial and contracting activities and do not perform the physical construction activities. Domestic growth is almost completely determined by regulation. The government cooperates actively with the main trade organizations but is not part of them, and is active in some other organizations which also stimulate sectorial cooperation. While a range of subsidies is available for companies looking towards domestic expansion, growth, venture and seed capital are barely offered. Note that this might change once InvestNL is in operation.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, High, Medium, Medium]

Foreign market exploration

The Dutch government plays a large role in the exploration of foreign markets for its private sector. The economic attachés of its embassy network, which are part of the Dutch Ministry of Foreign Affairs, offer a range of services to companies that want to explore foreign markets. On the request of companies, embassies can perform market studies assessing the potential for a company in that market *(executive role)*. They can also supply general market information, and offer information on legislative frameworks in these markets. In cooperation with Holland Home of Wind Energy and research institution ECN several economic attachés of the Dutch embassies have also given pitches in the Netherlands for Dutch companies, about opportunities for these companies in the offshore wind sector of several countries (Netherlands Enterprise Agency, 2015b) *(networking role)*. Most of these services are thus of an advisory nature.

The Dutch embassies generally act demand-driven, waiting for companies to indicate interest before expanding their networks and offering information. The services offered by Dutch embassies are free-of-charge for Dutch companies. Dutch embassies generally do not have a commercial (paid-for) department, nor host paid-for consultancy firms for follow-up research (Appendix 1, vi & xvii) (Barneveld van, 2014). The Dutch government bears the costs for the upkeep of embassies abroad *(financial role)*. The services offered by the economic attachés of these embassies are financed by the Dutch government (Barneveld van, 2014). Several governmental agencies also organize or aid in the organization of trade missions, usually in cooperation with the embassies.

In addition to the services offered by embassies, the Starters International Business (SIB) program offers companies vouchers to refund costs made for exploring and entering foreign markets. This program is aimed at SMEs who are starting their exploration of foreign markets, and refunds the costs for a coach or legal advisor hired to help enter a foreign market, or up to 50% of the costs of the participation of a trade mission, conference or trade fair (Netherlands Enterprise Agency, n.d.-e) *(financing role)*.

The Ministry of Economic Affairs (through RVO) has a yearly contest for SMEs wishing to export their products, called the Oranje Handelsmissiefonds *(networking role)*. The 10 winners of the contest receive support in the form of information and expertise from RVO (and experts from the ING bank), and financial support in the form of plane tickets and reimbursed costs for the participation in a trade mission. These costs are however covered by the partners of this project (KLM, ING, MKB Nederland). The author is not aware of any companies involved in offshore wind participating in the program (RVO, n.d.-c). Additionally, the Dutch Chambers of Commerce are part of a European network, which enables SMEs to get in contact with foreign companies, called the Enterprise Europe Network (Kamer van Koophandel, n.d.-b). The author is not aware of companies in the offshore wind sector making use of these services.

The Dutch government is organizing a masterclass for countries and policymakers about the Dutch tender system, its legislative framework and its application. By attracting policymakers from other countries and strengthening cooperation between the Dutch government and governments of foreign countries, this can lead to opportunities for Dutch companies in these markets in the long run *(executive role)*.

During this study, no regulative restrictions that have been implemented by the Dutch government have been found for foreign market exploration for any of the markets that show potential for offshore wind products and services.

Concluding, the Dutch government offers and facilitates a wide range of instruments stimulating companies to explore foreign markets. It works together with parties in the sector and has programs for international networking, but does not work together with local consultants in foreign markets. A large range of financial incentives is used to stimulate companies to explore foreign markets. No specific regulation stimulating or obstructing market exploration has been found.

Prevalence: [Executive, Regulative, Networking, Financing]:[High, None, Medium, High]

Market entry preparation

The Dutch government has a range of embassies and consulates abroad which maintain networks within their respective regions. The Dutch embassies generally work on an on-demand base. They wait for requests from companies in the Netherlands, or from one of the ministries, and in response to these requests they expand their networks. They facilitate companies to get in contact with foreign companies (e.g. in the form of business scans), but after first contact is made their role is generally fulfilled *(executive role)*. Through the Partners in International Business (PIB) program the embassies support clusters of companies in among others the offshore wind sector *(financial role)*. The offshore wind trade missions organized by HHWE have seen a strong cooperation between then embassies, RVO and HHWE.

Next to the embassy network, the Dutch Ministry of Economic Affairs hosts an innovation attaché network that performs functions similar to the economic attachés, but focused on research and development (RVO, 2015). Innovation attachés are not present in all embassies, but the 15 current innovation attachés are present in most of the countries with a potential growth in their offshore wind markets (with the notable exception of Denmark) (Netherlands Enterprise Agency, n.d.-b) *(networking role)*. Their main focus is the formation of partnerships between Dutch and foreign research organizations. In cooperation with the innovation attachés the Dutch Enterprise Agency offers the 'Internationale innovatie matchmaking', which can organize 'trade missions' focused on finding partners for innovation (Netherlands Enterprise Agency, n.d.-b) *(executive role)*. This program has not been utilized by the offshore wind sector yet.

Trade missions are organized by a range of actors in the Netherlands. Governmental actors active in the organization of trade missions for offshore wind are mainly The Ministry of Economic Affairs and The Ministry of Foreign Affairs, aided by the Netherlands Enterprise Agency. Local governments in the Netherlands also organize trade missions, such as the trade missions organized by the Province of North-Holland to China (EnergyValley, 2013). These trade missions can be incoming missions, receiving delegations from foreign countries, or outgoing missions, taking Dutch actors to foreign markets. Dutch trade missions in offshore wind are often organized in cooperation with Holland Home of Wind Energy.

The Dutch government also has an initiative called 'Holland Branding' (RVO, n.d.-b). This initiative aims to aid the promotion of Dutch industries towards foreign parties. The website offers some information about the Dutch offshore wind sector in the form of a presentation, which is translated in Chinese, Japanese and Korean, but its information on offshore wind is very limited. The Dutch government meets with the trade organizations approximately every 6 weeks to discuss export promotion, and align the resources and interests of the actors (Appendix 1, xii & ix) *(networking role)*. A running initiative is currently looking at the improvement of the branding of the Dutch offshore wind sector.

The Dutch government puts a high priority on economic diplomacy (Ministerie van Buitenlandse Zaken, 2016). On governmental level, the Netherland Enterprise Agency and the Taiwanese Bureau of Energy signed an MOU on cooperation in the development of renewable energy (Schutten, 2015). Another MOU is signed between the Dutch Ministry of Economic Affairs and Chinese National Energy Administration on the topic of the cooperation in the energy sector (OffshoreWIND.biz, 2014), which has been re-signed in 2016 with cooperation specifically aimed at the development of offshore wind[6] *(regulative role)*.

Other Memorandums of Understanding (MOU) between Dutch and foreign countries for cooperation in offshore wind come from the wind sector. Some of these are signed between HHWE and foreign wind trade organizations (Japan, China, Korea) (Schutten, 2015), others are between companies in the Netherlands and foreign companies (for example Wind Minds and DoArm Engineering).

[6] According to experts at the export consultation meeting at the Dutch Ministry of Economic Affairs.

The Dutch government utilizes the knowledge from the Ministry of Economic Affairs and the Netherland Enterprise Agency to attract foreign policymakers interested in also developing domestic offshore wind projects. Utilizing the contacts gained from these sessions can lead to opportunities for Dutch companies in foreign markets *(networking role)*.

For the market entry preparation stage, the most used program in the offshore wind sector is the Partners in International Business program (PIB) *(financial role)*. This program supports clusters of companies to explore and enter a foreign market, with a multi-year approach and strategy. It does so by financing workshops and networking events, and incoming and outgoing trade missions. These programs are supported by the local embassies (Netherlands Enterprise Agency, n.d.-c). For example, the PIB program has been used to organize trade missions (leading to MOUs) to Korea and Japan for the offshore wind industry, under the lead of HHWE (Appendix 1, ix). The program is suited to also organize programs focused on knowledge exchange and knowledge institutions, but no examples for the offshore industry of this use of the program have been found.

The Dutch government bears the costs for the upkeep of embassies abroad. The services offered by the economic and innovation attachés of these embassies are thus financed by the Dutch government (Barneveld van, 2014) *(financial role)*.

During this study, no regulative restrictions that have been implemented by the Dutch government have been found for market entry preparation for any of the markets that show potential for offshore wind products and services.

Concluding, the Dutch government offers a moderate range of market entry preparation activities, but considers many company-specific activities as the responsibility of the sector. While it has a wide international network, it does not work together with consultants who could offer follow-up activities. It is not active in the branding of its offshore wind sector. It has only a few memorandums of understanding active and is not actively looking for new ones. It does fund a large range of activities if companies take initiative for market entry activities.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, Low, Medium, Medium]

Export

No examples of the Dutch government commercially exporting goods or services in the offshore wind sector have been found during this study.

To promote the exports of Dutch companies, the commercial organization Atradius (NL) offers a range of financial products backed by the Dutch state under the Dutch State Business range (Atradius, n.d.) *(networking and financing role)*. The most important product in this range is export credit guarantees (ECGs). These products offer banks or other financial backers of export products or projects the certainty that, if the project fails or payments are not made by the client, that they do receive their money. The Dutch state thus takes the risks of the project (which it can do because it has the highest credit rating available, AAA), which lowers the cost of capital for exporters. ECGs are not viable for small projects (<1 mln euros), and are thus usually used by large companies. Although Atradius has promoted the use of ECGs in the offshore wind industry, ECGs have not been used on any projects in the offshore wind industry by Dutch companies (Appendix 1, i).

The products offered by Atradius for the Dutch State Business product line are executed by a separate company called Atradius Dutch State Business N.V. This is a private company, that works together with the Dutch state in a public-private partnership relation (De Minister van Financiën, 2010). The financial products of the Atradius State Business line are available for offshore wind companies, yet in spite of an active promotional campaign of Atradius towards the offshore wind sector they have not been utilized so far (Appendix 1, i).

During this study, no regulative restrictions have been found implemented by the Dutch government on the export of offshore wind products of goods to any of the markets showing potential for offshore wind.

Regulation restricting or enabling exports generally encompasses local content criteria or restrictions on the usage of foreign components or installations, and are found in other countries. This study will not look into negotiation methods in order to lift these restrictions, as these are usually not national-level negotiations, but are processes on a European or global level.

No examples of governmental influence in Dutch networks connecting exporters have been found during this study.

Concluding, the Dutch government cooperates with commercial parties to offer a range of financial products stimulating export which, while available and presumably suitable for the offshore wind sector, are rarely used by the sector. It exports no goods or services itself, nor does it implement any specific regulation to stimulate or prohibit the export of goods in the offshore wind sector.

Prevalence: [Executive, Regulative, Networking, Financing]:[None, None, Low, Low]

	The Netherlands			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Tennet (NL) researching and developing new grid concepts, Dutch Ministry of Economic Affairs and Netherlands Enterprise Agency designing tender procedures	Innovation design obligations in former wind farms, commercial freedom governmentally funded research organizations	Governmentally founded Topsector policy and involvement in GROW project, Dutch embassies hosting an international Innovation Attaché network	Financing to Topsector management and research projects, funding independent research organizations, MIT, SBIR and WBSO programs
Testing	Tennet (NL) testing grid-connection concepts	Separate tender procedure for offshore wind demonstration site Borssele V, onshore test location permits and access criteria	Innovatielink, Topsector policy	SDE+ for demonstration site, DEI and Hernieuwbare Energy programs
Domestic market development	TenneT (NL) developing offshore wind grid and substations, Netherlands Enterprise Agency managing preliminary studies parcels	(yearly) Tenders for domestic offshore wind farms, no state-level regulation for nearshore or lake areas to develop offshore wind farms	Innovatielink, Topsector policy	SDE+ for domestic offshore wind farms, Borgstelling MKB Kredieten, Garantie Ondernemingsfinanciering, Innovatiekrediet and seed-business angels program, Future InvestNL program
Foreign market exploration	Embassies performing exploratory studies, general information on foreign markets and their regulatory frameworks, organization trade missions by several governmental agencies	-	Public-private export meetings, Policy-level cooperation, pitches for domestic parties, Oranje Missiefonds program	Upkeep embassies ,SIB program
Market entry preparation	Embassies performing business scans, Netherlands Enterprise Agency organizing innovation matchmaking missions, governmental agencies organizing trade missions, Holland Branding	Government-to-government cooperation in the form of memorandums of understanding with China and Taiwan	Innovation attachés and embassies hosting networks connecting domestic parties to international partners, knowledge exchange of tender procedures	Upkeep embassies, PIB program, partial reimbursements trade-missions
Export	-	-	Cooperation with Atradius (NL) for offering export promotion financing	Financing of Atradius' Dutch State Business line of export promotion financing products

Figure 31: The research framework applied to the Dutch case

	The Netherlands			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	*Low*	*Low*	*High*	*High*
Testing	*Low*	*Medium*	*High*	*High*
Domestic market development	*Medium*	*High*	*Medium*	*Medium*
Foreign market exploration	*High*	*None*	*Medium*	*High*
Market entry preparation	*Medium*	*Low*	*Medium*	*Medium*
Export	*None*	*None*	*Low*	*Low*

Figure 32: The rated prevalences of the governmental roles in the Dutch case

4.2 Case: Denmark

Denmark is a country in the north of Europe with a population of approximately 5.8 mln. It is the world's 35th largest economy (International Monetary Fund, 2017), and is the world's 37th largest export economy (OEC, n.d.-a).

The Danish onshore and offshore wind sector are closely intertwined, and separate data on the offshore industry has proven to be hard to come by. The Danish wind industry employs 32.900 FTEs in 2016, and the sector had a turnover of €13 bln. The sector exported €7.5 bln worth of goods and services, totalling 57 percent of the turnover (Vindmølleindustrien, 2016). The share of exports in the offshore wind is even higher, estimated to be between 60 and 70 percent of the total turnover of the offshore wind industry (Appendix 1, xiii).

4.2.1 Domestic market

History in offshore wind

Denmark has been operating offshore wind parks since 1991, and was the first country to install an offshore wind park. This first park was the 5 MW Vindeby park, which was decommissioned in March 2017 (DONG Energy, 2017). Since then it has installed a large range of offshore wind parks. Since then it has installed 12 more offshore wind farms (see Table 10). Denmark currently has a capacity of just over 1250 MW of offshore wind. (4COffshore, n.d.-b; WindEurope, 2017).

