Abstract

The purpose of this study is to explore entrepreneurial activity in the offshore wind shipping segment. Due to lack of prior research on the topic, my thesis, *'Entrepreneurship in the offshore wind shipping segment – why and how does entrepreneurship occur within the context of niche segment shipping and who are the entrepreneurs taking part in this process? What kind of competences is needed in order to be able to exploit these new opportunities and what are the main challenges this niche segment is currently facing and how are they being addressed?* ', bridges the gap in knowledge by extending the application of entrepreneurship theory to niche segment shipping and investigating empirical data gathered by quantitative and qualitative means to conduct an industry analysis and facilitate a discussion of the extant business environment. My thesis contributes to entrepreneurship research by aiding a better understanding of the rationales, approaches and challenges of opportunity recognition and exploitation in the segment, documenting entry by individuals of predominantly maritime and engineering background, multiple cases of corporate venturing, and a locational shift in entrepreneurial opportunity. It furthermore advances the study of maritime economics by identifying areas of convergence between niche segment shipping and traditional shipping trades such tendencies towards commoditization and growing rivalry in all three main subsegments (installation, cable laying and service), heavy reliance on traditional production factors, but also ones of dissimilarity, e.g. the importance of social and intellectual capital to offshore wind's future development.

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Entrepreneurship in the offshore wind shipping segment

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List of commonly used abbreviations:

CLV – Cable laying vessel

CTV – Crew transfer vessel

O&M – operation and maintenance

MPV – Multipurpose vessel

TIV/WIV – Turbine installation vessel/ Wind farm installation vessel

1. Problem

1.1. Introduction

Innovation has always been a topic engaging practitioners and scholars alike because of its implications to economies, markets, companies and societies. Understanding its importance to development on every level has led to a number of studies within the entrepreneurship area, as innovation is usually brought to life by entrepreneurial efforts.

Many scholars have been trying to determine what exactly entrepreneurship is . While the definitions differ, it`s certain that its presence (or lack thereof) is an accurate landmark for the pace with which an industry is moving forward (Soriano 2013). The entrepreneur is an agent that brings new information flows within a complex and multilayered social environment. The contextual dissimilarities between environments often bring about diverging characteristics of entrepreneurship in different industries and markets, e.g. an entrepreneur in a small tech startup might need to mobilize different material and intellectual resources than an entrepreneur in shipping or an aspiring entrepreneur in the energy sector. The latter two types are often defined by higher risks, larger investment requirements and more intensive competition (Haveman et al 2012:586).

In this study there are two main themes which intertwine – one of entrepreneurship in niche segment shipping and another of the renewable offshore wind energy industry. In order to determine what prompts innovation within this relatively new industry, one has to acquire knowledge of the way it has historically evolved and the way actors within that industry assign meaning to their activities and surroundings. This is where understanding the specificity of a segment comes in, as it is important to comprehend the most important factors driving the segment forward and therefore be able to create an (albeit tentative) forecast for its future.

1.2. Problematization

Maritime shipping is an industry that has existed for centuries, serving the function of providing effective means for transportation of people and goods across countries and continents. Its most distinctive characteristics apart from its global scale are its high degree of competitiveness and volatility due to the fact that supply of vessels is often larger than demand, causing overcapacity. Long term competitive advantage in this increasingly commoditized trade can rarely be achieved by implementing technical novelties alone, as those can easily be copied by rivaling companies and often require a lot of initial investment in research and development(Stopford 2009).

The reasons stated above aim to explain why the majority of shipping operators engage in already familiar strategies such as `buy low, sell high`, economies of scale and costs optimization in order to remain on the market and/or gain a larger market share.

When talking about adopting novelty in the maritime transportation domain, one has to note that it, as a mode of transport, is a derived demand – this is to say that changes in demand for seaborne transport are strongly correlated to changes in demand for the cargo being transported, thereby making modifications in shipping more likely to happen as a response to customer needs rather than as a product of isolated research and development activities within the industry itself. Thus, identifying a demand that has not been catered to yet could well turn into a business opportunity.

An evidence of this is the niche shipping segments. There, an increasing number of vessels that significantly differ from the ones used in the traditional segments are required to attend to needs derived from new ways of executing operations and doing business in various industry segments (Wijnolst 2009).

1.3. Problem statement

Particularly interesting is the segment of wind farm installation and maintenance vessels. Ships with a complex structure that embody a number of new capabilities , they have emerged as a response to the need to install turbines on offshore platform facilities and ensure their maintenance in a resource efficient manner in particular and the need to generate larger amounts of renewable energy in general.

This gives rise to a number of questions: If innovation is the development of new values through solutions that meet new requirements and entrepreneurship the process of identifying and commercializing new solutions (Wijnolst 2009), then how and why does entrepreneurship occur within the context of niche segment shipping and who are the entrepreneurs taking part in this process? What kind of competences is needed in order to be able to exploit these new opportunities? What are the main challenges that this niche segment is currently facing and how are they addressed? These are all questions this study seeks to find an answer to and possibly identify areas of further research in order to try and fill the existing knowledge gap in this area.

1.4. Relevance

As this is a relatively new segment, little is known about the way operational and market activities are done. The reasons for its emergence and growth, the strategies employed by the diverse number of incumbents and its dependence on energy trade and policies are issues of concern not only to academia, but also to society and practitioners alike, due to shared agenda of ensuring an economically viable resource allocation to energy sources that have lesser impact on the environment in a long-term perspective than the traditionally used ones. The exploration of opportunity recognition and utilization in a niche shipping segment would furthermore provide entrepreneurship researchers with valuable empirical data and illustrate the way it relates to existing entrepreneurship literature regarding motivations, competences and strategic activities carried out by entrepreneurial individuals and organizations.

An analysis of the offshore wind shipping segment would put into perspective the degree to which entrepreneurship and innovation are important for the evolution of industries and their transition prompted by the turbulent conditions of the economy and changes in policies and regulations. It is also important to note the way industry boundaries lose their significance within the context of a global economy where the rivalry is much more intense and the heterogeneity of the competition leads to a much larger diversity of strategies implemented to stay in or dominate the market.

1.5. Delimitations

There are certain aspects of answering this question which will not be taken into account. Technical aspects of ship design and innovation will not be rigorously explored, as this is a study focused on analyzing its business aspects. The same applies for technical innovation aspects in wind turbines development, electronics and cable manufacturing.

Vessels not involved in one of the three subsegments (installation, service, cable laying) such as research/survey vessels have been mentioned, but not explored in-depth in the industry analysis chapter of this research, due to the relatively small demand for this type of ships and their brief participation in projects, as well as their low degree of commitment to the offshore wind industry.

The capital and operational expenses of the shipping operators in offshore wind, albeit an important source of information, are not discussed in the study, due to the lack of access to financial data.

2. Theoretical framework and literature review

The choice of literature material reviewed has been guided by a delimitation of the main knowledge areas that are to be employed while attempting to answer the research question. Thus, it seeks to identify the reasons and circumstances for the emergence of entrepreneurship within the niche segment of offshore shipping or alternatively aid in identifying the entrepreneurial actions that have caused the emergence of this particular shipping segment and understand the challenges related to undertaking and maintaining an entrepreneurial venture.

As already mentioned, at present a little amount of research has been carried out within the area of offshore wind farm shipping, presumably because of its nascence, leaving a lot of questions to be explored. Thus, relevant theories from the fields of entrepreneurship, shipping innovation as well as energy politics will be reviewed and consequently used as a framework to evaluate the gathered empirical data and facilitate a dialogue between the two, which would allow for new conclusions and areas of enquiry to emerge.

Therefore, relevant literature will be used to review relevant research concerning:

- What is entrepreneurship and why is fostering it important for an economy, how does it emerge and evolve, who is/could be an entrepreneur?

- What is the link between entrepreneurship and innovation? How is intrapreneurship different?
- How does entrepreneurship evolve within the field of shipping and what could be regarded as potential challenges?
- What is the role of energy/state policies in creating entrepreneurial opportunities?

2.1. Defining entrepreneurship

It has been frequently argued that entrepreneurial activity is one of the main drivers of economic growth (Schumpeter 1934, Porter 1985 , Kirzner 1997); this suggests that helping create an environment that encourages entrepreneurial efforts would be highly beneficial for any country`s economy, regardless of the developmental stage it is in. This prompts the need for setting clearer delimitations on its definition, as entrepreneurship has often served as an umbrella term for a diverse spectrum of economic activities, causing numerous debates between scholars (Davidsson 2005, Shane 2003, Harryson 2006).