Year	Name	Capacity (MW)
1991	Vindeby (decommissioned)	5
1995	Tunø Knob	5
2000	Middelgrunden	40
2002	Horns Rev I	160
2003	Frederikshavn	7.6
2003	Rønland 1	17.2
2003	Samsø	23
2003	Nysted	166
2009	Avedøre Holme	10.8
2009	Sprogø	21
2009	Horns Rev II	209
2010	Rødsand II	207
2013	Anholt	400
	Total	**1266.6**

Table 10: Offshore wind farms in Denmark

Domestic market developments

Denmark has set itself the goal to be the first country to be completely independent of fossil fuels in 2050 (Denmark.dk, n.d.-b). An important aspect of the transition to a fossil fuel free country is the introduction of large amounts of wind energy. Denmark is currently the country with the most capacity of wind power installed per capita (WindEurope, 2017). Offshore wind is playing an increasingly large role in the Danish power system. In 2012, a coalition of Danish governmental parties decided that another 1500 MW of wind should be added to the Danish system before 2021 (GWEC, 2017). To reach this goal, the Danish government has tendered the wind parks Horns Rev III (400 MW, operational in 2020) and Kriegers Flak (600 MW, operational in 2021). There is a tender running for 350 MW of nearshore wind in Vesterhav Nord and Vesterhav Syd (4COffshore, n.d.-b; Danish Energy Agency, n.d.-b).

The Danish waters still have a large technical potential for offshore wind power, but there are currently no (formal) plans for additional parks after the ones previously mentioned (Appendix 1, iii). The Danish government will form new plans for the roll-out of renewable energy systems at the end of this year or the start of next year. These plans are expected to contain a plan for new offshore wind tenders in Denmark. Due to typical lead times of offshore wind parks being approximately 8 years, no additional new offshore wind parks are expected to be installed before 2025 (Appendix 1, vii). This means that there will likely be a gap between 2021 and 2025, where there will be no domestic offshore wind projects for the Danish industry. This makes export all the more important for the Danish industry.

Denmark currently has the third most installed offshore wind capacity of all European countries (after Germany and the UK) (fourth globally accounting for China). With its current plans, Denmark is expected have the fifth largest capacity of offshore wind installed in 2023 (France and the Netherlands

are expected to excel Denmark between now and 2023), or sixth globally (Dickson, 2017; GWEC, 2017). No formal plans for the growth of the Danish domestic market after 2025 exist.

4.2.2 Organization of the Danish sector

The Danish offshore wind sector comprises a wide field of actors, with varying responsibilities. Figure 14 gives a simplified representation of the sector and the relations between its actors. Key actors are shortly expanded on below.

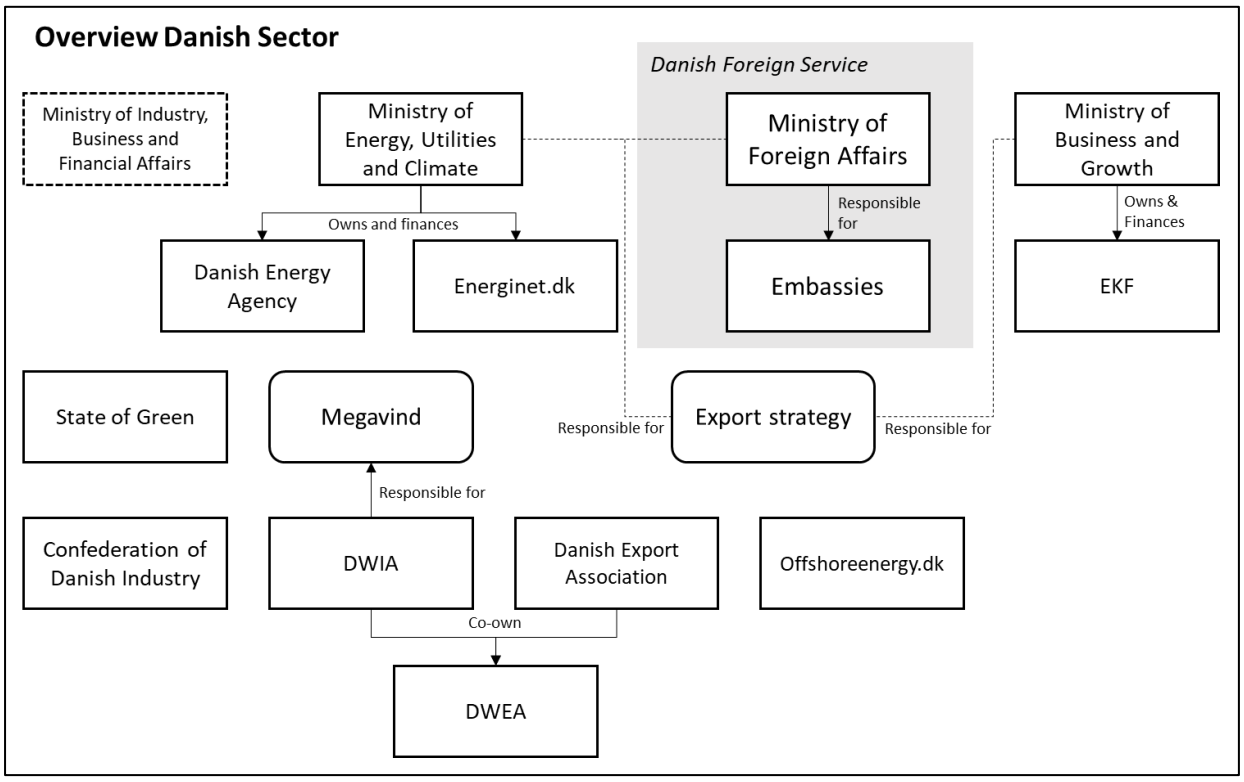


Figure 33: Overview of the Danish sector, the most important actors and their relations

Governmental parties

On a governmental level, there are three main responsible ministries for the offshore wind sector; The Danish Ministry of Energy, Utilities and Climate, The Ministry of Industry, Business and Financial Affairs and The Ministry of Foreign Affairs. Additionally, the Ministry of Business and Growth is the owner of the publicly owned EKF (The Danish export credit guarantee agency), and shares responsibility with the Ministry of Foreign Affairs and Ministry of Economic Affairs for the financial export promotion products offered by EKF (EKF, n.d.-b).

The Danish Ministry of Energy, Utilities and Climate aims to ensure safety and efficiency within the areas of energy and utilities and to promote a greener and more sustainable society. Concerning offshore wind, the ministry is responsible for administering legislation concerning energy supply and usage. The ministry consists of five agencies and three independently operating departments. Of the agencies, 'the Department' is responsible for the coordination of the agencies and departments and the formation of energy market related policy. Concerning offshore wind, the Danish Energy Agency and Energinet.dk also play an important role in the Danish system (State of Green, n.d.-c; The Danish Ministry of Energy Utilities and Climate, n.d.).

The Danish Energy Agency, which is an executive organ of the Danish Ministry of Energy, Utilities and Climate, is responsible for the legislation, dialogue around and formation of offshore wind tenders. It is the main responsible agency for communication between the Danish ministries, the industry and local parties. It is also in charge of managing the contracts with the winners of the tenders. The Danish Energy Agency also works together with private companies and universities to develop and

demonstrate new energy technologies. It does so through its Energy Development and Demonstration Program (Appendix 1, iii) (Danish Energy Agency, n.d.-a).

The Ministry of Industry, Business and Financial Affairs aims to create future-oriented conditions for growth for citizens and companies in an increasingly globalized world. Relevant for offshore wind, the ministry is responsible for business regulation, intellectual property rights, competition policy and the financial sector. The ministry stimulates favourable international framework conditions for the growth of several sectors of its industry. It has 'growth' teams, of which the one focused on Energy and Climate is interesting for offshore wind development (State of Green, n.d.-d).

The Ministry of Foreign Affairs facilitates intelligent green technology solutions worldwide, with a strong focus on wind energy. As part of the Danish Foreign Service, it is responsible for the operation of Denmark's global network of embassies, consulates-general and trade commissions. A part of the Ministry is the Danish Trade Council, which is founded to gather all governmental activities designed to promote Danish export and foreign investment in Denmark under one roof (Ministry of Foreign Affairs of Denmark, n.d.-e). The Danish Ministry of Energy, Utilities and Climate, the Ministry of Foreign Affairs and the Ministry of Business and Growth have launched an export strategy for the period of 2017 to 2019, focusing on doubling the exports of the Danish green energy sector by 2030 (Udenrigsministeriet et al., 2017). Initiatives are incorporated in the roles and instruments in the rest of this chapter.

Semi-government

Energinet.dk is the Danish TSO, and is the owner, operator and developer of the transmission system for electricity and natural gas in Denmark. It is an independent public enterprise, owned by the Danish Ministry of Climate and Energy. Energinet.dk's rights and functions are described in the Danish 'Law on Energinet.dk' ('lov om Energinet.dk'). One of its tasks is to perform the studies on the to-be-tendered parcels of offshore wind. Energinet.dk is also responsible for the export cables and the substations of the offshore wind parks, as well as the balancing the resulting loads in the onshore grid (Appendix 1, vii). Energinet has a small commercial consultancy department, called Energinet Energy Consultancy A/S.

Non-governmental organizations

Additionally, the Danish sector has some non-governmental organizations which are important for the development and export of the sector. There are a few influential trade and cluster organizations: The Confederation of Danish Industry, Offshoreenergy.dk, The Danish Wind Industry Association and the Danish Export Association. Denmark has a branding organization for green energy, State of Green, and an export association for wind products and service, the Danish Wind Export Association. These organizations are expanded on below.

The Confederation of Danish Industry is the voice of corporate Denmark, which aims to ensure that different goals concerning business competitiveness, a clean environment and energy security are realized to create the foundation for long-term and sustainable (green) growth for its >10.000 members. They have several branches, of which one focuses on energy (The Danish Energy Industries Federation), which has over 300 members. One of the main additional goals of this branch is to create coherence and visibility of the Danish energy industry (State of Green, n.d.-b).

One of the initiatives that creates this coherence and visibility is State of Green. State of Green is a Danish public-private partnership, which was founded in 2008 for the 2009 United Nations Climate Change Conference in Copenhagen. It was founded by a mix of Danish governmental parties and trade / cluster organizations of the Danish Industry. Its aim is to improve Denmark's branding in the green sector. State of Green is a (non-profit) foundation, which is funded by the industry and government (~50/50) (Appendix 1, xv).

Offshoreenergy.dk is a Danish cluster organization and innovation network for offshore oil, gas, wind and wave / marine energy parties, with over 240 members. The main focus areas of the organization are innovation and internationalization. It uses a triple-helix approach (university, industry,

government). It currently has several R&D projects running regarding offshore wind. The organization is funded by its members, regional and national government (Appendix 1, xiii).

The Danish Wind Industry Association (DWIA) is a trade and network organization for the Danish Wind Industry, with over 250 members. It is a non-profit organization that advocates the interests of the industry to the government, connections companies in the industry and helps innovation groups in the wind sector in Denmark. DWIA hosts Megavind, a Danish innovation project which acts as catalyst and initiator of a strengthened strategic agenda for research, development, and demonstration (RD&D) for the wind industry.

DWIA works together with the Danish Export Association (600+ members) for the export of wind products and services. For this, the DWIA and the Danish Export Association have founded the Danish Wind Export Association (DWEA). The Danish Wind Export Association a commercial organization, which is owned by the Danish Wind Industry Association and Danish Export Association. It offers networking, market intelligence and joint export group and stands for Danish companies who wish to strengthen their international sales to the global wind industry. The services of the DWEA are available for members of both founding organizations. DWEA coordinates all joint export activities for the Danish wind industry (Danish Wind Export Association, n.d.).

4.2.3 Danish government's roles in export process

With the Danish sector and its actors introduced, the next part of the chapter will look into the governmental roles in the different stages of the export process. The different stages of the export process are expanded on separately. Some stages show some overlap in the instruments as some instruments are applicable for several stages. In that case these instruments are mentioned several times in their respective applicable stages.

At the end of the chapter, Figure 34 will show the instruments of the different roles inserted in the framework, and Figure 35 will show the level of prevalence of the governmental roles in the case. A table of the ratings and motivation behind giving that specific rating is also presented in Appendix 6.5, an overview of the ratings is presented at the end of the case, and an overview of the ratings of all cases combined is found in Appendix 6.6.

Research and development

Research and developments activities are not typically executed by the Danish government in the energy market. The Danish government take a more steering / observing role in the R&D stage, except for the activities performed by its executive organs such as Energinet. Energinet is performing research on the usage of voltage-control of (offshore) wind turbines, and its usage to provide more security to the grid *(executive role)*. Energinet also performs its own research, development and testing on systems protecting the electric systems in the substations (from excessive loads / lightning) (Appendix 1, vii).

The Danish Energy Agency develops the tenders for the Danish government (Appendix 1, iii) *(executive role)*. Examples of the export of the knowledge of the studies around the formation of these tenders have not been found during this study.

Denmark has several research, development and testing programs for the offshore wind industry. The largest ones are the Megavind program, organized by the Danish DWIA, and the research projects organized by Offshoreenergy.dk. No governmentally coordinated innovation programs have been found in this study.

The Megavind program is an innovation program for on- and offshore wind. Its organization and board contain parties from the industry, consultancy firms, universities and trade organizations. It has no official governmental representation in the organization, and no signs of governmental steering of the program have been found in this study (Danish Wind Industry Association, n.d.; MegaVind, 2016) (Appendix 1, iv).

Offshoreenergy.dk has several research, development and testing programs focused on specific areas of offshore wind industry (next to several programs on other offshore energy technologies). Currently,

its focus is mainly on research in operation and maintenance of offshore wind parks (Appendix 1, xiii). Offshoreenergy.dk is an independent organization, and its board and organization do not have any representatives from the national government. Its board does contain an observer from Region South-Denmark, and representatives (and funding) from other regions in certain research projects (Offshoreenergy.dk, n.d.). The regions collaborate with offshorewind.dk and aim to strengthen their local industries. Offshoreenergy.dk does receive funding from the Danish regions and state for its general functioning and for specific research projects *(financing role)*.

Offshoreenergy.dk and DWIA had a common project, called 'Offshore Wind Denmark: Supporting the Danish offshore wind cluster', which was funded and supported by Region South-Denmark (Wind Offshore Denmark, 2014), but has been completed in 2016.

Next to national programs, the Danish government hosts (the previously mentioned) innovation hubs in foreign markets, which aim to connect Danish companies with international partners *(networking role)*.

The main subsidies for innovation in Denmark are supplied from the Innovation Fund Denmark (supplied by the Danish Ministry of Higher Education and Science) (Ministry of Foreign Affairs of Denmark, n.d.-d). This fund has three programs which can be applied for: Large-Scale Projects, InnoBooster and Entrepreneurial Pilot. The total budget for these programs was ~1.25 bln DKK (€170 mln) in 2015, of which ~93 percent goes to Large-Scale Projects, ~2 percent to InnoBooster and ~5 percent to the Entrepreneurial Pilots (Innovationsfonden, 2015) *(financing role)*.