According to (Venkatamaran, 1997; Shane and Venkatamaran,2000 in Shane, 2003:4), entrepreneurship is an activity involving the discovery, exploitation and evaluation of opportunities to introduce new goods and services, ways of organizing markets, processes through organizing efforts that have previously not existed ; alternatively, (Davidsson 2005:6) has defined it as the competitive forces that drive the market process. Both definitions are quite general and omit certain aspects related to entrepreneurial activity, such as risk and choice-related issues; therefore, they are difficult to employ within empirical research and case study analysis. As a consequence, a number of attempts to frame various market processes as entrepreneurial activity has emerged, reflecting different perspectives of scholars who describe it as: *new entry (Lumpkin & Dess, 1996)*

the creation of new enterprise (Low & MacMillan, 1988)
the creation of new organizations (Gartner, 1988)
a purposeful activity to initiate, maintain and aggrandize a profit-oriented business (Cole, 1949)
taking advantage of opportunity by novel combinations of resources in ways which have impact on the market (Wiklund, 1998)
the process by which individuals—either on their own or inside organizations—pursue opportunities without regard to the resources they currently control (Stevenson & Jarillo, 1990)
the process of creating something different with value by devoting the necessary time and effort; assuming the accompanying financial, psychological, and social risks; and receiving the resulting rewards of monetary and personal satisfaction (Hisrisch & Peters, 1989)

(cited in Davidsson 2005:1).

Furthermore, according to (Gartner 1990 in Sharma et al 1999), the opposing sides in this debate constitute of two distinct research clusters, one focused on defining entrepreneurship on the basis of certain characteristics (e.g., innovation, growth, uniqueness, etc.), thus prioritizing the activity that could be an end in itself; the second focused on the outcomes of entrepreneurship, tending towards it being a path that eventually has led to a particular result (self-employment, introduction of a new product, enterprise creation). The former cluster accounts for 79% of Gartner's sample, suggesting that entrepreneurship is currently viewed by academia as more than just means to an end and that the methods and procedures involved in entrepreneurial activity are an important subject of enquiry on the path to understanding the entrepreneurship phenomenon.

Having reviewed a plethora of definitions, for the purpose of this study it can be concluded that entrepreneurship signifies:

1. A deliberately caused change in the existing economic situation.
2. Introduction of a new means-ends framework by using information that other market participants do not have access to for various reasons.
3. An economic activity characterized by innovation, novelty, risk-taking, economic choice.
4. When focusing on the outcome, it can be viewed as a process leading to enterprise creation, self-employment, introducing new products/services on the market through incremental or radical innovation.

The definition of entrepreneurship cannot be complete without considering the role of the entrepreneur, the individual dubbed responsible for the occurrence of entrepreneurial acts.

Introduced by J.B. Say, the term entrepreneur initially meant someone that upsets and disorganizes the old to transfer economic resources from an area of low to an area of high productivity (Drucker, 1985 in Harryson 2006:13). He is an agent of change, an innovator, a speculator, a leader. This economic actor has been endowed with many syncretic functions, stemming from various theories regarding traits, personality development and opportunity exploration and exploitation. In a sense, its meaning changes across contexts and ranges from Mises` "acting man in regard to the changes occurring in the data of the market" (Mises 1949: 255 in Kirzner 1997), claiming that "In any real and living economy every actor is always an entrepreneur" (ibid), Schumpeter`s notion that "Everyone is an entrepreneur when he actually carries out new combinations"(UNCTAD, 2004:4), to a risk-taker in economic development(Cantillon(1755/1999), somebody dealing with uncertainty and linked to innovation (Hjorth 2004:389). It should be noted that entrepreneurs do not constitute a homogeneous social group – on the contrary, he/she might be an inventor or a merchant, coming from a variety of cultural, educational and professional backgrounds (Blanchflower et al 1998). However, in the search of a rationale for the decision to become an entrepreneur, authors have discovered that certain circumstances and events are likely to trigger the transition towards self-employment/opportunity exploitation by increasing the perceived utility of doing so (Shane 2003, Blanchflower 1998, Hjorth 2003, Kirzner 1997). In order to develop a better comprehension of this claim, one has to look into the most influential drivers and conduct an assessment on both the role of the individual and the environment within enterprise creation.

2.2. Drivers for the occurrence of entrepreneurship

Even though claims have been made that entrepreneurship is essentially a behavioral characteristic (Carree and Thurik 2002: 4–5 in UNCTAD 2004:4), reasons for the occurrence of an entrepreneurial act should be sought not only on an individual but on a macroeconomic level as well, as it is often changes, transformations and interactions between actors on different economic levels that facilitate entrepreneurship. This conveys the message that even though sometimes research is likely to shift the focus from the individual to the external circumstances and vice versa, both are equally important while assessing empirical cases of entrepreneurial activities. Conversely, all of these aspects will be reviewed below.

2.2.1. Macroeconomic trends as drivers for entrepreneurship

Changes in the macroeconomic environment are bound to enable the emergence of new entrepreneurial opportunities - an example of this is change of state and institutional policies, market structures, or in general, factors that cause market disequilibrium (Cooper et al 1986,Shane 2003,Holcombe 2006:30,). At present, a shift in values has led to a number of ongoing trends that influence economies and societies in general and entrepreneurial activity in particular:

- Globalization, characterized by merging of boundaries between different markets and facilitating constant interaction between them. This leads to internationalization of companies and exploration of new markets, while increasing the intensity of competition and the need for differentiation. As a response to a more competitive market, a lot of countries facilitate the formation of industrial clusters, which aim to increase national competitiveness through knowledge spillovers and collaboration between the companies and institutions involved in the cluster (Sornn-Friese and Hansen 2012, De Lange 2011). It has often been documented that small, young companies serve to disseminate new knowledge in an industry, and this is where entrepreneurship as firm creation is encouraged. That is, regions with higher levels of knowledge creation (i.e. innovation or innovation efforts) are expected to show greater levels of knowledge based (innovative) entrepreneurial activity with more start-ups in high-tech and ICT industries. This is the essence of the "Knowledge Spillover Theory of Entrepreneurship," put forward by (Audretsch, Keilbach, and Lehmann (2006) in Audretsch 2008:689, Sornn-Friese and Hansen 2012 , Gunter 2012:390). Young companies are also quick to enter international markets, enabling the rise of the so-called "born globals" phenomenon (Knight et al 2004).
- A transition towards a knowledge economy (OECD 1996 in Dean et al 2007:573), challenging and extending the existing notions of capital. This entails that knowledge has become an influential production resource, triggering different kinds of innovation and organizational theories, replacing the classical production factors (Drucker1993:38 ibid). Capital is traditionally used to refer to a stock of assets, often the result of past production put to use in the production process and thereby

generating a flow of goods and services over time (Dean et al 2007:575). However, with the emergence of hybrid forms of capital, such as human and social capital, capital is taken to mean more than tangible assets, it is not already associated only with a particular individual but it is also often found inside networks and interactions (Bourdieu,1980 ibid); furthermore, it is being continuously transformed within the production process. Human capital is used to denote the potential that workers bring to the organization. Social capital, on the other hand, means the relationships a certain person has, and sometimes capital is not attributed to an individual; it is something contained within the relationship between individuals. Capital is of course an essential resource for entrepreneurs, but capital transcends beyond tangible assets to mean potentially profitable ideas, connections, and knowledge. Ideas are becoming more and more valuable, but their importance is assessed in accordance to their ability to be utilized. Social networks and the information flowing through them are of increasing relevance (Dean et al, 2007), as businesses and individuals alike are becoming aware of the importance of novel and varied informational inputs in creative processes (Harryson 2006:17).

- Since the 1980s, a rise of the enterprise discourse has been observed, seeking to associate entrepreneurship and creativity with productivity, increased efficiency, empowering individuals to undertake proactively higher amounts of initiative and responsibility, leading to organizational and managerial changes promoting self-management and less steep hierarchy in organizations (Latham-Koenig 1983:85). More and more things become re-interpreted as matters of efficiency and cost (Hjorth 2003:55). Public policies encourage entrepreneurial research and initiatives (ibid). This becomes especially evident when one takes into consideration the number of programs on a global scale that are aimed at empowering different social groups to undertake self-employment. (UNCTAD 2004)Entrepreneurship is rationalized and studied , individuals are encouraged to best invest their 'human capital' in order to market themselves as a human resource, relocating responsibility for employment on the individual themselves, e.g. calling the unemployed job seekers(Hjorth 2004:389).Furthermore, it is also entrepreneurial activity that creates new entrepreneurial opportunities and causes a spread in entrepreneurial culture, which could provide a partial explanation in regards to the emergence of startup clusters in certain areas (Bygrave and Minniti 2000 in Holcombe 2006:34).

- The ending supplies of fossil fuel and the harmful effects of its consumption are directing a focus towards energy sustainability and climate preservation issues. While causing reforms and losses for certain traditionally prosperous businesses, this new paradigm promoting environmental awareness is opening doors to new business opportunities in the areas of sustainable energy harvesting, environmental consultancy, clean transportation, etc. (Xiaojing et al 2007, Løvdal et al 2011:1, Garnsey et al 2011 in Wustenhagen 2011)

2.2.2. Microeconomic trends as drivers for entrepreneurship

- Differential access to information within the boundaries of a market. This information could be very innovative, leading to a disequilibration of the economy, entailing a market breakthrough (Schumpeter,1934 in Shane,2003:20) or less innovative and equilibrating, implying a rather incremental approach based on accessing already existing information(Kirzner,1997 in Shane, 2003:20).It has been argued that most of the entrepreneurial acts fall predominantly within the category of the latter rather than the former, as the economic disruptions characterizing Schumpeterian opportunities are connected to a higher degree of risk and a lesser degree of replication of existing organizational forms and thus occur less frequently(Shane 2003:21).

- Peer effects influence individual economic choice (Granovetter 2005 in Isakson 2012:13) - while interacting often with entrepreneurial colleagues, employees are more likely to become entrepreneurs (ibid). Diverse social ties, meaning both strong and weak social ties are also proven to encourage the discovery of opportunities(Aldrich and Zimmer, 1986 in Shane 2003:49), presumably because of the access to diverse information, which allows for the creation of new means-ends frameworks.

- More flexible management and organizational structures, emerging as a response to the increasing internal and external organizational complexity, less focus on hierarchy, enabling a more open innovation system and cooperation between companies. (Løwendahl et al, 1998) as well as positive changes in the framework for creating new companies will encourage potential entrepreneurship attempts (UNCTAD, 2004:11)

- Professional experience, knowledge, education - It is often people working where specialized knowledge is involved that become aware of new entrepreneurial opportunities within their respective field and are able to exploit them (Shane 2003, Harryson 2006, Holcombe 2003:28).

- Triggering event in one's life that would prompt them to embrace self-employment - unemployment, opportunity cost and expected utility from entrepreneurial efforts. (Davidsson 2005: 45, Shane 2003:63).

- Access to initial funding could also be an important enabler, or alternatively, an obstacle to transition to self-employment, as argued by (Blanchflower et al, 1998).

2.2.3. Individual traits as drivers for entrepreneurship

On an individual level, such personal characteristics as extraversion and the ability to persuade, need for achievement and recognition, tendency to undertake risk, independency, self-efficacy (confidence in one`s own abilities), well-developed cognitive abilities have often been associated with an increased likeliness to take the decision to exploit an entrepreneurial opportunity.(Shane 2003).

Attempts have been made on calculating the probability of self-employment through econometric models, using the assumption of an economic equilibrium. (Blanchflower et al 1998) However, within those models little attention is paid to explaining the concept of utility, the behavior of actants within an environment of imperfect competition, freedom of human choice, what is it that represents entrepreneurial vision, as it is clear that possessing certain personality traits, knowledge and motivation would make some individuals more likely to identify particular novel opportunities and exploit them than others (Gimenez-roche 2011, Kirzner 1997).

2.3. Opportunity recognition and exploitation inside organizations. Corporate entrepreneurship/Intrapreneurship

Having evaluated separately the importance of the individual and the macro environment to the opportunity discovery and exploitation process, it is now relevant to understand the shape entrepreneurial activities take inside a large organization, namely intrapreneurship. As the analysis of the offshore wind shipping segment indicated that many of the incumbents had emerged as a result of corporate spinoffs, acquisitions and diversifications, this would allow for a more holistic comprehension of the complexity of an entrepreneurial act in the segment, while attempting to theorize and map the entrepreneurial activities in a corporate environment.

In a globalized economy with a constantly intensified competitive structure where 'Innovate or die` is an unwritten rule that every company has to follow in order to remain on the market, organizational changes are crucial for corporate survival (Burton 2001). In line with the claims made by (Shane 2003) about entrepreneurs developing their ideas on the basis of information they are exposed to at their workplace, it has been documented that a lot of employees have started their own companies with ideas explored while still at their workplace(Subramanian 2005). But what are the incentives to employees exploiting a so-discovered opportunity internally in an organization?

There are important differences between enterprises created by other enterprises and ones created by individuals – one of them is that the individual would usually go about researching established competitors, and which leverage social ties as well as general human capital. Intrapreneurship, on the other hand, often offers business-to-business value proposition which seems to be difficult to translate into individual enterprise creation (Parker 2011). The types of products commercialized by new start-ups are also likely to differ, as R&D activities allow bigger companies to come up with more radical innovations (ibid). Indeed, contrary to a popular belief that large enterprises stifle creativity, large corporations can have an enabling effect on proactive initiative and entrepreneurial attitudes from individual employees because they can simultaneously provide exposure to new opportunities and offer the means to allocate resources and develop that opportunity internally, which helps overcome the capital constraints often encountered in an entrepreneurial venture, thus increase individual rate of intrapreneurship even though suppressing entrepreneurial rates(Kacperczyk 2012).

Which employees are likely to undertake acts of intrapreneurship? According to (Andersson et al 2013,247), technical specialists and managers are more inclined to found firms as their

work experience defines the quality of startups they can form - high-level employees are the best acquainted with the organizational challenges they might be facing in their own firm. Spin offs, particularly pulled ones (company venturing prompted by market demand), perform better and are larger than other startups, also, spin-offs that enter the same industry as their parent, perform better than other spin-offs, with their performance quality being proportionally correlated to the size of the parent company. The performance of a new intrapreneurial venture is also influenced by the motivation for its establishment – it does better if it is based around a new idea instead of on incentives/threats. (ibid)
How intrapreneurial efforts are usually triggered? Apart from adversities, which seem to have a favorable influence on employees moving to a spin-off (ibid), favorable internal atmosphere is also a critical factor to intrapreneurship, as it enables an environment where intrapreneurs to engage in opportunity-seeking entrepreneurial behaviors, as in the case of independent entrepreneurs discovering important challenges and opportunities (Slevin and Covin, 1990; Zahra, 1991; Barringer and Bluedorn, 1999; Jeong et al., 2006 in Alpkan 2010). When these efforts are supported and coordinated by managers, these endeavors will result in sustainable competitive advantages through innovation in the form of new products, services, and processes, or in a combination of the three (Quinn, 1985; Brentani, 2001; Hornsby et al., 2002 in Alpkan 2010) . Again, the role of the manager/leader is accentuated as an actor that needs to facilitate the generation and development of new ideas by allocating free time, ensuring a flat organizational structure and decentralization, providing employees with a decision-making autonomy, appropriately used incentives and rewards, tolerance for failures in case of creative projects (e.g. Kuratko et al., 1990, 1992, 2004, 2005; Hornsby et al., 1999, 2002 in Alpkan 2010) . As (Chakravarthy et al 2007) point out, strategic renewal requires both a top-down and bottom-up effort – leaders and employees alike need to strive for coming up with better ways to do business, where the leaders are to set the broad vision, scope and pace while the managers help foster its implementation. This is where a manager with entrepreneurial skills would be extremely useful as he would be able to both stimulate a creative environment and encourage new ideas and control for whether ultimately the initial vision is being followed. Unlike the intrapreneur (Pinchot,1985), whose primary focus is in creating a new venture and not in integrating it with the rest of the firm(Chakravarthy et al 2007), the manager needs to create a bridge between the incoming new ideas with and the overall company strategy, thus enabling corporate innovation and making sure creative efforts are not stifled by dogmatic or steeply hierarchical company structures.
Having asserted certain theoretical assumptions regarding entrepreneurship internally and externally to organizations, its reasons for emergence and the obstacles entrepreneurs encounter, the focus of the analysis shall be narrowed down towards exploration of entrepreneurial activity in the maritime shipping domain.