The Large-Scale Projects program is for substantial investments and long-term projects/partnerships where the focus is on research, technology, experimental development and market development (and thus also encompasses the testing and domestic market development stage). The InnoBooster program is for small enterprises and entrepreneurs with sound development plans, which can get a subsidy of up to 5 mln DKK (~€680.000) to be spent on the development of knowledge-based innovation projects (Innovationsfonden, n.d.). The Entrepreneurial Pilot supplies funds to companies and organization that want to accommodate a PhD or Post-doc position. None of these programs specifically for offshore wind products or services, but they are available to the offshore wind sector. Additionally, Danish firms are allowed to write off capital expenditures for R&D, which can be reimbursed by the government (PWC, 2017a) *(financing role)*.

The Danish tenders for offshore wind tenders do not specifically target research and development activities, or contain innovation-stimulating criteria. The selection criteria are focused on cost-reductions (by selecting the tender which needs the lowest subsidy), which is seen as a primary driver for innovation (Appendix 1, iii). No regulative restrictions that are more strict than a typical Environmental Impact Assessments are present in the tender procedure of the Kriegers Flak (Danish Energy Agency, 2016). The upcoming tender for the nearshore park does have some minor regulative obligations regarding the creation of local apprenticeships, but these also do not directly impact research and development (Energistyrelsen, 2016).

Most of the research in Denmarks outside of its private sector takes place in its universities (Denmark.dk, n.d.-a). The author is not aware of any commercial activities performed by Danmarks Teknisike Universistet (DTU) or Aalborgh University, the two main governmentally funded research institutions active in the Danish Megavind project (Danish Wind Industry Association, n.d.).

No additional regulatory instruments directly stimulating the research and development of the Danish offshore wind sector have been identified. No indications have been found that general patent laws apply differently to the offshore wind sector.

Concluding, Denmark has some governmental agencies that perform research and development activities but only as an extension of their core activities. The government role in domestic research networks is small to absent, but it does host an international innovation network. The Danish government does offer a wide range of financial incentives for research and development. Regulation specifically stimulating or hindering research and development is not utilized.

Prevalence: [Executive, Regulative, Networking, Financing]:[Low, None, Low, High]

Testing

Testing activities are not also typically executed by the Danish government in the energy market, except for again the activities performed by its executive organs such as Energinet. Energinet performs tests on the usage of voltage-control of (offshore) wind turbines, and its usage to provide more security to the grid. Energinet also performs its own tests on systems protecting the electric systems in the substations (from excessive loads / lightning) *(executive role)*.

The Danish government, in the form of the Danish Energy Agency, is responsible for the awarding of permits for offshore wind test parcels. For this purpose, it has tendered 50 MW of offshore wind test projects in 2016, of which 28 MW was awarded for a testing facility around Frederikshavn (4COffshore, n.d.-b) *(regulative role)*. This tender was done under the open-door policy; companies proposed testing projects and a location for the testing procedures, and the Danish Energy Agency reviews the received testing plans and awards up to 50 MW of testing facilities for nearshore projects (ENS, 2016).

Additionally, Denmark has a range of onshore testing facilities that are suited for the testing of large offshore turbines. The wind test sites in Østerild and Høvsøre are owned by Danmarks Tekniske Universitet (DTU), and currently have room for the testing of respectively 7 and 5 large turbines (DTU Wind Energy, 2015). The Danish government has consented to expand these sites to respectively 9 and 7 turbines (State of Green, 2017a) *(regulative role)*.

The onshore testing facilities owned by the DTU are sold or rented to companies testing their equipment. No subsidies for the parcels or the electricity generated on these parcels have been found in this study (DTU Wind Energy, 2015), although it is likely that they fall under the onshore subsidy regimen. Upcoming offshore test parcels are tendered under the open-door policy, and will receive a market premium equal to onshore wind farms *(financing role)*.

Connections to the electricity grid for all current testing sites are the responsibility of the owner of these test sites (Appendix 1, vii).

The Danish Energy Agency offers financing to development and demonstration projects under its EUDP program (EUDP, 2017). The EUDP program has a total budget of 6 bln DKK (€800 mln) over the lifespan of the project, with 3 mln DKK already being spent since 2007. It aims to invest in projects areas in which there is a particularly good match between global demand for new energy technology, on the one hand, and Danish strongholds and business potentials on the other. It is focused on technologies with a TRL of 4 – 8, with a view of being able to export these technologies. It focuses on all energy technologies and has no specific regulations for offshore wind. The average awarded subsidy is ~€650.000. The program has no specific arrangements for offshore wind *(financing role)*. In addition, the Danish government offers the earlier mentioned 'Large-Scale Projects program' for the testing of larger scale concepts *(financing role)* and funds Offshoreenergy.dk *(financing role)*.

Concluding, Denmark has some governmental agencies that perform testing activities, but only as an extension of their core activities. It allows a wide range of options for test facilities for its industry, and actively stimulates the creation of such facilities. It is not active in trade organizations or other networks stimulating testing, but offers a wide range of financial instruments stimulating tests to take place.

Prevalence: [Executive, Regulative, Networking, Financing]:[Low, High, None, High]

Domestic market development

Domestic market development activities in Denmark are largely executed by commercial parties, with the exception of offshore grid developments performed by Energinet *(executive role)*. Energinet plays the role of a project manager and contractor in this process, with the manufacturing and installation activities being performed by commercial parties (Appendix 1, vii). Energinet is also responsible for the preliminary studies performed on the offshore wind parcels (Environment Impact Assessment, geotechnical, geophysical). Here it also plays the primarily the role of the project manager and

contractor, with commercial parties performing the actual studies. The costs of the studies for the area of the parcel that will be operated by the winner of the tender will be paid by the winning party of the tender.

In the Danish market, the DWIA and Offshoreenergy.dk are the central organizations to align the interest of the actors in the domestic market. As indicated before, national governmental influence on the goals and projects these organization is not found in this study. Regional governments are active in these networks and aim to attract local developments in their regions. While the branding of the Danish sector has some influence on domestic market developments, its main function is to connect national and foreign companies, and as such is discussed under the next header.

The Danish state is the owner of the Danish waters and its economic exclusive area. As such, it directly decides on the roll-out of new offshore wind parks *(regulative role)*. The Danish Energy Agency is responsible for the exploration of the possible areas in which offshore wind parks can be built. There are two possible procedures for this. The first procedure follows a tender system where parties bid for the subsidy needed to operate an offshore wind farm in an area selected by the Danish Energy Agency. The second possibility is an open-door-procedure, in which a project developer must submit an unsolicited application for a license to carry out preliminary investigations in a given area. The Danish Energy Agency then consults with relevant governmental parties to decide on the application. Wind parks constructed after an open-door procedure receive price premiums at the same level as onshore wind turbines (Danish Energy Agency, n.d.-c). No limit to the capacity of open-door procedure wind farm is stated. The Danish Energy Agency will consider several public interests when judging the open-door applications, and decide per case.

Offshore wind parks constructed through a tender system are awarded the difference between the market price and the price of their bid per unit of electricity. Offshore wind parks constructed through the open door procedure are awarded a flat amount per unit of electricity, corresponding with the subsidies given to onshore wind parks (Danish Energy Agency, n.d.-c) *(financing role)*.

The Danish Growth Fund is the official investment fund of the Danish state, which supplies investments to SMEs that show potential for socio-economic return. It invests in start-ups that lack financial resources, absorbs risk for privately owned funds, and gives loans and guarantees to SMEs lacking collateral for a bank loan. It had a budget of 770 mln DKK in 2015 (~€100 mln) (MegaVind, n.d.). The Danish Growth Fund has a special fund for green technologies, called the Danish Green Investment Fund. This fund can co-finance around 60 percent of the costs of a green energy project that is economically viable, up to a limit of 5 bln DKK (€680 mln). The funds have no specific arrangements for offshore wind *(financing role)*.

The Market Development Fund (offered by the Danish Business Authority) takes over where R&D and demonstration programmes stop in order to assist in the final market adaptation of enterprises' innovative new solutions. It has a yearly budget of ~5.6 mln DKK (~€760.000) and focusses on SMEs. It has no specific arrangements for offshore wind (Markedsmodningsfonden, n.d.) *(financing role)*.

The Danish National government and the Danish regional governments supply funds to Offshoreenergy.dk. These funds are both for supporting the organization in its function to connect domestic parties, and for specific R&D projects (as such this financing also encompasses the Research and Development and Testing stage) (Appendix 1, xiii) *(financing role)*.

In addition, the Danish government offers the earlier mentioned 'Large-Scale Projects program' for the testing of larger scale concepts *(financing role)*.

The Danish Chambers of Commerce are non-governmental and have not been found to be active in the offshore wind sector (DIHK, n.d.).

Concluding, the Netherlands has governmental agencies that are responsible for significant part of the offshore wind farms, yet these agencies are primarily focused on managerial and contracting activities and do not perform the physical construction activities. Domestic growth is almost completely

determined by regulation. The government cooperates with trade organizations and is part of the organizations who also connect the sector next to their core activities. While a range of subsidies is available for companies looking towards domestic expansion, growth, venture and seed capital are barely offered. Note that this might chance once InvestNL is in operation.

Concluding, Denmark has governmental agencies that are responsible for significant part of the offshore wind farms, yet these agencies are primarily focused on managerial and contracting activities and do not perform the physical construction activities. Domestic growth is almost completely determined by regulation. The government is not active in trade organizations or other networks connecting domestic parties, but offers a wide portfolio of subsidies and funds for companies and projects in the offshore wind sector.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, High, None, High]

Foreign market exploration

The Danish government plays an active role in the foreign market entry process. The activities it performs are largely performed through its embassies and its Trade Council, both part of the Danish Ministry of Foreign Affairs. The Danish governmental organizations make a distinction between general services performed by embassies, which are usually free-of-charge, and business-driven specific services that are usually paid for on an hourly base by the companies requesting them. The Danish embassies and export promotion instruments organized by the Trade Council work on a customer-based approach. Companies in Denmark are encouraged to approach the Trade Council, and are offered services that help the companies throughout the whole export process. These services are specifically tailored to the company being supported, and are often on a paid-per-hour basis (Barneveld van, 2014) (Appendix 1, xvii) *(executive and financing role)*.

The embassies organize trade missions, which can be policy-driven (exploring new possibilities) or business-driven. When policy-driven, these are free-of-charge. When business driven, the companies participating finance them. Additionally, embassies offer general market information and shallow market explorations, and offer information on legislative frameworks *(executive role)*. Consultancy firms working with the embassy offer business-specific market explorations on a pay-per-hour basis (Barneveld van, 2014; Ministry of Foreign Affairs of Denmark, n.d.-c) *(networking role)*. The Danish government bears the costs for the upkeep of embassies abroad. The activities of the embassies are partially funded by the Danish government, but are offered largely on a pay-per-hour basis (Barneveld van, 2014).

The Trade Council offers the VITUS program, which selects 10 SMEs each year with high potential for exports, and walks them through an intensive support program, lasting 12 months, which is partially (50 percent) subsidized *(executive & financing role)*. The Trade Council also offers sparring sessions with a local office in Denmark which offers SMEs with no experience in exports basic market information and guidance to make an export plan (free of charge for 40 hours) *(financing and networking role)*. Lastly, it has the GROW program, which can be used by a group of SDEs for to make a plan of exporting to a sector, which is partially (35 percent) subsidized (Ministry of Foreign Affairs of Denmark, n.d.-d) *(financing role)*.

The Danish Trade Council actively approaches companies to participate in their programs, and aims to reach around 7000 companies every year with their free-of-charge services (Barneveld van, 2014).

The Danish Chambers of Commerce are part of a European network and offer services connection Danish SMEs with foreign partners (Danish Chamber of Commerce, 2009). The author is not aware of companies in the offshore wind sector making use of these services.

In this study, no regulative restrictions that have been implemented by the Danish government have been found for foreign market exploration of the markets that show potential for offshore wind products and services.

Concluding, the Danish government offers and facilitates a wide range of instruments stimulating companies to explore foreign markets. It works together with parties in the sector and local consultancies in foreign markets, and has programs connecting domestic parties which want to explore markets. It partially reimburses companies for many of the services it offers, or activities these companies execute, yet expects companies to contribute financially as well. It makes no use of regulation to stimulate or discourage market exploration.

Prevalence: [Executive, Regulative, Networking, Financing]:[High, None, High, Medium]

Market entry preparation

The Danish government also plays an active role in the market entry preparation process. The activities it performs are again largely performed through its embassies and its Trade Council, both part of the Danish Ministry of Foreign Affairs. Upkeep of the embassies is paid for by the Danish government *(financial role)*.

Services offered by the Danish government regarding market entry preparation are primarily offered by the Trade Council. The following services are offered on a pay-per-hour basis by consultants working for the Trade Council: Consultancy on setting up companies abroad, recruiting foreign staff and dealing with corruption, business partner scans, strategic advice to approach relevant networks, setting up companies abroad and getting access to international financing, (Barneveld van, 2014; Ministry of Foreign Affairs of Denmark, n.d.-c) *(executive role)*.

The Danish Trade Council also subsidizes export activities like trade fairs, company visits, seminars or individual contact meetings *(financing role)*. Funds for these activities are available for delegations of at least 5 companies, of which at least 25 percent has to be an SME, cover up to 50 percent of the costs of the activity, and can be applied for by industry associations of export promotion focused consultancy firms. As described earlier, the Trade Council also subsidizes 50 percent of the hourly-rate of companies making use of the VITUS program (Ministry of Foreign Affairs of Denmark, n.d.-f). Most other programs offered by the trade council are on a paid-per-hour basis available for Danish companies (Barneveld van, 2014). Also for this stage, consultancy firms working with the embassy offer business-specific market explorations on a pay-per-hour basis (Barneveld van, 2014; Ministry of Foreign Affairs of Denmark, n.d.-c) *(networking and financing role)*.

The Danish Ministry of Foreign Affairs also has innovation centres set up in seven cities in the world (Munich, New Delhi, São Paulo, Seoul, Shanghai, Silicon Valley and Tel Aviv), with the primary goal of connecting Danish companies and research institutions to relevant partners and international knowledge. Especially the centres in Munich, Seoul, Shanghai and Silicon Valley can play a role in forming connections for the offshore wind industry (Ministry of Foreign Affairs of Denmark, n.d.-b) *(networking role)*.

The Danish government is strongly involved in projects promoting the branding of its industries. For the branding of the Danish green technology sector a combination of governmental parties, trade organizations and companies have founded State of Green. State of Green hosts a website which presents the Danish green solutions and (available in Chinese, English, German and Japanese), is present at trade missions and fairs and writes white-papers and news articles promoting the Danish green industry. It also has a physical location in Copenhagen to introduce visitors to the Danish sector *(networking and financing role)*. Additionally, it organizes tours for incoming delegations (aimed at policymakers and businesses), connecting visitors with Danish companies and organizations. With this program, it arranges tours for ~2000 incoming visitors each year. Governmental parties form approximately half of the board of State of Green, and have a strong say in the direction of the organization. Branding of the sector is seen as a vital part of a successfully exporting product and services of the Danish green sector, and support to State of Green is to be strengthened under the new export strategy of the Danish government (Udenrigsministeriet et al., 2017). The Danish government supplies about half of the finances of the State of Green organization (Appendix 1, xv).