2.4. Shipping, innovation and entrepreneurship

2.4.1. Traditional shipping economics and the relevance of innovation

Maritime transportation is a global industry that has existed for centuries, and one that, regardless of the cyclicality and volatility of most shipping markets, never ceased its steady growth, reaching an annual turnover for over a trillion in 2004 and employing about 1.23 million seafarers worldwide(Stopford 2009:42). The turbulent industry conditions of a business which is, because of it being a derived demand, following the cycles of trade,

coupled with the rather conservative business strategies of the firms involved in the shipping trades, has facilitated for the main business activities of building, ownership, operation and chartering to comply with the laws of asset play, buying low and selling high.
However, come commoditization of shipping markets, together with the need for differentiation and decentralization as well as outsourcing of certain activities, these business models became obsolete (Lorange and Fjeldstad 2010) . Prompted by the need for differentiation, a variety of companies emerged, dedicated to various activities such as third-party ship management, technical innovation(ship design, propulsion methods), environmental services, etc. - as per (Jenssen and Randøy 2006:328), innovation can be defined as the effort to create something new and the concept is closely related to the economic objective of creating differentiation. Naturally, the timing of these innovations is to a large degree determined by market forecasting and analysis and the ability to predict the customer's needs, which is often done with the assistance of consulting firms and ship brokers, as the failure rate in innovations is high and many initiatives never create profit (Jenssen and Randøy 2006). For companies innovating in shipping, as in many other industries, attracting talented employees and thus creating a know-how base is crucial for success. The importance of intellectual capital in the most important shipping areas of market competence, operations, chartering, innovation, finance is highlighted and sought after on a global scale, overcoming cultural and geographical constraints (Lorange and Fjeldstad 2010). Entrepreneurial and inspirational leadership is required, placing a higher importance on human relationships and capital, as well as a clear strategy for innovation for promoting product - process innovation and entering new markets (Jenssen and Randøy 2006).
How is entrepreneurship facilitated in such an environment where there is seemingly no place for players with insufficient amounts of capital? In contradiction to the current market dynamics, some of the most prominent shipping entrepreneurs established their companies around 1930 rapidly increased their size in the following decades, while in contrast come larger companies ceased to exist (Svendsen 1981:139). This serves to further affirm the turbulent conditions of an industry where new incumbents are continually entering the stage - thus it is critically important to understand better the mechanics of innovation and entrepreneurial activities and their influence on shipping markets and market success.

2.4.2. Triggers of shipping innovation

Although there has been some research on innovation into the four main shipping trades, cases of innovation in niche segments are less frequently documented (Lorange and Fjeldstad 2010). In niche segments, innovation occurs in a similar manner in one of three main areas of ship design, operation, and environmental services. It follows an S-curve, which tends to shift respectively left or right depending on the innovation's character, reflecting its performance and the efforts invested in it, some S-curves being steeper and some following a rather incremental path (Wijnolst et al 2009:368). It can occur as a response to globalization – attempts to differentiate (such as research ships, luxury cruisers and icebreakers) on a know-how and quality basis (Cho & Porter, 1986 in Poulsen and Sornn-Friese 2011) Hereby the following factors have been identified as main triggers of innovation by (Wijnolst et al 2009:382-400):

- Laws of physics – improving speed parameters of the vessel and overcoming unfavorable weather conditions in general.

- Geographical conditions –dealing with obstacles such as draught restrictions, ice blockages, e.g. developing river-sized ships, dredging, etc.
- Regulations - administrative, political, environmental, labor/manning regulations imposing restrictions on fuel consumption, noise level, emissions, ship size and overall design, standardization, etc.
- Related sectors- Innovations in related sectors can trigger innovations in shipping through adoption of new technologies already used in other industries (Diesel engine, fuel cells).
- Economic parameters - maximization of revenues, economies of scale, cost reduction of capital investment, minimizing voyage and cargo-handling costs
- Design concepts – different innovative ship designs are tested in order to improve performance and generate a competitive advantage.

Each of the abovementioned factors could both be looked upon as an obstacle and as an opportunity to innovate and improve even further, if exploited in the right manner. However, as mentioned earlier, innovations in shipping can be quite costly and often not bring the expected revenues or even lead to losses. This is an important reason why a lot of shipping companies, just like in many other transportation industries, are prompted to collaborate in certain areas of their activity, while still competing in others (Stopford 2009). Below follows an exploration of clusters as vehicles of knowledge exchange and triggers for innovation.

2.4.3. Clusters and knowledge exchange

Another traditionally important driver for innovation in shipping is clusters. Their impact on innovation activities is tremendous, particularly in the context of shipping, because it allows for different companies to collaborate on collective innovation projects, knowledge diffusion, attracting investments and labor pooling (Wijnolst 2009).

Clusters are defined as *"geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions in particular fields that compete but also cooperate"*, thus consist of related economic actors and institutions, active in multiple levels of the cluster, and that the scale is sufficient to achieve the critical mass, which leads to the development of specialized suppliers, resources, and services(Porter in DSA working paper 2010:7).They emerge as a result of knowledge spillovers, labor market pooling, sharing of specialized inputs (Sornn-Friese and Hansen 2012:23). It is also a population, constructed of a variety of business units, organizations, and associations, private and public organizations. Clusters are constructed by both scientists and practitioners (De Langen 2002:210) and represent a complex, geographically concentrated network of constantly interacting entities, centered around and participating into a particular economical specialization. This happens by constructing a cluster core, after that a list of cluster activities is developed, a certain region is determined and the cluster population is defined according to its participation in the cluster activities and its location in regards to the cluster region. The performance of a cluster is influenced by internal competition, agglomeration economies, entry and exit barriers, heterogeneity of the cluster population, and presence of intermediaries (ibid), where innovation is a primary and important output of cluster because of the internal pressure, complementarities and knowledge diffusion (Wijnolst 2009:483). A potential obstacle to successful cluster activities can be market imperfection (externalities), where companies underestimate the importance of their activities as an influential factor to the activity of other companies, prompt for public intervention aimed at stimulating the process of agglomeration politics.(ibid: 487)

The impact of leader firms is important, as they can often make a large initial investment in innovation and knowledge creation, creating standards and benchmarking, an organizational infrastructure and creating positive reputation for the cluster, acting as a lead user to suppliers because of their increased bargaining power. (ibid)

It has been argued that there is a significant impact of government policies in terms of enabling or reducing competitiveness. Also, the value and the need for a level playing field in maritime policy terms is highlighted, stressing the importance of such policy measures to be consistent and continuous, to enable long-term decision making and investments. (DSA working paper 2010:57, Poulsen and Sornn-Friese 2011:578) Thus, as in this thesis aims to comprehend a particular shipping segment, the focus will be narrowed down even further to highlight recent developments in renewable energy policies and regulations and their influence on the shipping segment dedicated to servicing this industry.

2.5. Energy policies and regulations

Energy can be defined as the potential to produce heat or do work. It is traditionally derived from burning a fuel (a substance which generates heat upon burning), or, recently, through alternatives such as solar rays, thermal resources, ocean waves, wind offshore and onshore (Bhattacharyya 2011:9). The obvious disadvantages of employing the former for power production, namely its harmful impact on the environment and it being finite and controlled to a large degree by a few suppliers with increasing bargaining power has prompted for acceleration in the development of the latter - it has been documented that by 2050 80% of the world`s energy supply could come from renewable sources(UN Energy renewables status report, 2011), and this further underlines the relevance of implementing this kind of policies (Sun et al 2012).

Energy policies and the effective allocation of power generation resources is undoubtedly an important part of the political decision-making for every country, economic region and the global economy as a whole. Sustaining a balance between energy supply and demand is essential for ensuring worldwide economic progress. Particularly in the case of Europe, which depends for its fuel deliveries on a small number of suppliers with an increasing bargaining power (Russia and the OPECs), the desire for (partial) energy independence is an additional driver for the implementation of an energy mix containing new and varied sources of energy(Esteban et al 2011). As in any other industry, there is the pertaining dilemma of selecting the best and most effective resource allocation method to do that. This is why choosing the best projects to invest in is crucial for implementing an overall successful energy policy. Investments are essential, be it public or private. How are these projects evaluated? The assessment covers issues such as whether the venture should be undertaken by private or public sector, what are its fiscal impacts, efficiency and equity of cost recovery and environmental impacts of the project. This happens by identification and estimation of costs, benefits from the investment, comparing the costs and benefits to determine the appropriateness of an investment (Bhattacharyya 2011:166).

2.5.1. Renewable energy

The renewable energy supply has grown at an annual rate of 2.3% for the last 30 years; the present use is but a small fraction of their potential, so the regional production is expected to grow (ibid:251). Non-hydro renewables occupy barely 3.6% on a global average basis – however, in Europe the distribution varies according to areas – some countries have abundant hydropower (Norway, France, Sweden and Spain), while others stand out in non-hydro renewable energies (Germany, Italy). Electricity from wind turbines has emerged as the leading form of renewable electricity. Some technologies can be used 10% of the time in a year (such as photo voltage), indicating intermittency of supply, while others like geothermal are operating at 100% capacity. The intermittent nature of solar and wind energy adds to the capacity utilization and increases the cost of supply. (ibid)

The evolvement of renewables as a source of energy is driven by a desire for reduction in CO_2 emissions, security of energy supply and improving energy access and other spillover effects such as reducing the possibilities of economic shocks (ibid).

The main obstacles preventing growth for the alternative energy technologies are technological (related to intermittency of supply, especially for wind and solar), uneven playing field(failure of the marketplace to internalize the externalities of fossil fuel supply, e.g. not taking into account the environmental benefits), marketplace barriers(access to grid, regulatory barriers) and non-market place barriers (administrative difficulties, lack of long-term commitment, lack of information) (ibid). It could be claimed, then, that the lack of public awareness of the benefits and costs of fuels is leading to a potential undervaluation of these projects and not a big decrease in financial incentives for their implementation. Outside hydropower, wind has been dominating the market. It is the dominantly used energy resource, especially onshore, with projections for further growth in the next decades (ibid).

2.5.2. Offshore wind

Wind technologies are maturing and capacities are increasing due to their potential role in the future energy mix. But even more promising is the relatively young offshore wind segment, as the positioning offshore of the wind farms eliminates some of the arguments against implementation of wind energy (noise, spatial land constraints) and facilitates a better wind harvesting because of the stronger, more consistent and smoother winds offshore (Sun et al 2012). However, a major barrier is the high costs of developments and the investments needed, which are higher than onshore because of the harsh weather conditions and distance from shore. The derived from this cost of electricity produced in this way is higher than that produced with other sources and therefore makes offshore wind power less competitive - the cost is calculated to be between 6 and 12 €ct/kWh compared with 3–8 €ct/kWh for the onshore sites (ibid). Even though the costs have increased above expectations, the offshore wind capital costs are expected to fall to about 1500 EUR/kW by 2020. The different actors involved in this subject are already pushing towards that objective. Due to their obviously different modes of operation, their costs constitute of different expenses: mainly investment costs, operation & maintenance (O&M) costs and network connection costs (Madariaga et al 2012).

Leaders in offshore wind are the United Kingdom (UK), Denmark, Netherlands and Belgium. China, Canada and the US are also preparing to enter the market but do not play a significant part in the offshore wind global industry as of yet. Albeit a delay in the offshore installations, most countries involved in this energy segment are working towards a forecasted 9.8 GW, even though costs tend to increase in parallel with turbine farms going further and deeper offshore (Madariaga et al 2012). The reduction of offshore wind costs is expected to come together with increased efforts in R& D, experience curve concept which is a function of increased cumulative installed capacity, economies of scale. The former can be achieved by the use of either larger capacity turbines or offshore wind farms. Thus, when total installed offshore wind power doubles, it is estimated by using the experience curves that the costs per produced kWh can decrease by between 9 and 17%. Key areas where research is urgently needed are innovative and efficient wind turbine design, offshore electricity transmission, innovative offshore foundation concepts and installation, and new O&M strategies. Recent developments include vertical axis turbines that would allow for the turbine to kinetically store the energy collected even when there is no wind, floating turbine foundations, anti-corrosion and anti-typhoon design modifications, as well as minimizing the turbines' impact on birds and sea fauna, which should be closely monitored (Sun et al 2012).

European energy policies prompt a further decrease in costs by proposing lower energy price ceilings in the competitive tenders for offshore wind development zones and have developed a number of legal instruments to ensure the fair market positioning of offshore wind on the renewables market, e.g. the directives 2009/28/EC and 2009/72/EC, which promote easier adoption of offshore wind sources through direct price support schemes, obligated quotas, investment aid and tax exemptions or reductions, the support schemes used to promote offshore wind power are direct price support and obligated quotas (Madariaga et al 2012).

Considering the high costs and the volatility that electricity markets show in the presence of bulk wind power, investment in offshore wind demands specific and adequate political support. The European regulatory framework and the support policies adopted by European

Member States through their NREAPs have been presented. As the amount of wind power in European grids increases, the role of TSOs in offshore wind power integration is essential(ibid).

As utility companies are often state-owned, the government plays an important role in deciding the type of energy sources that should be invested into. These decisions are often a driver for spurring of some industries and stalling of others, as they determine the priorities of a certain country/economic region. It is true that there are many challenges in this industry, many of them solvable only with a sustaining long-term efforts from both governments and companies; however, those challenges are also an opportunity to innovate and improve the existing methods and materials - not only with the turbines themselves but also for the vessels transporting them.

2.5.3. Energy Policies as triggers for innovation in shipping

After having assessed the importance of governmental policies and regulations on the energy industry and its present developments, it is fit to analyze the factors relevant to the offshore wind energy sector and especially the shipping segment. As mentioned earlier, new policies could well be a trigger for innovation in shipping. Just like transportation and infrastructure, maritime shipping is important in any type of energy as a derived demand serving to help facilitate the needed movement of goods or services from one place to another. It has been an influential factor in the traditional energy sources like oil and gas, where a whole shipping segment is dedicated to the transportation of these fuels from the refineries to the power plants etc. An example of the way shipping is influenced by energy trade is bulk shipping, where this group of commodities accounts for 44% of seaborne trade, comprises crude oil, oil products, liquefied gas and thermal coal for use in generating electricity. These fuel sources compete with each other and non-traded energy commodities such as nuclear power (Stopford 2009:58). Furthermore, innovations within that shipping segment are often driven by energy regulations and demands from large customers that have an ever increasing bargaining power (Wijnost et al 2011).

Energy politics, in particular those regarding the renewable energy industry, have begun to influence shipping as well, most notably in offshore wind, where it is needed to facilitate the installation of wind turbines, cables and substructures and provide maintenance afterwards(Kaldellis 2012). Its dependence on the offshore wind and the dependence of the latter on government regulations make it easy to understand why the government in general and the implemented energy policies in particular influence heavily the developments in this shipping segment.

2.6. Governmental policies and locational opportunity windows

It can be argued that entrepreneurs themselves create opportunity windows or that they simply become aware of those and then exploit them – both of these hypotheses seem plausible. In the case of offshore wind shipping and the governmental actions contributing to its popularization, it is quite likely that the spatial dimension of these actions has led to the introduction of a window of locational opportunity (Sine and David 2003 in Brachert et al

2011 in Wustenhagen et al 2011) for shipping entrepreneurs – especially in the Northern European countries, where offshore wind developments are most prominent at present.

The challenge in an already existing industry is determining whether an opportunity has already reached its threshold of entrants and if an entrance in such market is not a viable idea any longer. (Sull 2005) establishes a theoretical framework that helps understand better the existence (or lack thereof) of profitable opportunity. He offers analyzing a market from a timing-based perspective, considering the continuity of demand, the essence of this opportunity, the presence of established competitors, probability of rivals entering the market simultaneously, the resourcefulness of these potential rivals, the probability of retaining one's market share and why is this opportunity still not seized. In the situation of a consistent demand, no big competitors, low threat of entry and lack of intense competition, he considers the opportunity window to still be open for new entrants.

Further on, as per (Hougaard 2005), competency, exceptional value, being able to match those to an existing need and accurate risk assessment are also essential for one to be able to enter the opportunity window. He asserts that the opportunity window depends on the discontinuity and the market not being cultivated , while maturation and intensified competition are a sign that the window has closed, the demand has to a degree been saturated, concluding that success requires customer focus, market perception and insight into one`s own competencies. The inability to perceive the market objectively can be related to some of the many paradoxes concerning opportunity windows – overvaluation of the idea, biased perception of the market situation, uncertainty of demand, and reliance on strong social ties that impede an entrepreneur's judgment and prevent him from adopting a different perspective. This might well be one of the reasons why many new ventures are doomed to cease their existence.

Other reasons for market failure, as per (Ridgman 1996), are an overly competitive market, insufficient preliminary market research, lack of innovation (commoditized product offering), not enough initial investments, which bring the focus back on understanding the customer. In order for these to be avoided, he proposes that new entrants develop a better understanding of their market, reduce their product development lead time, introduce an improved and formalized decision-making process and effective risk management across the product portfolio as well as with individual products.

3. Method

3.1. Methodological considerations

Answering a research question predicates selecting methods that would enable an in-depth exploration of the subject of enquiry. The choice of methods is founded on preliminary methodological considerations. The methodological considerations were defined by a number of philosophical assumptions which determine the direction and process of the research.

The main purpose of this study is to provide with an understanding of how and why does entrepreneurship occur within the wind farm installation shipping segment. Therefore, the research design is created with three main questions in mind:

- What is entrepreneurship characterized by in this context?
- How can knowledge be acquired about it?
- What would be the best way to acquire knowledge on this topic?

There is not one right answer to any of those questions. However, one can, through logical argumentation, adopt a stance that would facilitate the construction of a coherent framework for further research. Hereby follows a discussion on the ontological and epistemological assumptions and the way they reflect the research design and strategy.