The Danish government is looking for bilateral cooperation with markets that offer potential for its green energy technologies. One of the goals of this cooperation is to shape better framework conditions in these countries for Danish firms to export their goods to these markets *(regulative role)*. By offering knowledge and experience to foreign governments, they thus hope to affect the regulatory framework in these markets positively for Danish firms (Udenrigsministeriet et al., 2017). In their export strategy, they indicate the goal to strengthen cooperation on governmental level with Germany, the UK and the USA. With this cooperation, they aim to facilitate access for Danish companies to policy- and decision makers in these markets (Udenrigsministeriet et al., 2017). The Danish government is also looking for more forms of bilateral governmental cooperation with new growth markets (e.g. China).

Denmark has several Memorandums of Understanding regarding offshore wind or related fields *(regulative role)*. The most influential of likely to be the MOU between the Danish government (represented by its embassy in Washington) and the government of the USA (represented by its Board of Ocean Energy Management (BOEM)), on the cooperation and knowledge sharing regarding the development of offshore wind (The Government of the Kingdom of Denmark and The Government of the United States of America, 2016).

An MOU related to offshore wind is the MOU signed between the Danish government and the government of China regarding collaboration on green maritime technologies, including offshore activities (State of Green, 2017b). Additionally, Denmark has an MOU with China about the development of renewable energy, which has last been signed in 2014. Whether this MOU is still in function has not been confirmed during this study (The Government of the Kingdom of Denmark and The Government of the People's Republic of China, 2014). Offshoreenergy.dk has an MOU with Team Humber (UK) about cooperation in education, research and cooperation during trade missions (Garus, 2015). No governmental influence in the signing of this MOU has been found.

In this study, no regulative restrictions that have been implemented by the Danish government have been found for the preparation of entry for any of the markets that show potential for offshore wind products and services.

Concluding, the Danish government offers a wide range of market entry preparation activities. It has a wide international network and works together with consultants who could offer follow-up activities, and actively works on government-to-government cooperation. Additionally, it actively works together with the sector on the branding of its sector. It finances or partially finances a range of activities for companies, has programs for international market entry, and provides finances to its sector's branding initiatives.

Prevalence: [Executive, Regulative, Networking, Financing]:[High, High, High, High]

Export

The state-owned company Energinet.dk has a fully owned commercial department called Energinet.dk Energy Consultancy A/S. This consultancy firm exports knowledge about grid-related issues, including the connection of offshore wind farms (Energinet.dk Energy Consultancy A/S, n.d.) *(executive role)*.

To promote the exports of Danish companies, EKF (independently operating company owned by the Danish state) offers a range of financial products supporting exporting companies (EKF, n.d.-a) *(executive and financing role)*. Among these products, the most important credits are in the export credit guarantee range. These export credit guarantees offer security to banks or other investors, lowering the cost of capital raising the availability of capital for Danish exporting firms. The Danish state also has an AAA credit rating. EKF serves both SMEs and large companies (~respectively 80 percent and 20 percent of customers). EKFs is the world's leading export credit agency in wind products, and due to its 20 years of experience in the wind market is able to absorb large amounts of risk for wind projects. Wind projects contributed to 79% of EKFs new guarantees in 2016, amounting to 11 bln DKK (~€1.5 bln). Of these guarantees, ~4.6 bln DKK went to onshore wind projects and the remaining ~6.4 bln DKK went to offshore wind projects (EKF, 2016).

During this study, no regulative restrictions have been found implemented by the Danish government on the export of offshore wind products of goods to any of the markets showing potential for offshore wind. Denmark does have a clear point on the website of the Ministry of Foreign Affairs where Danish companies can report trade barriers. These are then addressed by the Danish government by reporting them to the European Commission (Ministry of Foreign Affairs of Denmark, n.d.-a).

No examples of governmental influence in Danish networks which support exporters with their actual exporting have been found during this study.

Concluding, the Danish government owns the organization which offers financial support to exporting companies and governmental agencies sporadically export some consultancy services. The financial products offered by the former organization are used often by the offshore wind sector. It does not use regulative nor networking activities to stimulate during the export stage.

Prevalence: [Executive, Regulative, Networking, Financing]:[Low, None, None, High]

	Denmark			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Energinet researching and developing grid security and voltage control concepts, Danish Energy Agency designing tender procedures	-	Innovation hub network	Innovation Fund Denmark offering Large-Scale Projects, InnoBooster and Entrepreneurial Pilot programs, Tax incentives capital expenses of R&D, Funding Offshoreenergy.dk
Testing	Energinet testing grid security and voltage control concepts	Open door tenders for test locations, onshore test permits for locations for large offshore turbines	-	Market premium subsidies to test locations, EUDP program, Large-Scale Projects program, Funding Offshoreenergy.dk
Domestic market development	Energinet developing offshore grid and substations and managing preliminary studies	Tenders for domestic offshore wind farms, additional open door procedure for offshore wind farms	-	Market premium to bid for tenders, feed-in tariff for open door, Danish Growth Fund, Market Development Fund, Large-Scale Projects program, Funds Offshoreenergy.dk
Foreign market exploration	Trade Council offering information on foreign markets, legislative frameworks and performing shallow market explorations, local sparring sessions and GROW program	-	Embassies cooperating with local consultancy firms	VITUS program, GROW program financing, upkeep embassies
Market entry preparation	Trade Council offering advice on setting up companies abroad, recruiting foreign staff, dealing with corruption, business partner scans, strategic advice to approach networks and getting access to international financing	Government-to-government framework and regulation design in foreign markets, memorandums of understanding with China and USA	Embassies cooperating with local consultancy firms, Innovation centres networks, State of Green	Financing of trade fairs, company visits, seminars and individual company meetings, State of Green, upkeep embassies
Export	Energinet.dk's Energy Consultancy, state-ownership of EKF offering export credit guarantees	-	-	Financing of products EKF

Figure 34: The research framework applied to the Danish case

	Denmark			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	*Low*	*None*	*Low*	*High*
Testing	*Low*	*High*	*None*	*High*
Domestic market development	*Medium*	*High*	*None*	*High*
Foreign market exploration	*High*	*None*	*High*	*Medium*
Market entry preparation	*High*	*High*	*High*	*High*
Export	*Low*	*None*	*None*	*High*

Figure 35: The rated prevalences of the governmental roles in the Danish case

4.3 Case: Germany

Germany is a country in the north-west of Europe with a population of approximately 82 mln. It is the world's 3th largest economy (International Monetary Fund, 2017), and is the world's 3rd largest export economy (OEC, n.d.-b).

The German offshore wind industry employed ~20.500 FTEs in 2015, with a turnover of ~4.7 bln euros (GWS, 2016), and these numbers are expected to rise in 2016 and 2017. Of this 4.7 bln, around 67 percent is accounted for by exports (in 2015) (German Wind Energy Association, 2015), amounting to ~3.1 bln euros. The German offshore wind industry holds a 20 percent (global) market share, mainly in offshore foundation construction, grid infrastructure and wind turbine exports (German Wind Energy Association, 2017).

4.3.1 Domestic market

History in offshore wind

Germany has been operating offshore wind turbines since 2004, and has seen its first offshore wind park (i.e. more than one turbine) in 2010. It currently has 16 installed offshore wind parks, which (combined with three solo turbines) amount to a total installed capacity of 4566 MW in August 2017 (4COffshore, n.d.-b; WindEurope, 2017). A list of offshore wind parks and their respective capacities can be found in Table 11.

Year	Name	Capacity (MW)
2004	Ems Emden (single turbine)	4.5
2006	Breitling (single turbine)	2.5
2008	Hooksiel (single turbine)	5
2010	Alpha Ventus	60
2011	EnBW Baltic 1	48
2013	BARD Offshore 1	400
2014	Meerwind Süd/Ost	288
2014	Riffgat	113
2015	Amrumbank West	302
2015	Borkum Riffgrund I	312
2015	Butendiek	288
2015	DanTysk	288
2015	EnBW Baltic 2	288
2015	Global Tech I	400
2015	Nordsee Ost	295
2015	Trianel Windpark Borkum	200
2016	Gode Wind 1 & 2	582
2017	Sandbank	288
2017	Veja Mate	402
	Total	4566

Table 11: Offshore wind farms in the Germany

Domestic market developments

As a part of the German Energiewende (the German transition from nuclear and fossil energy to low carbon energy sources) (Die Bundesregierung, 2017) the German government has set itself the goal to generate at least 80% of the total volume of power consumed in Germany from renewable energy sources by 2050. The share of renewable energy resources will have to be increased by 40 - 45% by 2025, and to 55 – 60% in 2035 (Allen & Overy, 2016). Offshore wind plays an important part in this transition.

Germany has recently revised its renewable energy act (Okt 2016), the 'Erneuerbare-Energien-Gesetz', (Bundesverband der Energie- und Wasserwirtschaft e.V., 2016), to defines the desired growth of Germany's offshore wind capacity. Due to the German grid having difficulties keeping up with the large amounts of wind energy being generated in the north of Germany, and having to be transported to the south by HVDC connections, the German government has reduced its ambitions towards offshore wind (Norton Rose Fulbright, 2017a). The Nordsee One farm (332 MW) and Wikinger farm (350 MW) and Nordergründe (111 MW) are expected to be fully commissioned later this year. Further wind farms under construction in German seas are the Arkona (385 MW, 2019), the Borkum Riffgrund 2 (450 MW, 2019), Merkur (396 MW, 2019) (4COffshore, n.d.-b).

Germany tendered 1490 MW of offshore wind parks in 2017, with some of the parcels resulting in the world's first subsidy-free tenders (Clark, 2017). It plans to tender another ~1600 MW in 2018, but after that will reduce the tendered capacity. It is planning a transitional period from 2021 – 2025, in which ~500 MW will be tendered yearly, and after 2026 it plans to introduce a centralized model with a yearly average tender volume of 840 MW. Germany plans to have 15 GW of installed capacity in 2030 (Allen & Overy, 2016; Dickson, 2017; Norton Rose Fulbright, 2017a).

Germany currently has the second most installed offshore wind capacity in the world (after the UK). With its current plans, Germany is expected to have the second most installed capacity for most of the 2020s, and is expected to be surpassed by China around halfway in the decade (Dickson, 2017; GWEC, 2017). Germany is the first country to formally consent to the tender and commissioning of wind parks after 2023, and has a steady pipeline of projects until 2030.

4.3.2 Organization of the German sector

The German offshore wind sector is comprised of a wide field of actors, with varying responsibilities. Figure 36 gives a simplified representation of the sector and the relations between its actors. Key actors are shortly expanded on below.

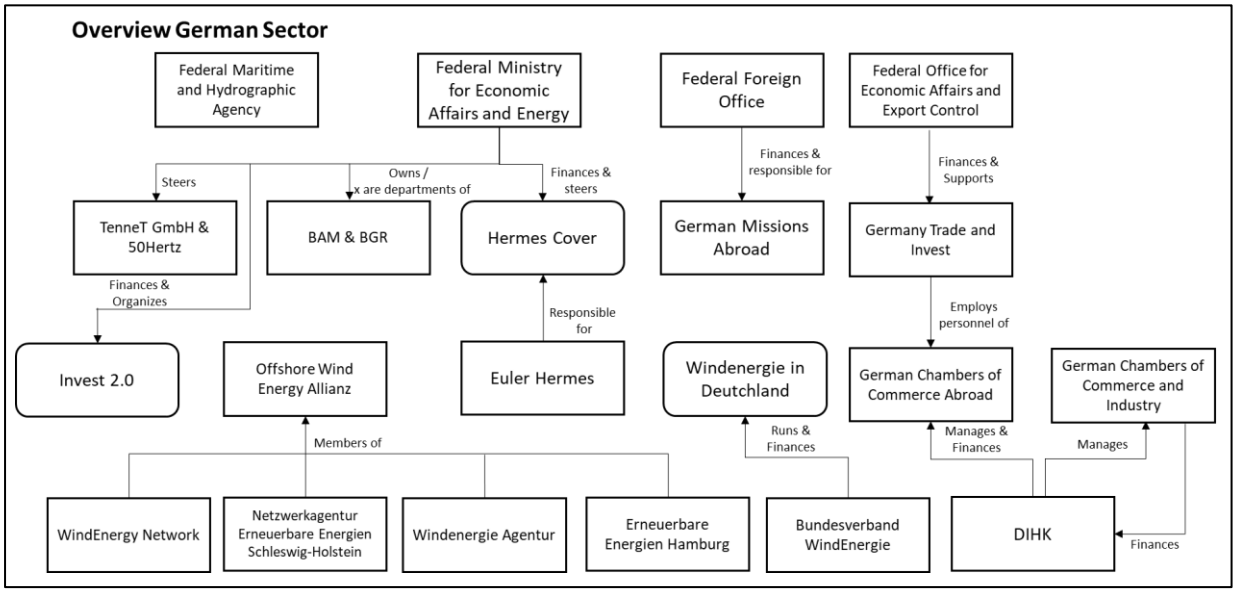


Figure 36: Overview of the German sector, the most important actors and their relations

Governmental parties

The Federal Ministry for Economic Affairs and Energy (BMWi) is the German Ministry responsible for investment, innovation, internationalization and energy policy. As such, they wield a wide range of instruments, and provide funding to a range of offshore wind-related activities discussed later in this chapter (Federal Ministry for Economic Affairs and Energy, n.d.). BMWi is the main ministry supporting German companies in both the domestic market and foreign markets, and works together closely with the German Chambers of Commerce and the Federal Agency for Investment Promotion (Germany Trade and Invest, or GTAI) (Barneveld van, 2014).

The BMWi is also the main responsible ministry for the export promoting products offered by Euler Hermes in Germany. A part of its organization are three departments performing research, development and testing activities. These are the Bundesanstalt für Materialforschung und -prüfung (BAM), the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Physikalisch-Technische Bundesanstalt (PTB). In this study, examples of research regarding offshore wind have been found related to the first two of these institutions (BAM and BGR).

The Federal Foreign Office is the organization in charge of the German Missions Abroad, i.e. the embassies, consulate-generals etc. The German Missions Abroad promote economic relations and activities in countries abroad (Federal Foreign Office, 2017).