3.1.1. Ontological considerations

Lawson (2012) states that

`Ontology within the context of social sciences can be defined as

1) the study of what is, or what exists, in the social domain; the study of social entities or social things; and

2) the study of what all the social entities or things that are have in common. `

Within ontology, there are two positions at the opposing ends of the ideological spectrum - universalism and relativism, the former entailing the existence of an absolute truth that can be objectively determined while the latter implying the plurality of realities, which are dynamically evolving and constantly modified by the participating agents.

Realizing the multilayered complexity of social reality and social entities, combined with the polysemy of their mutual interactions, raises the question which set of assumptions would enable a better understanding of the concept of entrepreneurship.

The answer points back to the initial research question, where an answer is sought within a certain context – that of the niche segment of offshore shipping. This prompts for, at least partially, reliance on subjectivity, acknowledging that there is not one correct definition of entrepreneurship but that it, as a subject of social enquiry, is looked upon as something that is continuously constructed and modified by contesting discourses. Thus, it would make sense that a company's strategy and vision of the industry's future and opportunities would depend upon its competitive placement and position in the value chain and it might not be shared by a company which is positioned differently in relation to the industry drivers.

Here , the focus of the study is both on interpreting observable facts(industry description and analysis) and on acknowledging the meaning a particular group of actors attribute to a certain concept(entrepreneurial efforts within offshore shipping and its potential developments). In order to do that, one needs to gather longitudinal data relevant to the industry's history and evolvement over the years, the reasons for its emergence and simultaneously develop an understanding of the differing perspectives of company representatives and thus be able to triangulate the information for further analysis.

How can this be done? Firstly, a sample needs to be made of the companies involved in this industry, sketching its size and structural characteristics and the most influential dynamics. After that, typical or especially relevant to the question of entrepreneurship company cases within this industry can be selected and analyzed which allows for more specific ,albeit non-generalizable, answers to emerge. Furthermore, situational specificity enables one to concentrate and delimit a certain discourse and study it. Even though the ever-dynamic interactions between social entities make it difficult to isolate a certain phenomenon and study it for itself, exploring and interpreting the contextual causalities is crucial in order to achieve a deeper understanding within the research area and identify all the themes involved and associated with entrepreneurship within this segment.

3.1.2. Epistemological considerations

There are two distinct approaches for acquiring knowledge. One is the positivistic one, holding that acquiring knowledge independent of bias is possible. The other is the one of constructivism, which argues that the knowledge one gathers is always somewhat influenced by the social construction of reality as well as by one`s own thought subjectivity. Although the traditional scientific paradigm thinking holds that positivism is the preferred way of seeking answers[1], the constructivist one claims that knowledge is mostly acquired from interpreting meanings and attributions, made by the actors that are creating this reality. In this sense, one should not forget the self as a tool of enquiry - this would entail acknowledging one`s own perceptions and subjectivity throughout the research process, which, as double interpretation, further decreases the degree of objectivity. [2]

Both of these assumptions can be used in different stages of the research, where at the beginning objectivity is sought in order to establish boundaries, delimit, describe and define the object of enquiry better, and then subjectivity in order to find out more about the attitudes and meanings associated with it from the actors involved. Such reflexivity in

[1]Social research methods, positivism and post-positivism
[2]Richards D,The Research Project, University of Liverpool

approach is needed to come up with conclusions that are at the same time relevant to the question and derived from the gathered data.

3.2. Choice of methods

To briefly synthesize the main assumptions:

- Reality is relative and dynamically reconstructed by various actors
- What can be known about this reality is biased in its own right, but at the same time
- A degree of objectivity is essential to establish the facts and data relevant to the study in order to conduct a thorough and reliable analysis

As the different sub questions posed by the main question require different approaches for finding an answer, this will shape the way one would acquire knowledge, namely employing both the positivistic and constructionist paradigms. The choice of methods will thus be based on the underlying assumptions stated above.

3.2.1. Data gathering and interpretation

It has been argued that certain approaches entail certain research methods which are considered best for gathering data within the context of a certain research paradigm. This is not necessarily true, as it is not only the method itself, but also the way it is being employed that generates relevant empirical material. Within this research, methods would be used that would facilitate a dialogue allowing for a collective construction of meaning, such as :

- Interviewing with open-ended questions combined with careful selection of key informants
- Analysis of secondary information
- Quantitative data from the companies that are a part of the industry regarding their number, size, financials, employee number.

In this research, there are no preliminary stated hypotheses; rather, it is an attempt to utilize entrepreneurship theories into the analysis of the offshore shipping industry and its future potential to incumbents and potential entrants alike. Some of the aspects of the research are interpretive in nature. The latter especially applies to interviews with individual firm representatives within the industry. Therefore it was deemed fit to employ so-called middle range theories that could bridge the gap between empirical data and grand theories without making generalizations.

The purpose of the study is to find out the reasons for the emergence and enterprise creation in this industry, whether there are still opportunities for entrepreneurship and who can take advantage of those and understand whether, like in other shipping segments, there is commoditization already taking place. Another important enquiry concerns the current challenges that companies in this industry are facing and the most influential industry drivers.

3.2.1.1. Delimitation of the offshore wind shipping segment

In order to find answers to these questions, the companies belonging to the segment had to be researched. The delimitation was done in both geographical and products/services offered terms, as well as in terms of a company's position in the supply chain.

The value chain in this shipping segment is closely intertwined with that of the offshore wind industry. This is why in order to find more information about the industry, the 25 largest currently operational offshore wind farms in Northern Europe were identified with the help of EWEA statistics and reports. This data was used to help identify the offshore turbine manufacturers and their respective market share, as well as the market share of the companies owning the wind farms. Throughout the construction, installation and subsequent maintenance of the wind parks, a number of vessels were employed for various purposes in different stages of the project. With the help of 4Coffshore vessels database, for each of the offshore wind projects data was extracted regarding the participating marine contractors and then included in the wind offshore vessels industry analysis. This was needed in order to get an overview of the main incumbents. Although the data gathered was not sufficient to measure the degree of involvement of the studied companies in this industry, for companies focusing only on offshore wind it could be possible to measure their financial and market performance by tracing the change in their employee number, turnover and net profit throughout the years.

Microeconomic data were collected for 62 maritime shipping contractors that had participated in offshore wind projects. For those firms, the following data was extracted: number of employees and its change through the last 5 years, year of establishment, ownership history, turnover, net profit, location, fleet size and age, type of service offering, activity in other industries, founder background. This data facilitated a comprehension of their commitment to the industry, their reasons for entry and evaluation of their subsequent performance. In regards to the entrepreneurial aspects of this study, reviewing the founder's background provided a better basis of evaluating the opportunity in offshore wind and the competences required to exploit it.

3.2.1.2. Key informants selection and interviewing

Another important detail that should be taken in consideration is that within the offshore wind shipping segment there are three main subsegments of marine contractors, handling the most important tasks throughout an offshore wind turbine's lifecycle: turbine and foundation installation vessels, cable laying vessels and service vessels (including operation & maintenance, crew transfer and accommodation vessels), with some of the companies participating in two or all subsegments. In each of these subsegments, there are certain structural differences, which prompted the individual analysis of each of them. This was taken into account not only in the quantitative data gathering, but also throughout the qualitative data gathering process by conducting an interview with at least one company from each subsegment. Choosing the companies to contact was crucial to getting essential information about industry perception of the participants. Selection criteria included that companies needed to either be started by an entrepreneurial individual or represent a certain subsegment, thus the companies belonged to varying subsegments. The interview questions explored three aspects – the past, present and future developments in the industry, accentuating the entrepreneurial aspects. Past developments concentrated on opportunity exploitation, rationales for entry in the segment, resources that had to be mobilized for market success. Present developments included questions about current industry challenges and the company representative's evaluation of their company's competitive position and situation. Future developments covered enquiries regarding future industry outlooks and possible new markets.

40 companies were contacted via emails and/or telephone. Out of them,8 responded and 5 interviews were arranged - with Hans Froholdt, Head of Service & Logistics at *A2SEA* A/S(installation subsegment), Thorsten Jalk – CEO of DBB Jack-up(O&M, service subsegment), Michael Rix, head of shipping at Monjasa/ C-Bed(accommodation vessels), Kell N. Thyssen ,, director of international projects at JD-Contractor (cable laying subsegment) and Petra Ernst-Gutierrez, marketing and communications manager at Cwind (crew transfer service vessels). The questionnaires were specifically designed for each company that agreed to be interviewed to ensure that relevant data was gathered**.** The interview transcripts and guides can be found in the appendix (See Appendix A).