Germany Trade and Invest is the economic development agency of the Federal Republic of Germany, and the main point of contact for foreign trade; both for German companies wanting to invest abroad and non-German companies looking do business in Germany (Germany Trade and Invest, n.d.-b). It primarily aims at supporting German SMEs, with a range of activities facilitating them in their

international business activities. It includes employees from the BAFA and from the Germany Chambers of Commerce Abroad

The Federal Office for Economic Affairs and Export Control (BAFA) is responsible for export and import controls, and supports SMEs in their domestic development. Among the instruments it offers to companies are the 'INVEST – Venture Capital Grant' program and the lending of administrative support to SMEs wanting to participate in selected fairs and exhibitions abroad (The Federal Office for Economic Affairs and Export Control, n.d.).

The Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie, BSH) is responsible for the approval of offshore wind turbine installations located in the Exclusive Economic Zone (EEZ). Federal states are responsible for the approval of installations in their territorial waters, which are in the 12-nautical mile perimeter from their coast (50Hertz, n.d.-b).

TSOs (non-governmental)
Germany has two TSOs responsible for the connection of offshore wind parks. TenneT connects the offshore wind parks in the North-Sea, ad 50Hertz connects the offshore wind parks in the Baltic Sea.

TenneT TSO GmbH is a subsidiary of TenneT, and performs regulated activities connecting ~24 mln people in Germany. A part of these regulated activities is the connection of offshore wind parks to the onshore grid. Its tasks in Germany stem from the German 'Energiewirtschaftsgesetz' (Energy Industry Law) (EnWG, 2017). TenneT TSO GmbH is owned by the Dutch Ministry of Economic Affairs, and owns TenneT Offshore GmbH which is responsible for its offshore wind activities (TenneT, 2017). TenneT Offshore GmbH founds a subsidiary company for each connection of an offshore wind farm, which are sometimes fully owned by TenneT Offshore GmbH (e.g. DolWin4), and sometimes attract investments from commercial companies (e.g. Mitsubishi) (van der Zee, 2015). TenneT Offshore takes care of the design, planning, construction and operation of offshore connections to onshore grid connection points, while TenneT itself is responsible for the connection procedure and grid control (TenneT, n.d.-a).

50Hertz is the German TSO responsible for the grid of North-East Germany, which encompasses the offshore wind park connections in the Baltic Sea. It is part of Elia Group, which also owns the Belgium TSO Elia. Its tasks in Germany stem from the German 'Energiewirtschaftsgesetz' (Energy Industry Law) (EnWG, 2017). 50Hertz owns the subsidiary company 50Hertz Offshore, which is responsible for the connection of offshore wind parks for 50Hertz. 50Hertz hosts commercial activities, but none are related to offshore wind farms. 50Hertz is responsible for the grid connection of all wind farms in the Baltic Sea (50Hertz, n.d.-a).

Non-governmental organizations
All German (commercial) companies are by law required to be members of their Chamber of Commerce and Industry (CCI). The Deutscher Industrie- und Handelskammertag (DIHK) is the association of all the 79 CCIs, and represents all German companies. The DIHK operates a worldwide network of German Chambers of Commerce Abroad (130 locations in 90 countries). German Chambers of Commerce Abroad are a representation of the German economy abroad. They promote global business relationships through their networks abroad, attract foreign companies to do business in Germany, and offer services to German companies that want to enter markets abroad (Deutscher Industrie- und Handelskammertag, n.d.).

The 'Bundesverband WindEnergie' is the German Wind Industry Association. With over 20.000 members, it represents the German wind industry's interests. It serves as a trade-organization, for both on- and offshore wind companies, connecting companies in the sector. Additionally, it serves as a lobby organization, conveying the interest of German companies to national and supra-national authorities (Bundesverband WindEnergie, n.d.). It acquires funds from membership fees and the sale of reports about the industry. No governmental funding, nor governmental influence in the direction of the organization has been found in this study.

The Bundesverband WindEnergie operates the 'Windindustrie in Deutschland' platform. This platform operates as in point where German companies can find information about developments in the market, as well as find partners / other companies to connect to. The platform is mainly aimed at the German sector, and does not focus on attracting foreign companies or exports (Windenergie in Deutschland, n.d.).

Additionally, there are four trade organizations in the North of Germany which are active in the promotion of (offshore) wind. These are the Windenergie Agentur (Wind Energy Agency, north-west of Germany, including Bremen), Erneuerbare Energien Hamburg (Renewable Energy Hamburg, metropolitan region Hamburg, Netzwerkagentur Erneuerbare Energien Schleswig-Holstein (Renewable Energy Network Agency, northern part of Germany connected to Denmark) and WindEnergy Network e.V. (Wind Energy Network, north-east of Germany including Rostock). Each of these organizations lobbies for the interests of their respective regions. The organizations cooperate to lobby for the interest of offshore wind in the umbrella-organization Offshore-Wind-Energie-Allianz (OWIA, n.d.). The (advisory) boards of these agencies commonly contain members of both regional and national governmental organizations.

Each of these individual organization has a program for internationalization / exports. Windenergie Agentur organizes workshops, fairs and exhibitions, does market research, publishes newsletters and reports and hosts incoming delegations of international visitors interested in the region's goods and services (Windenergie Agentur, 2013). The WindEnergy Network e.V. organizes workshops and is present at fairs and exhibitions with and for its members (WindEnergy Network, 2017). Netzwerkagentur Erneuerbare Energien offers consultancy to its members, with information about potential markets and support to gain the relevant funding. It also organizes trade missions and fairs to establish contacts with partners abroad, receives foreign delegations and common areas in fairs abroad (Netzwerkagentur Erneuerbare Energien Schleswig-Holstein, 2016). Lastly, Erneuerbare Energien Hamburg sends and hosts delegation to promote its region's technologies and companies (Renewable Energy Hamburg Cluster Agency, n.d.).

4.3.3 German government's roles in the export process

With the German sector and its actors introduced, the next part of the chapter will look into the governmental roles in the different stages of the export process. The different stages of the export process are expanded on separately. Some stages show some overlap in the instruments as some instruments are applicable for several stages. In that case, these instruments are mentioned several times in their respective applicable stages.

At the end of the chapter, Figure 37 will show the instruments of the different roles inserted in the framework, and Figure 38 will show the level of prevalence of the governmental roles in the case. A table of the ratings and motivation behind giving that specific rating is also presented in Appendix 6.5, an overview of the ratings is presented at the end of the case, and an overview of the ratings of all cases combined is found in Appendix 6.6.

Note that the German government has a range of research organizations which offer goods and services to the offshore wind industry, which are considered under its executive function. The German government is not the owner of TenneT TSO GmbH and 50Hertz, so activities performed by these organizations are not shared under the executive role. The German government is active in several networks and trade organizations that offer services to the offshore wind sector. In Germany, most companies are obliged to join a local Chamber of Commerce, and Germany has a range of Chambers of Commerce Abroad that fulfil functions which are done by embassies in other countries. These Chambers are officially independent organizations, but do fulfil sector-specific tasks for the German government as well. As these organizations work in a public-private partnership form, cooperation with these organizations is considered a networking function of the government, and not an executive function.

Research and development

The German government deviates from the approach of the Dutch and Danish governments in regards to research and development. The German BMWi encompasses two research organizations that perform research and development activities linked to offshore wind, the BAM and the BGR.

The Bundesanstalt für Materialforschung und -prüfung (BAM) performs its own research and development activities and can be hired by companies to perform research, tests or offer advice. These services provided to companies ask for an hourly fee of the company requesting them. BAM is thus allowed to perform services that could be performed by commercial parties. For their services to stay relevant, BAM is thus stimulated to keep innovating (Bundesministerium der Justiz und für Verbraucherschutz, 2013). Among these services are for example licencing and certification services for offshore wind farms *(executive role)*. The Bundesanstalt für Materialforschung und -prüfung performs research and development activities on amongst others the materials used in offshore wind turbine blades (Bundesanstalt für Materialforschung und -prüfung, 2015). It is also involved performing studies in the German Alpha Ventus offshore wind testing park, primarily focused on the foundations and of the turbines *(executive role)*.

The Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) performs research and development activities, and tests instruments for the environmental impact assessments of offshore wind parks. They are for example involved in the Alpha Ventus offshore wind testing park (RAVE, 2017) *(executive role)*.

On the federal level, the German government has released its 6th Energy Research Program (BMWi, 2014). This program is focused on a wide range of energy technologies, of which wind (on- and offshore) is one of the focus areas with funding priority. Research and development of this program takes shape in funded projects performed by research institutions like the Fraunhofer IWES, programs executed by the wind industry, and funding to test locations like the Alpha Ventus demonstration farm (Die Forschungsförderung des Bundesministeriums für Wirtschaft und Energie, n.d.) *(financial role)*.

The BMWi is the main German federal party subsidizing research and development projects in the wind industry. Through its 'Innovation durch Forschung' program, the BMWi has invested ~€136 mln in 2016 in innovation programs focused on the wind industry *(financing role)*. Of this €136 mln, €24 mln was invested directly in research and development programs focused on offshore wind, the rest of the budget is spread on projects on the development of on- and offshore parks, logistics, environmental research, meteorological research and some miscellaneous categories (Bundesamt für Wirtschaft und Energie, 2017). Overall, the BMWi is estimated to provide ~€50 mln per year on research and development concerning offshore wind energy (RAVE, n.d.). As such, this program applies to the research and development, the testing and the domestic development phase.

The Fraunhofer IWES is the main research organization for wind energy in Germany. This independent organization is allowed to perform a mix of commercial and public activities (Fraunhofer IWES, 2017). It received €7.1 mln in base funding in 2016, but receives a large portion of its funding for specific projects for public or private parties (Fraunhofer IWES, 2017) *(financing role)*.

The WIPANO program supports SMEs that are looking to get a patent on an innovation. It offers advice for the patent procedure, and can reimburse a part of the costs of the patent application (BMWi, 2017b) *(financial role)*.

The German government has an umbrella-program to connect all of its innovative cluster organizations, called the 'go-cluster' (BMWi, n.d.-c), which can support them in making their management more effective, and their innovation programs more efficient. At least one of the German regional trade association involved with offshore wind energy (the WAB) is connected to this program (BMWi, 2017c) *(networking role)*.

On the state level, each German Bundesland has programs for the stimulation of research and innovation of their companies. No programs which specifically focused on offshore wind were found

during this study (WAB e.V., 2017). The Netzwerkagentur Erneuerbare Energien has its own innovation program supporting companies in Schleswig-Holstein (EE.SH, n.d.). The author of this report is not aware of any governmental support regarding this program.

The current German offshore wind tenders select the winner of the tender solely on the lowest price of the bid (assuming they comply with the standard conditions set in the tenders). The tenders thus rely on cost-reductions as a primary driver for innovation (Huebler & Radov, 2017; Norton Rose Fulbright, 2017a). No indications have been found that this will change in the new tender system for tenders after 2025.

Concluding, the German government has research organizations that perform research and development activities which are sometimes related to offshore wind. It also hosts research programs which focus on offshore wind as part of broader wind programs, but these are not specifically aimed to connect companies in the sector. It utilizes a wide range of subsidies but uses little regulative stimulants for research and development.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, Low, Medium, High]

Testing

As indicated under the previous header, the BAM and BGR perform testing activities next to their research and development activities *(executive role)*. The also previously mentioned 'Innovation durch Forschung' program also offers financing for demonstration activities and the Alpha Ventus demonstration farm *(financial role)*.

The main testing and demonstration site for offshore wind in Germany is the Alpha Ventus. This wind farm, which was the first German offshore wind farm, has a range of research and testing projects running, which are shared under the Research at Alpha Ventus (RAVE) project *(regulative role)*. The farm hosts 12 turbines which each has 5 MW of capacity (Deutsche Offshore-Testfeld und Infrastruktur GmbH & Co.KG, 2015). Alpha Ventus falls under the old subsidy regimen for offshore wind parks, and receives a market premium price on the electricity it generates (Deutsche Offshore-Testfeld und Infrastruktur GmbH & Co.KG, 2015). The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety also provided €30 mln in funds for the construction of the farm *(financial role)*.

The Fraunhofer IWES organization has recently received approval and funding from BMWi for an offshore wind site, suited for one test turbine *(regulative and financial role)*. They plan on testing the 8 MW Adwen offshore wind turbine, which is currently the largest wind turbine in the world. The tests will be performed in close cooperation with Adwen GmbH, and will be open to other research partners (Fraunhofer Institute for Wind Energy and Energy System Technology, 2017). The Fraunhofer IWES will receive €18.5 mln for the construction of new its offshore wind test site from the BMWi. Additionally, Fraunhofer is planning to construct a test centre for the bearings of (on- and offshore) turbine bearings, for which it will receive €19.9 mln from BMWi and the municipality of Hamburg. For a test facility for (on- and offshore) blades in Bremen it will receive €10 mln from BMWi and the municipality of Bremen (Fraunhofer IWES, 2017) *(financial role)*.

The Federal Maritime and Hydrographic Agency (BSH) (in the name of the Federal Ministry of Transport and Digital Infrastructure) is responsible for the awarding of permits for offshore wind (test) locations. Companies and organizations can submit a request for a permit for a test location within the German territorial waters or economic exclusive zone, which can be accepted by the BSH if it meets the applicable requirements. The German government has pre-selected preferential areas for offshore wind parks, and it is unlikely that application outside these areas will be accepted (Bundesamt für Seeschifffahrt und Hydrographie, 2017) *(regulative role)*.

Concluding, the German government has research organizations which also perform testing activities which sometimes relate to offshore wind. It utilizes its regulation around its waters to host large offshore test sites, and allows the development of additional test sites and other onshore test facilities.

While it is not active in networks stimulating testing, it has a wide range of subsidies and funds available for companies that want to develop and test concepts, or that support current test locations.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, High, None, High]

Domestic market development

The German system on the regulation around offshore wind farms is currently undergoing large changes. The current and future systems will work with a tender system, in which the government will determine the capacity and preferential areas of offshore wind parks to be constructed. In the tenders of 2017 and 2018, companies are free to submit proposals on where in the preferential areas they want to construct the wind farms. In tenders after 2018, the German government will pre-determine the areas where the wind parks will be located. In both cases, the capacity of the farms is determined by the German government (Allen & Overy, 2016; Huebler & Radov, 2017) *(regulative role)*.

Current offshore wind parks in Germany, and offshore wind parks that received a confirmation or allocation of their connection capacity before January 2017, are reimbursed with a market-premium system without auctions. These parks are thus granted a fixed subsidy per unit of electricity generated. Wind parks tendered after January 2017 will fall under a market premium tender system similar to that of Denmark and the Netherlands (as demanded by EU regulation) (Watson Farley & Williams, 2016) *(financial role)*. Once the centralized system starts in 2025, the German government will also perform (and pay) the site investigations for the upcoming offshore wind parks (PWC, 2017b). Before the introduction of this system, these are paid for by the bidding parties *(financial role)*. Costs for the grid connection of the offshore wind parks are currently paid by the TSO (and socialized by levies to consumers) (Schittekatte, 2016b). The TSOs in Germany are not owned by the German state, but their grid-related tasks are regulated *(regulative role)* by German electricity laws (BMWi, 2017a).

The Federal Maritime and Hydrographic Agency is responsible for performing the preliminary studies on the to-be-tendered parcels for offshore wind (BMWi, 2017a). These studies will be fully paid for by BMWi in the tender procedures after 2025 (Allen & Overy, 2016). The Federal Maritime and Hydrographic Agency has its own survey vessels performing studies (BSH, n.d.) *(executive role)*, but also works together with commercial companies performing the preliminary studies of the offshore parcels (Offshorewind.biz, 2015).

The German government offers a range of financial incentives for companies to support them in their development on the domestic market. The earlier mentioned 'Innovation durch Forschung' program is one of the programs *(financial role)*. Other programs offered are expanded on below.

The 'Invest 2.0' program stimulates the availability of venture capital for young innovative enterprises. It does so by removing taxes on investments, and removing risks by offering a subsidy which has to be paid back if the company succeeds. The program is available for innovative companies with < 50 FTEs that are younger than 7 years. The program has mobilized 211 mln euros in venture capital from 2013 to 2016 (BMWi, 2016) *(financial role)*.

Der High-Tech Gründerfonds (HTGF) invests in technology-oriented young enterprises that have high-risk high-potential products. It provides these enterprises with co-investments up to €600.000 euros (BMWi, 2017b) *(financial role)*.

The Zentralen Innovationsprogramm Mittelstand (ZIM) supports SMEs in bringing their ideas to the market. For this it offers a range of funding opportunities. Availability of the funding depends on the size of the SME, and whether the project is executed by one or several companies (BMWi, n.d.-a, 2017b) *(financial role)*.

German companies are by law required to be a member of one of the German Chambers of Commerce and Industry (with some exceptions for vocations like handicraft businesses and farms) (DIHK, n.d.) *(regulative role)*. These chambers are comparable to guilds. They provide a range of services to companies in their region, and must be consulted when regulatory changes regarding their sector are implemented.

As such, they function in a public-private partnership relation with the German government (Barneveld van, 2014) *(networking role)*.

Four of the northern German Bundesländer have their own trade organization for offshore wind projects. These organizations are often supported by their local respective local governments (WAB e.V., n.d.; WindEnergy Network e.V., n.d.). These trade organizations work together through the Offshore Wind Energie Allianz. No central governmental influence in the OWEA has been found in this study. No central governmental influence has also been found in the German Wind Energy Association. The four trade-organizations in the north of Germany that are members of the Offshore Wind Energie Allianz are committed to regional development. Local governments support these organizations to reach these goals. In this study it was found that at least two of the four trade organizations receive funding from their region (WAB e.V., n.d.; WindEnergy Network e.V., n.d.). As the WindEnergy Network e.V. organizations is situated in Mecklenburg-Vorpommern, which is a region receiving structural funds from the European Union (European Commission, 2014), they are also able to receive European funding. No federal funding to these organizations was found.

Concluding, the German government has organizations that are active in a relatively small part of the offshore wind farms (preliminary studies), which perform contracting, managerial but also physical activities on this part of the farms. Domestic growth is almost completely determined by regulation in the old and new system. The German government has an active role in the steering of its Chambers, but is not involved in trade organizations. It offers a wide portfolio of subsidies and funds for companies and projects in the offshore wind sector.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, High, Medium, High]

Foreign market exploration

Under the Exportinitiative Energie program, BAFA (as an executive organization under BMWi) organizes information events for companies interested in entering foreign markets. During these events, experts provide overviews of market opportunities and sector-specific sales potentials (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-a). Incoming missions and networking events in Germany are also organized by BAFA *(executive role)*.

BAFA makes a distinction between market exploration missions (Markterkundungsreise) and trade missions bringing companies in contact with market parties (Geschäftsanbahnungsreisen). The former are organized as training events for German companies, who can gain experience and knowledge about the opportunities in foreign markets. These missions are sector-specific, and sometimes also offer opportunities to meet companies or local decision makers (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b). The latter are described under the next header.

Market exploration missions organized by BAFA are organized for groups of maximum 20 people. The costs of these missions are mostly covered by BMWi *(financial role)*, but the participants of the trade mission are expected to contribute between 500 and 1000 euros, depending on the size of the company they represent (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b) *(executive role)*.

The 'Exportinitiative Energie' program offers SMEs the possibility to participate in a highly subsidized community stand at selected fairs and exhibitions (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-a). Trade missions organized by BAFA are organized for groups of 8 to 12 SMEs, but large companies can join when the minimum amount of companies is reached. The costs of these trade missions are mostly covered by BMWi, but the participating companies are expected to contribute between 500 and 1000 euros per company for the organization of these trips, with the height of the price depending on company size (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b). A similar program is offered for the visitation of symposiums (with the same participant obligations) *(executive and financing role)*.

Germany Trade and Invest offers standardized information to German SMEs of trends and market developments in more than 50 strategic growth markets. This information is presented in the published

articles, which can be bought by interested companies (for €2.50 per article) (Germany Trade and Invest, n.d.-a) *(executive role)*.

Germany has a network of German Chambers of Commerce Abroad. These Chambers are also public-private partnerships with the German government, and are usually locally established companies, in the countries in which they promote German companies (Barneveld van, 2014; Deutscher Industrie- und Handelskammertag, n.d.). The Chambers offer a range of services to German companies interested in exploring and entering foreign markets. These services include the supply of market information, information and support around legal and fiscal issues, translation services and support to companies attending fairs (Barneveld van, 2014). Services offered by the Chambers of Commerce abroad generally have hourly fees for the companies making use of these services, and are partially funded by the Chambers themselves *(networking role)*.

The BMWi offers funding to some of its Chambers of Commerce Abroad. This funding is channelled through the DIHK, and varies per Chamber of Commerce. Funding depends on the maturity of the Chamber, this is generally only a fraction of the overall budget of the Chambers (Barneveld van, 2014) *(financing role)*.

Concluding, the German government has a moderate portfolio of instruments available for foreign market exploration and cooperates with its Chambers to offers services and local consultants, yet hosts no large programs for market exploration. It offers some reimbursements to companies undertaking market exploration activities, but most activities are paid for by the companies or the Chambers. It makes no use of regulation to stimulate or discourage market exploration.

Prevalence: [Executive, Regulative, Networking, Financing]:[Medium, None, Medium, Low]

Market entry preparation

Under the 'Exportinitiative Energie' program, the German foreign trade chambers and BAFA organize trade missions and delegation trips promoting German energy solutions. These core element of these missions are individual appointments with German businesses and potential foreign partners / customers. Market analyses are provided to participating companies prior to the trip (Bundesamt für Wirtschaft und Ausfuhrkontrolle, n.d.-b) *(executive and networking role)*. Most of the other market entry preparation products are offered by the German Chambers of Commerce, with the German government sometimes steering where these should be offered *(networking role)*. Companies receive reimbursements for a part of the costs of participating in trade and delegation trips *(financing role)*.

The German BMWi engages in regular dialogue with institutions abroad, to both foster bilateral economic relations and promote the activities of German firms abroad (BMWi, n.d.-b) *(networking role)*. This dialogue can lead to formal forms of cooperation, like memorandums of understanding *(regulative role)*. Two German memorandums of understanding related to offshore wind energy have been found during this study.

The first memorandum of understanding found is signed between the Taiwanese Ministry of Economic Affairs and the German government's representative in Taiwan, and focuses on energy policy for the promotion of clear and renewable energy (Wen-shin, 2016).

A second memorandum found in this study is signed between the WAB (DE) and OrbisEnergy (UK), on cooperation in the development of offshore wind energy in Germany and the UK. No governmental parties have been found to be involved in this MOU (Offshorewind.biz, 2014).

The German Federal Ministry of Research and Education has an internationalization program to promote international networking activities (Federal Ministry of Education and Research, 2014). No official branches of this program in the embassies or Chambers of Commerce Abroad have been found in this study. No activities or programs aimed specifically at the offshore wind sector have been found either (BMBF, 2017).

The four trade-organizations in the north of Germany that are members of the Offshore Wind Energie Allianz each hosts a range of activities to promote and support the companies of their respective regions in exploring and entering markets abroad. During these activities, they often work closely together with local governments (and often receive financial support). No cooperation with or influence from the federal government has been found in these organizations during this study.

During this study, no regulative restrictions that have been implemented by the German government have been found that impede foreign market exploration for any of the markets that show potential for offshore wind products. Germany has no centrally / governmentally coordinated branding initiatives for its (offshore) wind industry.

Concluding, the German government offers a small number of activities stimulating market entry, and relies mostly on the German Chambers to offer these services. Working together with the Chambers it has a large international network and works together with consultants abroad. It is not active in the branding of its sector. It offers little funding to market entry preparation activities or the Chambers. Few examples of regulative cooperation between the German government and other governments concerning offshore wind have been found.

Prevalence: [Executive, Regulative, Networking, Financing]:[Low, Low, Medium, Low]

Export

The export supporting products offered by Hermes in the Hermes Cover product line are executed the German Branch of Hermes Euler, a private company. This company works together with the German state in a public-private partnership relation (Euler Hermes Aktiengesellschaft, n.d.). The main product in this line is export credit guarantees. These guarantees are based on the German state's AAA credit rating. Hermes Euler provided €827 mln on export credit guarantees to the renewable energy sector in 2016, of which the majority went to project in wind (Hermes Cover, 2017). This study found no programs specified for offshore wind projects, or exact numbers on export credit finances awarded to offshore wind projects by Hermes Cover. Several offshore wind projects have used the services of Hermes Cover (Appendix 1, i & xi) *(networking and financing role).*

BMWi is in charge of the development of the German offshore wind tenders (BMWi, 2017a). The Federal Grid Agency is responsible for the execution of the tender procedure (Norton Rose Fulbright, 2017a). Germany is currently in the process of revising its own tender procedures. Examples of the export of the knowledge of German governmental agencies on tender procedures have not been found during this study.

Germany offers 'German Centres' to German companies who wants to operate in certain foreign markets. These centres rent offices (often below market rates), offer advice and can connect German companies that do business in that market *(networking role)*. However, the only centres that could be relevant for offshore wind are those in China (Bejing, Shanghai and Tiacang), and no examples of companies operating in the wind industry making use of their facilities are found (German Centre for Industry and Trade, n.d.).

No examples of the German government exporting goods or services have been found during this study. No regulative restrictions by the German government, BAFA or other organizations are found that have been implemented by the German government for the import and export of specifically offshore wind goods and services. No examples of governmental influence in German networks which support exporters with their actual exporting have been found during this study.

Concluding, the German government cooperates with commercial parties to offer a range of financial products stimulating export which are often used by the offshore wind sector. It exports no goods or services itself, nor does it implement any specific regulation to stimulate or prohibit the export of goods in the offshore wind sector.

Prevalence: [Executive, Regulative, Networking, Financing]:[None, None, Low, High]

	Germany			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	BAM researching materials for offshore wind components, BGR researching instruments and EIAs	Commercial freedom research organization	Go-cluster network	Projects financed by the 6th Energy Research Program, Innovation Durch Forschung program, WIPANO program
Testing	BAM testing material concepts for offshore wind components, BGR testing instruments for offshore wind measurements	Alpha Ventus windfarm and attached RAVE project, offshore wind test farm Fraunhofer IWES, possibilities test locations outside EEZ	-	Innovation Durch Forschung program, financing to construction and testing Alpha Ventus including market premium on output, funding to Fraunhofer test facilities
Domestic market development	BSH performing preliminary studies	From allocation of connection to pre-arranged tender system for offshore wind farms, obligatory membership of German Chambers of Commerce, regulatory steering of TSOs	Chambers of Commerce network	From market premium system to tender system for generated electricity, Innovation Durch Forschung program, HTGF program, ZIM program, Invest 2.0 program
Foreign market exploration	BAFA organizing information events, incoming missions and networking events, market exploration missions, Exportinitiative Energy community stands, standardized information GTIA	-	Network and activities offered by Chambers of Commerce Abroad	Reimbursement costs market exploration missions companies, subsidies for companies at community stand, funding of Chambers of Commerce Abroad
Market entry preparation	BAFA and German foreign trade chambers organizing trade missions and delegation trips	Memorandum of understanding with Taiwan	Network and activities offered by Chambers of Commerce Abroad, trade and delegation trips from BAFA and German trade chambers	Funding of Chambers of Commerce Abroad reimbursements costs participation trade or delegation trips
Export	-	-	Cooperation with Hermes Euler for offering export promotion financing, German Centres	Financing of the Hermes Cover line

Figure 37: The research framework applied to the German case

	Germany			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	*Medium*	*Low*	*Medium*	*High*
Testing	*Medium*	*High*	*None*	*High*
Domestic market development	*Medium*	*High*	*Medium*	*High*
Foreign market exploration	*Medium*	*None*	*Medium*	*Low*
Market entry preparation	*Low*	*Low*	*Medium*	*Low*
Export	*None*	*None*	*Low*	*High*

Figure 38: The rated prevalences of the governmental roles in the German case

Appendix 5 – Additional findings

In this Appendix, the additional findings of this study which fall outside the scope of the research framework are presented, which expand on the findings presented in chapter seven in the main report. The first finding looks at potential improvements to the organizational structure of the Dutch sector. The second finding looks at applications of export credit guarantees for offshore projects in the domestic offshore wind market. The third finding looks at developments in the tender procedures and their similarity to option pricing.

5.1 Organization of the sector

The organization of the sectors between the case-countries differs, but the Dutch and Danish organization of the sector is relatively similar. Both countries have a Ministry of Foreign Affairs responsible for export promotion services, an executive agency for the practical procedures around the tenders (RVO and DEA), a wind energy association (NWEA and DWIA), an offshore energy association (IRO and Offshoreenergy.dk), an export promotion organization (HHWE and DWEA) and a nationally owned TSO responsible for the offshore grid (TenneT and Energinet). There are some interesting differences between the precise roles and cooperation between those organizations though.

The most impactful difference in cooperation and roles for the export of the offshore wind products is the position of Holland Home of Wind Energy (HHWE) and the Danish Wind Export Association (DWEA) in their respective systems. In the Netherlands, the NWEA, IRO and HHWE all provide export promotion services to their members, but have separate (although sometimes overlapping) groups of members. As such, to take full advantage of the export promotion services offered by the sector, parties in the sector need to stay updated on the activities of each of these organizations. The export-focused association of HHWE has only 36 members, while the other organizations have larger members pools, leading to a scarcity of resources for the export promotion services offered by HHWE. The demand for these services is higher than the supply of the organizations (Appendix 1, ix & xii).

In Denmark, the DWEA is the responsible organ for export promotion services. This organization is a mutually coordinated organ of the Danish Wind Industry Association and the Danish Export Association. Members of both organizations can make use of the services of the Danish Wind Export Association, giving this association a large potential of resources, and making the Danish Wind Export Association a clear point to start export activities.