The qualitative data gathered from the interviews was coded and disclosed to the industry analysis and discussion part of this study as means of aiding the evaluation of opportunity, rivalry and commoditization in the segment. Nvivo interview coding software was used to analyze the data and code the emerging patterns from the qualitative input. There were few main patterns, related to entrepreneurship and intrapreneurship, opportunity recognition and innovation, customers and competitors, challenges, perception of the industry and its future, perception of the role of the government. It was important to understand their attitude towards entrepreneurship as well. They were coded twice - first in order to identify information of the interviewees that could be relevant to the industry analysis such as attitude towards competitors, perceptions of the industry and its future in the following decades, and a second time in order to find more information about the meaning of entrepreneurship and innovation to them and the perceived role of entrepreneurs and know-how in the industry.

3.2.2. Porter's 5 forces model as a framework for industry analysis

Once the industry's boundaries were defined and data about the respective companies was gathered by qualitative and quantitative means, the market forces crucial to its current state and future developments had to be identified. Porter`s revised framework (Porter 2008) was chosen to interpret the empirical data and conduct an industry assessment. In its essence, the former focuses on 5 main areas: bargaining power of suppliers, bargaining power of buyers, rivalry among existing competitors, threat of substitutes, threat of new entrants and the government as a force. The industry structure depends to a large degree on the intensity of the 5 abovementioned forces – the more intensive the forces, the less profitable the firms participating in that particular industry (ibid). Being aware, defending against those forces and shaping them in a company's favor is crucial. As this study attempts to provide information about the strategies firms in offshore wind shipping employ in order to enter and remain on the market, employing this framework for industry analysis allowed for an assessment of the extent to which its theoretical proposals align with the situation in the wind shipping segment. According to Porter, industry structure drives profitability, and defining the industry's structure enabled a better understanding of the commercial success or failure of offshore wind incumbents.

3.3. Ideal data set

Data that could not be obtained but could ideally contribute to a more thorough study of the segment:

- Longitudinal financial data regarding the industry incumbents, going back to the 1990s, when the initial developments in the offshore wind industry began.
- Data about the companies that have gone bankrupt, so that one could better trace the reasons for their insolvency and see what is the failure rate in the different subsegments.
- As a lot of the companies are private, data about their financial results and employee number was not available in the database. Data from more companies would have allowed for a more comprehensive and generalizable study of their growth and financial performance through the years.
- Intrapreneurship data - data about the founders of the companies that had been established as spinoffs/ the person people that came up with the idea of horizontal integration was not readily available, but it would have helped understand better the causes of intrapreneurship in the industry.
- For the vertically integrated companies – data about the distribution of employees in the different activities – e.g. the percentage of the employees involved in installation activities, the percentage involved in cable, etc.
- For horizontally integrated/diversified companies – data regarding the distribution of employees in the different industries where they are commercially active in order to evaluate their commitment to offshore wind
- Quantitative data regarding the participation of companies in offshore wind projects, so that their market share in the respective segment could be calculated.
- More extensive data regarding the motivation of individuals to set up companies in offshore wind shipping. Some information was gathered through the interviews, but it did not suffice to evaluate all of the theoretical propositions concerning entrepreneurial drivers.

3.4. Reliability, Validity, and Generalizability of the Findings

This study is based on a combination of macro and microeconomic data. Macroeconomic data(regarding energy statistics) was collected from Eurostat, World Bank, energy agencies and consulting agencies reports, microeconomic (data about the companies) from the Orbis and Navne& Numre databases, all of them accessible through the CBS library server.

There are potential limitations in any framework that could be employed. The quantitative databases could be biased by their choice of data sources. Regarding the study of entrepreneurial motivation, extensive use was made of interviews of shipping executives. A potential problem is interviewee bias where interviewees, could attempt to create a socially desirable impression of their firms. As a result, the interviews can only serve as an indicator and cannot guarantee completely reliable and accurate accounts for the industry's state. Some of these findings, especially ones generated through interviewing, are specific to only some of the companies. Generalizability can be derived from the quantitative sample more than from the interviews, which tend to carry a higher degree of subjective bias. It should be noted that the firm environment, on a macro as well as micro level, is constantly changing; thus the validity of the empirics will potentially change on a temporal continuum.

4. Analysis of industry competitiveness

This chapter consists of delimitation and description of the offshore wind shipping segment, using guidelines from (Wijnolst 2009, Porter 2008), and analysis of the competitive forces by employing Porter's revised (Porter 2008) 5 forces framework. Subsequently to the analysis, the BSG advantage matrix (Wijnolst, 2009:108) is employed in order to locate each offshore wind shipping segment on the economies of scale-differentiation graph and compare it against other types of shipping.

4.1. Offshore wind shipping - industry description

According to (Porter 2008), an industry analysis aims to understand the underpinnings of competition and the roots of profitability amongst a plethora of companies servicing the same customers and operating in a similar environment.

This definition can be expanded in a more utilizable way by pointing out that industry is an activity concentrated around a certain technology and know-how needed to provide a particular product or around the product itself (Sornn-Friese and Hansen 2012:70), thus the offshore wind shipping industry should include the companies owning and/operating vessels providing services to offshore wind farm parks throughout the various stages of their lifecycle. In order to enhance the specificity of segmentation criteria, the boundaries will be drawn around those shipping operators that have specifically stated and acted upon their intent to operate in wind farm offshore projects – thus only the companies that have signed and completed contracts with offshore wind parks are considered in this analysis. Shipping being a traditionally global industry, permeated with cross-national relationships between customers and suppliers, the delimitation is not based on geographical constraints as much as on specifics regarding the company's commercial activities, fleet and its place in the offshore wind industry supply chain.

4.1.1. Criteria for segmentation

In order to define the industry's boundaries (the criteria for delimitation are explained in more detail in the methodology chapter under 3.2.1.1.Delimitation of the offshore wind shipping segment), one needs to consider the whole value chain and the production process which begins with energy regulations and governmental orders and ends with turbines being connected to the grid and maintained in proper operation .This lengthy process requires a number of competences and this is why a lot of different companies are involved. The scheme below was drafted to point out the most important categories. The numbers above the connectors and the connectors themselves indicate the complex relationships ongoing simultaneously between the various actors. These typically include[3]:

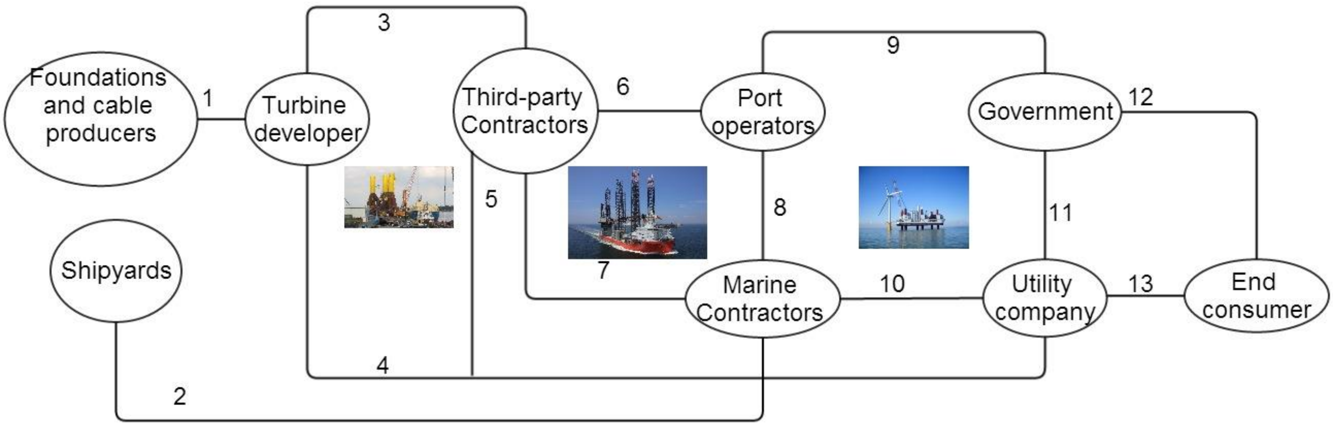

Figure 1 Offshore wind value chain, Source: This study`s industry analysis

- Electrical equipment and turbine foundations suppliers, producing the equipment needed for connecting the turbines to the grid (substations, transformers, cables, etc) and the turbine's foundations in accordance with specifications given from the OEMs[4].(1)
- A wind turbine manufacturing company, responsible for producing and supplying the wind turbines. Even though most of them already have extensive experience from onshore turbine production, they still have a learning curve, having realized that different design and features should be utilized offshore, because the operational environment is starkly different. It is important to note that because of the warranty they give on their equipment, the 5 years those companies are the ones responsible for signing maintenance(3,4) contracts. [5]