A similar structure in the Dutch sector could improve the transparency of the export promotion offered by the sector, and provide a better distribution of resources to more effectively approach export promotion. From an organizational point, a logical step would be the merger between HHWE and NWEA or HHWE and IRO, and a potential second step would be a model where HHWE would become a mutually coordinated organ of NWEA and IRO[7].

5.2 Export credit guarantees

Export credit guarantees are insurance products offered to domestic parties who like to export abroad, in order to protect them from the risks around their investments. As such, they are typically a financial product available to exporting companies, but not to companies operating domestically. The fact that these products are offered by governments allows them to have the highest credit rating and insurance for large volumes of investments; something most commercial credit guarantee agencies cannot offer.

Many of the risks covered by export credit guarantees, such as the risk of producers defaulting or projects being cancelled due to external factors, are also faced by domestically operating companies. When similar financial products to insure domestic companies do not exist, these domestic companies can be at a disadvantage compared to foreign investors. This is the case in several European countries where offshore wind projects take place, of which the Netherlands is one of them.

[7]These findings have been presented to and discussed with the relevant trade organizations, and steps are currently being taken to explore possibilities for further integration of the services of these associations.

Belgium and France faced similar challenges, and have decided to offer their export credit guarantees not only to companies exporting from their country, but also to domestic companies working on offshore wind projects in their own countries. With this liberal application of their export credit guarantees, they ensure a level playing field for their own industry (Appendix 1, i).

As the Dutch domestic offshore wind industry is expected to grow strongly, a similar system could give Dutch companies an edge (or take away a disadvantage) in their participation in national projects. As such, the Dutch Ministry of Foreign Affairs, together with the Dutch Ministry of Finance could explore the feasibility of concept together with the Dutch Atradius.

5.3 Option pricing

In option pricing, companies or traders invest into having an opportunity to establish or construct something later on. Companies or traders invest in 'real options', as having this opportunity has an economic value on itself, as it allows for flexibility and potential benefit.

In the offshore wind sector, the last tenders have seen large reduction in the necessary subsidies, and the last German tenders have seen three out of four of the tendered parcels being won by bids requiring no subsidies. While these no subsidy bids are in general good news for the sector, proving the advancements made in the sector and the viability of offshore wind, there are some new risks that arise with these developments.

The winning bids in the last round of German tenders affect offshore wind farms which have to be commissioned in 2023 and 2024. The bidding parties have made assumptions in the development of the size of the turbines (there being 10 - 15 MW turbines available at the time of construction) and developments in electricity price (which they assume will rise) which heavily affect the viability of their bids. If these assumptions prove false, the project developers have the option to continue or cancel the project. There is a fine on the cancellation of these wind farms (€10 – 27 mln in the last German tenders) (Huebler & Radov, 2017), but compared to the full investment which encompasses the construction of such a farm (several billion euros), these fines are financially very acceptable for the companies compared to the option of constructing and operating a wind farm at a loss (Appendix 1, xiv). The bids on these tenders could thus be seen as relatively cheap 'real options', which put most of the risks of the projects on society.

The damage to the society of the cancellation of such an offshore wind farms would be substantial though; new tender procedures, delays in the commissioning of offshore wind farms, companies anticipating projects which will be delayed and general damage to the reputation of the country's reliability in the offshore wind sector could mean a large setback to the country hosting the cancelled project.

As such, it is important that policymakers ensure that the regulation around the auction design limits the risks of non-delivery to an acceptable level, balancing risk absorbed by society leading to lower auction prices and incentives of companies to not choose the option of non-delivery (Huebler & Radov, 2017). In the Netherlands, it is important that these issues are taken in account by the team of the Ministry of Economic Affairs and RVO responsible for the planning of the upcoming tenders for the Dutch offshore wind farms.

Appendix 6 – Frameworks of the study

In this Appendix, the large and full versions of the frameworks used in this study are presented. In Figure 39 and Figure 40 the full framework of the case studies is presented, which is based on chapter five, chapter six and the full case studies in Appendix 3. In Figure 41, Figure 42 and this framework is presented for each country separately. In Figure 44 and Figure 45 the framework which is used to rate the prevalences, which is based on the methodology described in chapter four, and uses the results of the full version of the case studies presented in Appendix 3. The rated prevalences of the governmental roles are visualized in Figure 46and Figure 47, which are larger versions of the framework presented in chapter six.

6.1 Full framework comparative case study

		The Netherlands	Denmark	Germany	Points of improvement NL
Research and development	*Executive*	Tennet (NL) researching and developing new grid concepts, Dutch Ministry of Economic Affairs and Netherlands Enterprise Agency designing tender procedures	Energinet researching and developing grid security and voltage control concepts, Danish Energy Agency designing tender procedures	BAM researching materials for offshore wind components, BGR researching instruments and EIAs	Increase utilization of regulative steering in tenders towards exportable technologies, ensure sector is acquainted with services Innovation Attaché network, acquire data for the assessment and benchmark of efficiency subsidies and Topsector policy
	Regulative	Innovation design obligations in former wind farms, commercial freedom governmentally funded research organizations	-	Commercial freedom research organization	
	Networking	Governmentally founded Topsector policy and involvement in GROW project, Dutch embassies hosting an international Innovation Attaché network	Innovation hub network	Go-cluster network	
	Financing	Financing to Topsector management and research projects, funding independent research organizations, MIT, SBIR and WBSO programs	Innovation Fund Denmark offering Large-Scale Projects, InnoBooster and Entrepreneurial Pilot programs, Tax incentives capital expenses of R&D, Funding Offshoreenergy.dk	Projects financed by the 6th Energy Research Program, Innovation Durch Forschung program, WIPANO program	
Testing	*Executive*	Tennet (NL) testing grid-connection concepts	Energinet testing grid security and voltage control concepts	BAM testing material concepts for offshore wind components, BGR testing instruments for offshore wind measurements	Ensure a continuation of the co-location model and implement an open-door policy for test locations, offer subsidies focusing on technology with high export potential
	Regulative	Separate tender procedure for offshore wind demonstration site Borssele V, onshore test location permits and access criteria	Open door tenders for test locations, onshore test permits for locations for large offshore turbines	Alpha Ventus windfarm and attached RAVE project, offshore wind test farm Fraunhofer IWES, possibilities test locations outside EEZ	
	Networking	Innovatielink, Topsector policy	-	-	
	Financing	SDE+ for demonstration site, DEI and Hernieuwbare Energy programs	Market premium subsidies to test locations, EUDP program, Large-Scale Projects program, Funding Offshoreenergy.dk	Innovation Durch Forschung program, financing to construction and testing Alpha Ventus including market premium on output, funding to Fraunhofer test facilities	
Domestic market development	*Executive*	TenneT (NL) developing offshore wind grid and substations, Netherlands Enterprise Agency managing preliminary studies parcels	Energinet developing offshore grid and substations and managing preliminary studies	BSH performing preliminary studies	Ensure that InvestNL meets the needs of the sector for risk-, seed- and venture capital or implement additional means of financing for risk-, seed- and venture capital
	Regulative	(yearly) Tenders for domestic offshore wind farms, no state-level regulation for nearshore or lake areas to develop offshore wind farms	Tenders for domestic offshore wind farms, additional open door procedure for offshore wind farms	From allocation of connection to pre-arranged tender system for offshore wind farms, obligatory membership of German Chambers of Commerce, regulatory steering of TSOs	
	Networking	Innovatielink, Topsector policy	-	Chambers of Commerce network	
	Financing	SDE+ for domestic offshore wind farms, Borgstelling MKB Kredieten, Garantie Ondernemingsfinanciering, Innovatiekrediet and seed-business angels program, Future InvestNL program	Market premium to bid for tenders, feed-in tariff for open door, Danish Growth Fund, Market Development Fund, Large-Scale Projects program, Funds Offshoreenergy.dk	From market premium system to tender system for generated electricity, Innovation Durch Forschung program, HTGF program, ZIM program, Invest 2.0 program	

Figure 39: Full framework of the comparative case study, part 1

		The Netherlands	Denmark	Germany	Points of improvement
Foreign market exploration	*Executive*	Embassies performing exploratory studies, general information on foreign markets and their regulatory frameworks, organization trade missions by several governmental agencies	Trade Council offering information on foreign markets, legislative frameworks and performing shallow market explorations, local sparring sessions and GROW program	BAFA organizing information events, incoming missions and networking events, market exploration missions, Exportinitiative Energy community stands, standardized information GTIA	Add business-specific paid services to embassies or arrange cooperation between embassies and local consultants for high-potential markets, explore the utilization of Dutch chambers of commerce's international network for offshore sector
	Regulative	-	-	-	
	Networking	Public-private export meetings, Policy-level cooperation, pitches for domestic parties, Oranje Missiefonds program	Embassies cooperating with local consultancy firms	Network and activities offered by Chambers of Commerce Abroad	
	Financing	Upkeep embassies ,SIB program	VITUS program, GROW program financing, upkeep embassies	Reimbursement costs market exploration missions companies, subsidies for companies at community stand, funding of Chambers of Commerce Abroad	
Market entry preparation	*Executive*	Embassies performing business scans, Netherlands Enterprise Agency organizing innovation matchmaking missions, governmental agencies organizing trade missions, Holland Branding	Trade Council offering advice on setting up companies abroad, recruiting foreign staff, dealing with corruption, business partner scans, strategic advice to approach networks and getting access to international financing	BAFA and German foreign trade chambers organizing trade missions and delegation trips	Follow recommendations foreign market exploration, in addition aim to utilize knowledge on tender design and grid-connection to enhance government-to-government cooperation with upcoming offshore wind markets, initiate national branding initiative in cooperation with trade organizations
	Regulative	Government-to-government cooperation in the form of memorandums of understanding with China and Taiwan	Government-to-government framework and regulation design in foreign markets, memorandums of understanding with China and USA	Memorandum of understanding with Taiwan	
	Networking	Innovation attachés and embassies hosting networks connecting domestic parties to international partners, knowledge exchange of tender procedures	Embassies cooperating with local consultancy firms, Innovation centres networks, State of Green	Network and activities offered by Chambers of Commerce Abroad, trade and delegation trips from BAFA and German trade chambers	
	Financing	Upkeep embassies, PIB program, partial reimbursements trade-missions	Financing of trade fairs, company visits, seminars and individual company meetings, State of Green, upkeep embassies	Funding of Chambers of Commerce Abroad reimbursements costs participation trade or delegation trips	
Export	*Executive*	-	Energinet.dk's Energy Consultancy, state-ownership of EKF offering export credit guarantees	-	-
	Regulative	-	-	-	
	Networking	Cooperation with Atradius (NL) for offering export promotion financing	-	Cooperation with Hermes Euler for offering export promotion financing, German Centres	
	Financing	Financing of Atradius' Dutch State Business line of export promotion financing products	Financing of products EKF	Financing of the Hermes Cover line	

Figure 40: Full framework of the comparative case study, part 2

6.2 Large version case study Netherlands

	The Netherlands			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Tennet (NL) researching and developing new grid concepts, Dutch Ministry of Economic Affairs and Netherlands Enterprise Agency designing tender procedures	Innovation design obligations in former wind farms, commercial freedom governmentally funded research organizations	Governmentally founded Topsector policy and involvement in GROW project, Dutch embassies hosting an international Innovation Attach é network	Financing to Topsector management and research projects, funding independent research organizations, MIT, SBIR and WBSO programs
Testing	Tennet (NL) testing grid-connection concepts	Separate tender procedure for offshore wind demonstration site Borssele V, onshore test location permits and access criteria	Innovatielink, Topsector policy	SDE+ for demonstration site, DEI and Hernieuwbare Energy programs
Domestic market development	TenneT (NL) developing offshore wind grid and substations, Netherlands Enterprise Agency managing preliminary studies parcels	(yearly) Tenders for domestic offshore wind farms, no state-level regulation for nearshore or lake areas to develop offshore wind farms	Innovatielink, Topsector policy	SDE+ for domestic offshore wind farms, Borgstelling MKB Kredieten, Garantie Ondernemingsfinanciering, Innovatiekrediet and seed-business angels program, Future InvestNL program
Foreign market exploration	Embassies performing exploratory studies, general information on foreign markets and their regulatory frameworks, organization trade missions by several governmental agencies	-	Public-private export meetings, Policy-level cooperation, pitches for domestic parties, Oranje Missiefonds program	Upkeep embassies ,SIB program
Market entry preparation	Embassies performing business scans, Netherlands Enterprise Agency organizing innovation matchmaking missions, governmental agencies organizing trade missions, Holland Branding	Government-to-government cooperation in the form of memorandums of understanding with China and Taiwan	Innovation attach é s and embassies hosting networks connecting domestic parties to international partners, knowledge exchange of tender procedures	Upkeep embassies, PIB program, partial reimbursements trade-missions
Export	-	-	Cooperation with Atradius (NL) for offering export promotion financing	Financing of Atradius' Dutch State Business line of export promotion financing products

Figure 41: Large version of the framework applied to the Dutch case study

6.3 Large version case study Denmark

	Denmark			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	Energinet researching and developing grid security and voltage control concepts, Danish Energy Agency designing tender procedures	-	Innovation hub network	Innovation Fund Denmark offering Large-Scale Projects, InnoBooster and Entrepreneurial Pilot programs, Tax incentives capital expenses of R&D, Funding Offshoreenergy.dk
Testing	Energinet testing grid security and voltage control concepts	Open door tenders for test locations, onshore test permits for locations for large offshore turbines	-	Market premium subsidies to test locations, EUDP program, Large-Scale Projects program, Funding Offshoreenergy.dk
Domestic market development	Energinet developing offshore grid and substations and managing preliminary studies	Tenders for domestic offshore wind farms, additional open door procedure for offshore wind farms	-	Market premium to bid for tenders, feed-in tariff for open door, Danish Growth Fund, Market Development Fund, Large-Scale Projects program, Funds Offshoreenergy.dk
Foreign market exploration	Trade Council offering information on foreign markets, legislative frameworks and performing shallow market explorations, local sparring sessions and GROW program	-	Embassies cooperating with local consultancy firms	VITUS program, GROW program financing, upkeep embassies
Market entry preparation	Trade Council offering advice on setting up companies abroad, recruiting foreign staff, dealing with corruption, business partner scans, strategic advice to approach networks and getting access to international financing	Government-to-government framework and regulation design in foreign markets, memorandums of understanding with China and USA	Embassies cooperating with local consultancy firms, Innovation centres networks, State of Green	Financing of trade fairs, company visits, seminars and individual company meetings, State of Green, upkeep embassies
Export	Energinet.dk's Energy Consultancy, state-ownership of EKF offering export credit guarantees	-	-	Financing of products EKF

Figure 42: Large version of the framework applied to the Danish case study

6.4 Large version case study Germany

	Germany			
	Executive	*Regulative*	*Networking*	*Financing*
Research and development	BAM researching materials for offshore wind components, BGR researching instruments and EIAs	Commercial freedom research organization	Go-cluster network	Projects financed by the 6th Energy Research Program, Innovation Durch Forschung program, WIPANO program
Testing	BAM testing material concepts for offshore wind components, BGR testing instruments for offshore wind measurements	Alpha Ventus windfarm and attached RAVE project, offshore wind test farm Fraunhofer IWES, possibilities test locations outside EEZ	-	Innovation Durch Forschung program, financing to construction and testing Alpha Ventus including market premium on output, funding to Fraunhofer test facilities
Domestic market development	BSH performing preliminary studies	From allocation of connection to pre-arranged tender system for offshore wind farms, obligatory membership of German Chambers of Commerce, regulatory steering of TSOs	Chambers of Commerce network	From market premium system to tender system for generated electricity, Innovation Durch Forschung program, HTGF program, ZIM program, Invest 2.0 program
Foreign market exploration	BAFA organizing information events, incoming missions and networking events, market exploration missions, Exportinitiative Energy community stands, standardized information GTIA	-	Network and activities offered by Chambers of Commerce Abroad	Reimbursement costs market exploration missions companies, subsidies for companies at community stand, funding of Chambers of Commerce Abroad
Market entry preparation	BAFA and German foreign trade chambers organizing trade missions and delegation trips	Memorandum of understanding with Taiwan	Network and activities offered by Chambers of Commerce Abroad, trade and delegation trips from BAFA and German trade chambers	Funding of Chambers of Commerce Abroad reimbursements costs participation trade or delegation trips
Export	-	-	Cooperation with Hermes Euler for offering export promotion financing, German Centres	Financing of the Hermes Cover line

Figure 43: Large version of the framework applied to the German case study

6.5 Overview of process rating governmental prevalences

In the following part of the appendix, the process of rating of the prevalence of the governmental roles is presented. For each of the export stages, the respective roles and countries are crossed in a table. For each of the crossed areas then a rating on a scale of four is presented, which has been explained in chapter 4.5. Under each rating, the grounds on which this rating is established are shown, which are based on the full case studies in Appendix 3.

		The Netherlands	**Denmark**	**Germany**
Research and development	**Executive**	*Low*	*Low*	*Medium*
	R&D as core activity and specific to offshore wind sector	Some R&D activities as extension of tasks governmental agencies	Some R&D activities as extension of tasks governmental agencies	Governmental research organizations, yet role in offshore wind sector moderate
	Regulative	*Low*	*None*	*Low*
	Steering in tenders and commercial freedom research organizations	Little steering in tenders and commercial freedom research organizations	No instruments found	Commercial freedom research organizations
	Networking	*High*	*Low*	*Medium*
	Role in organization research programs, cross-sectoral cooperation and innovation networks	Government organizer main research program, hosts international innovation network	No governmental representation main research programs, hosts international innovation network	Government organizing general research programs which include offshore wind, stimulates cross-sectoral cooperation
	Financing	*High*	*High*	*High*
	Availability of subsidies for offshore wind R&D projects	Mix of general and offshore specific subsidy programs covering a wide range of R&D activities	Mix of general and offshore specific subsidy programs covering a wide range of R&D activities	Mix of general subsidy programs focusing on renewable energy and wind including offshore wind
Testing	**Executive**	*Low*	*Low*	*Medium*
	Testing as core activity and specific to offshore wind sector	Some testing activities as extension of tasks governmental agencies	Some testing activities as extension of tasks governmental agencies	Governmental research organizations performing tests, yet role in offshore wind sector moderate
	Regulative	*Medium*	*High*	*High*
	Availability and strictness framework test locations	Regulation for future separate test sites but no current offshore test sites	Regulation for test sites and possibilities additional sites, onshore sites specific for offshore turbines	Regulation around current and future test sites, both on- and offshore
	Networking	*High*	*None*	*None*
	Connecting companies through research programs or other means	Governmental research programs and actively connecting SMEs and large companies	No instruments found	No instruments found
	Financing	*High*	*High*	*High*
	Availability of subsidies for offshore wind test projects	Subsidies for a large range of demonstration and development projects and organizations	Subsidies for a large range of demonstration and development projects and organizations	Subsidies for a large rage of demonstration and development programs and organizations
Domestic market development	**Executive**	*Medium*	*Medium*	*Medium*
	Government produces or manages part of domestic offshore wind farms	Government is charge of ~25% construction offshore wind farm, primarily managerial activities	Government is charge of ~25% construction offshore wind farm, primarily managerial activities	Government in charge of small part construction (<5%) offshore wind farm, partially managerial and partially self-performed activities
	Regulative	*High*	*High*	*High*
	Growth determined or steered	Government determines nearly all domestic growth with regulation	Government determines nearly all domestic growth with regulation	Government determines nearly all domestic growth with regulation
	Networking	*Medium*	*None*	*Medium*
	Government involved in main trade organizations, networks in domestic market	No governmental presence in trade organizations, strong governmental presence in networks connecting companies	No (federal) governmental presence in networks connecting domestic parties	Strong governmental steering of national organizations connecting domestic companies
	Financing	*Medium*	*High*	*High*
	Available risk- or venture capital, funds for start-ups, financing for domestic wind farms	Subsidies for offshore wind farms available, some funds for growing companies yet (currently) little risk- or venture capital	Subsidies for offshore wind farms available, many programs and funds for all types of capital	Subsidies for offshore wind farms available, many programs and funds for all types of capital

Figure 44: Overview of the rating process for the prevalences of the governmental roles in the framework, part 1

		The Netherlands	Denmark	Germany
Foreign market exploration	**Executive**	*High*	*High*	*Medium*
	Export activities for market exploration offered, trade missions organized, programs for potential exporters	Large portfolio of instruments offered, trade missions organized and programs for market exploration	Large portfolio of instruments offered, trade missions organized and programs for market exploration	Moderate portfolio of instruments offered, trade missions organized, no specific programs for market exploration
	Regulative	*None*	*None*	*None*
	Regulation promoting or discouraging foreign market exploration	No relevant regulation found	No relevant regulation found	No relevant regulation found
	Networking	*Medium*	*High*	*Medium*
	Collaboration sector to stimulate exports, programs for international networking, collaboration with local consultancy	Active cooperation with sector, programs for international networking, no collaborations local consultants	Collaboration government and sector in export, collaboration with local consultancy, programs for international networking	Strong cooperation with local network offering services and local consultants
	Financing	*High*	*Medium*	*Low*
	Funding foreign networks, market exploration activities, market exploration programs, activities in foreign markets	Foreign network, and market exploration programs funded, market exploration activities partially or fully funded	Foreign network, several market exploration programs funded, activities in foreign markets partially funded	Little funding to foreign network, market activities funded, no market exploration programs, market exploration activities partially funded
Market entry preparation	**Executive**	*Medium*	*High*	*Low*
	Organization of market entry preparation activities and missions	Trade missions organized moderate range of market entry preparation activities	Large range of market entry preparation activities, trade missions organized	Trade missions organized, small range of market entry preparation activities
	Regulative	*Low*	*High*	*Low*
	Governmental cooperation on regulation, formal cooperation documents	Moderate amount of formal cooperation with offshore wind sectors	Active cooperation for impacting regulatory frameworks potential markets, high amount formal cooperation with offshore wind sectors	Low amount of formal cooperation with offshore wind sectors
	Networking	*Medium*	*High*	*Medium*
	Active networks connected with relevant markets and parties, cooperation with local partners, branding activities	Several active foreign networks relevant for the offshore wind sector, no cooperation local consultants, little relevant branding activites	Several active foreign networks relevant for the offshore wind sector, cooperation local consultants, highly relevant branding activities	Moderately relevant foreign network, ooperation with organizations featuring foreign networks, cooperation with local consultants, little relevant branding activities
	Financing	*Medium*	*High*	*Low*
	Funding to foreign networks, market entry activities and programs, branding programs	Funding to foreign governmental network, market entry activities funded or partially funded, market entry programs funded, no current funding to branding	Funding to foreign governmental network, market entry activities funded or partially funded, market entry programs funded, branding programs	Funding to market entry activities, no market entry programs, no branding activities, some funding to foreign networks
Export	**Executive**	*None*	*Low*	*None*
	Governmental agencies exporting or offering goods directly supporting export	No relevant examples found	Few services commercially exported, governmental agency responsible for export credit guarantees	No relevant examples found
	Regulative	*None*	*None*	*None*
	Governmental regulating restricting or promoting export	No relevant examples found	No relevant examples found	No relevant examples found
	Networking	*Low*	*None*	*Low*
	Governmental cooperation with organizations promoting export activities, linking exporting parties	Public-private cooperation with organization offering export credit guarantees, no governmental influence in networks connecting exporters	No governmental influence in networks connecting exporters	Public-private cooperation with organization offering export credit guarantees, no governmental influence in networks connecting exporters
	Financing	*Low*	*High*	*High*
	Offering of products or services promoting the export of offshore wind	Financial products for export promotion offered to sector, yet currently not utilized	Highly used financial products promoting exports for the offshore wind sector	Highly used financial products promoting exports for the offshore wind sector

Figure 45: Overview of the rating process for the prevalences of the governmental roles in the framework, part 2

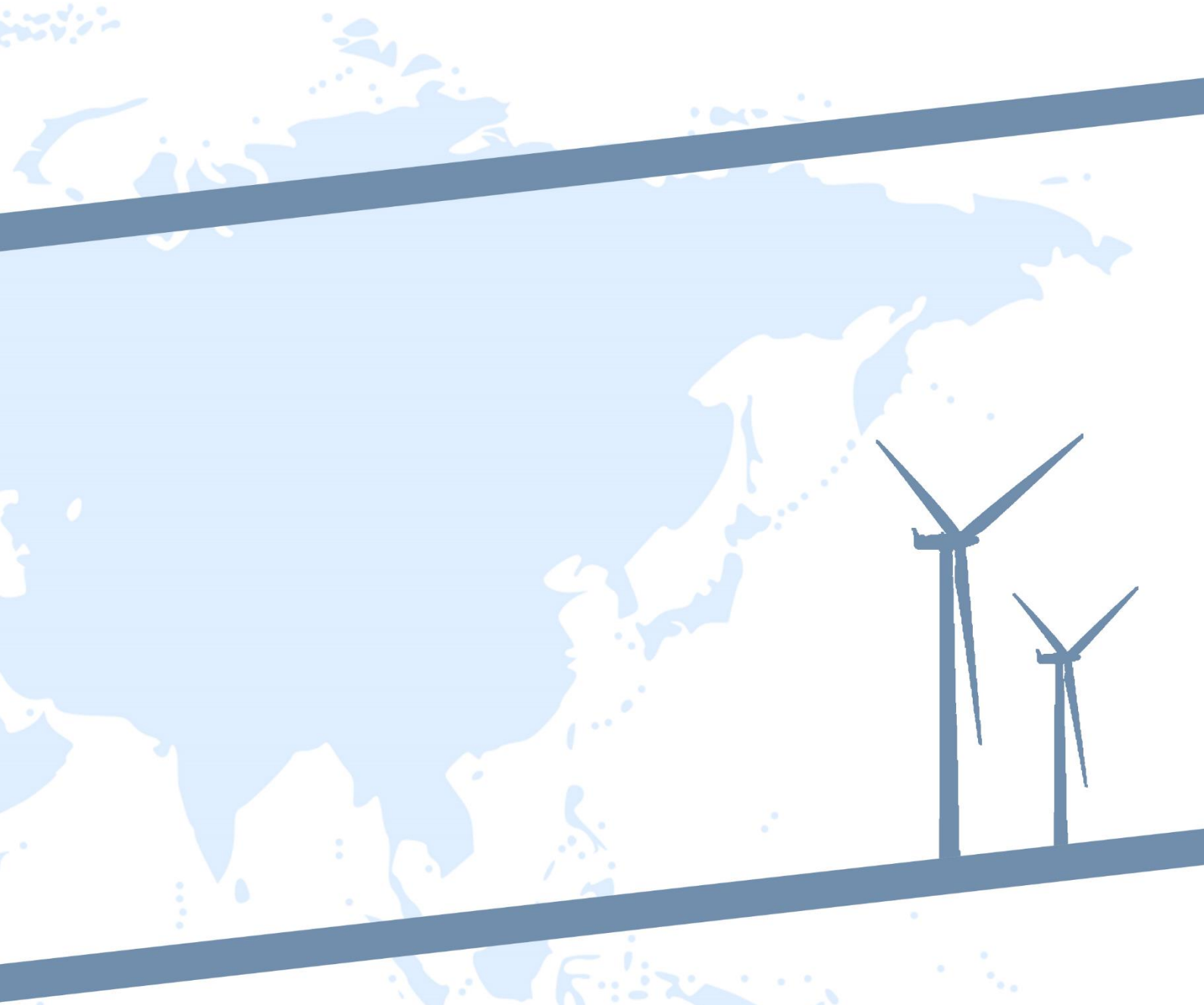
6.6 Visualization of the rated governmental prevalences across the case studies

	The Netherlands				Denmark				Germany			
	Executive	*Regulative*	*Networking*	*Financing*	*Executive*	*Regulative*	*Networking*	*Financing*	*Executive*	*Regulative*	*Networking*	*Financing*
Research and development	Low	Low	High	High	Low	None	Low	High	Medium	Low	Medium	High
Testing	Low	Medium	High	High	Low	High	None	High	Medium	High	None	High
Domestic market development	Medium	High	Medium	Medium	Medium	High	None	High	Medium	High	Medium	High
Foreign market exploration	High	None	Medium	High	High	None	High	Medium	Medium	None	Medium	Low
Market entry preparation	Medium	Low	Medium	Medium	High	High	High	High	Low	Low	Medium	Low
Export	None	None	Low	Low	Low	None	None	High	None	None	Low	High

Figure 46: The visualization of the prevalences of the governmental roles across the case studies, structured per country

	Executive			Regulative			Networking			Financing		
	Netherlands	*Denmark*	*Germany*	*Netherlands*	*Denmark*	*Germany*	*Netherlands*	*Denmark*	*Germany*	*Netherlands*	*Denmark*	*Germany*
Research and development	Low	Low	Medium	Low	None	Low	High	Low	Medium	High	High	High
Testing	Low	Low	Medium	Medium	High	High	High	None	None	High	High	High
Domestic market development	Medium	Medium	Medium	High	High	High	Medium	None	Medium	Medium	High	High
Foreign market exploration	High	High	Medium	None	None	None	Medium	High	Medium	High	Medium	Low
Market entry preparation	Medium	High	Low	Low	High	Low	Medium	High	Medium	Medium	High	Low
Export	None	Low	None	None	None	None	Low	None	Low	Low	High	High

Figure 47: The visualization of the prevalences of the governmental roles across the case studies, structured per role



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