[3] Which Way Is the Wind Blowing?J.Bieksha ,November 19, 2012 in Connector-Supplier

[4] Offshore and onshore windfarm solutions, Alstom brochure , p.4-7
5 Guide to offshore wind report, January 2014, SSE, p.19

- Shipyards – shipbuilding companies, producing the tailor-made vessels needed for installation (WIVs) and maintenance (2) of offshore wind parks.
- Marine contractors – shipping operators executing turbine transportation and installation, service and maintenance, including also cable suppliers and installers – companies supplying and helping install the export cables. They sign contracts with OEMs, utilities (10), port operators(8), third party contractors(7).
- Third-party contractors – Companies, usually hired by the project owner, dedicated to managing and execution of installation and maintenance offshore projects through employing in-house competences or subcontracting.
- Port operators – port companies and publically owned harbors(9), providing the marine contractors infrastructure(storage) needed for installation and maintenance(8).
- Energy companies, owners of the project. After the 5-year warranty of the OEMs has expired, they have 3 options: renew the contract with the OEM(4), sign a maintenance contract with a third-party contractor(5), or take a hands-on approach where they either outsource to a marine contractor(10) or insource the installation process. They need to allocate and manage their resources so that they can ensure their customers are receiving good energy at good prices and in an efficient manner.
- End consumers, which represent the final destination of the produced energy – households, companies, economy sectors, etc. (12,13).
- Government, an influential stakeholder and investor in renewable energy projects(9,11,12), which has to manage the complex relationships between port operators, utilities and end consumers.

This analysis follows the business activities of the marine contractors providing assistance with installing and maintaining the turbines and the cable infrastructure. Because of the specificity of these services, a number of different vessels are needed to perform the variety of tasks and thus providing a different service within the context of each of the four offshore turbine lifecycle stages: Pre-Installation, Installation, Operation and Decommission.[6]

There are three main subsegments related to the diverse services the shipping companies offer as assistance to turbine installation and maintenance: cable laying, turbine and foundation installation and service and maintenance. The chart below shows the vessels typically employed in each subsegment[6].

[6] Offshore Infrastructure: Ports and Vessels , A report of the Off-shore Renewable Energy Conversion , platforms 2011 – Coordination Action

Geotechnical and environmental surveys	Turbine and foundations Installation	Cable installation	Service (Here O&M and crew transfer)	Decomissioning
• Survey vessels and platforms • Diving vessels	• Jack-up barges(non self-propelled) -feeder service • Jack-up vessels(self-propelled) • Crane ships/floating cranes - large sheerleg mounted cranes, used for substructures • WIVs - custom designed for turbine installation ships • Accomodation vessels (floatels) Passenger Ro/Ro	• Custom-made/Retrofitted cable laying vessels (CLVs)	• MPVs used for maintenance too costly to be performed with a WIV • Crew transfer vessels (CTVs) • Accomodation vessels (floatels) Passenger Ro/Ro	• Jack-up barges(non self-propelled) -feeder service • Jack-up vessels(self-propelled) • Crane ships/floating cranes - large sheerleg mounted cranes, used for substructures • WIVs - custom designed for turbine installation ships • Accomodation vessels (floatels) Passenger Ro/Ro • Custom-made cable laying vessels (CLVs)

Inspection and surveillance is a part of the pre-installation process, where the terrain is inspected and a subsurface investigation is conducted in order to evaluate the environmental impact of the future installation and plan it accordingly. [7] The parts are preassembled at the harbor, foundations and transformer stations are installed by the heavy lifting floating cranes[8]. This phase also involves planning, mapping the overall development concept and preparing the necessary project documentation[9].

Cable installation is one of the first steps during the installation phase of an offshore renewable energy farm project. The two main tasks which have to be dealt with are the array cable installation, meaning the interconnection of e.g. the wind turbines with the offshore substation, and the export cable installation. First the inter-array cables are installed, followed by installing groups of wind turbines (piles, nacelles and blades); testing ensues. After, the wind park is connected to the grid through installation of transformer stations and cable-to- shore laying [8].

Cable laying vessels of two types are required – for array and export cables, although recently there have been introduced new MPV designs, capable of doing both.[10] DP2 offshore supply vessels can be retro-fitted with cable-reels and cable engines. [10] The primary feature of these vessels is the capability to un-coil and lay the cable directly onto the bottom. All of the equipment associated with the deployment of the cable (including ROVs

[7] Offshore wind ship types, Offshore wind energie GmbH website
[8] Building windfarms, Renewable energy focus newsletter website
[9] European offshore windfarms – a survey to analyze experiences and lessons learnt, p.4, 2007
[10] Damen launches new design: Damen offshore carrier, Damen shipyard website, 08/2012

and ploughs) is controlled directly from the ship, and is linked to the laying vessel's positional system. In general the vessels are ocean-going vessels and they cannot typically operate in shallow near shore waters, relying on shallow-draft barges to assist with the deployment in water depths less than (typically) 8-10 m. The presence of the cable essentially constrains the vessel to a relatively small area and a single course or heading, thereby representing a potential barrier to marine traffic.[11] This accentuates the need for planning the project in temporal and spatial terms.

Turbine installation - in this stage, ships capable of being propelled as well as of carrying heavy loads are required, thus the vessels used are mainly jack up barges and vessels, crane ships for transportation of the substructures. An important addition to the fleet are the WIVs specifically designed to transport turbines and at a greater depth and distance offshore. In order for these vessels to be usable for wind farm installation purposes, they need to respond to certain requirements for their carrying capacity, as the approximate weight of an offshore turbine tower head can reach 360 tons[12], and the foundation 400-630 tons[13]. They also need to respond to a number of standards and regulations which would ensure safety and high performance at sea. [14]

Service and maintenance – Including operation and maintenance (often MPVs) for damaged elements replacement and Crew transfer Vessels (CTVs), used for minor repairs, as well as accommodation vessels. CTVs are often used throughout the installation phase as well, just like accommodation vessels, or floating hotels, as they are also called. Floating hotels can serve as accommodation for personnel working on installing or repairing the turbines so that they are not obliged to sail to shore should the operation last more than a day.
However, some of the companies in the industry, as the data gathered indicates, tend to participate in more than one of the subsegments. These cases of horizontal integration will be reviewed later on.
Decommissioning is the final stage of an offshore wind turbine's lifecycle. The average life of a turbine is about 20 years[15]. When a turbine has to be scrapped, an installation vessel is required to decommission the nacelle and the foundations, and a cable laying vessel in order to remove the cabling. None of the gathered data indicated that cable decommissioning has already taken place; however, as the interview with JD-contractor showed, the companies are already trying their hand at cable maintenance and repair in Northern Europe.
Another important issue when defining industry boundaries are geographical constraints. Although the industry has achieved a significant growth for the last decade, most of the largest wind parks are still situated in the North sea, with the respective shipping companies located in proximity to them. (EWEA 2012) However, new markets are already shaping in the rest of Europe (Spain, Portugal)[16], Asia and US[17]. For the purpose of this study, the

[11] Deepwater offshore wind report, compiled by University of Maine, 2012
[12] Siemens 6.0 MW Offshore Wind Turbine Brochure, Jan2012, Siemens Energy website
[13] Facts about Anholt Offshore Windfarm, DONG energy website
[14] Mapping the future in offshore wind2012,p.7-9,Germanischer Lloyd website
[15] Offshore wind Frequently Asked Questions , RWE website
[16] The European offshore wind industry - key trends and statistics 2013, EWEA 2013, p.10
[17] Offshore wind technology – prospects, Wind prospect website

geographical boundaries will be set to cover companies that service offshore wind parks in the Northern part of Europe (Netherlands, Denmark, Germany, Sweden, Norway, UK, Belgium) because of the concentration of activities here; however, some of the interviewees (DBB Jack-up, A2Sea, CWind) asserted that they are interested and see opportunities in entering the already emerging markets in Asia and US. After an extensive search, 62 companies situated in the abovementioned countries were identified as a part of the offshore renewables shipping industry; furthermore, in the UK there are already knowledge clusters starting to form, combining a variety of competences for more effective product and supply chain solutions. [18]
In conclusion, the delimitation criteria are, as follows:

- Companies operating vessels used for the installation, maintenance and crew transfer or cable laying of offshore wind parks
- Have provided or are currently providing services to wind parks situated in the North and Baltic sea.

Most of the companies included are situated in Northern Europe because, as the interviews with C-Bed, DBB Jack-up and CWind representatives indicated, of the commercial opportunities this location provides - for the newly established firms it was the proximity to the first offshore wind projects, while for the ones already in shipping but diversifying their activity to wind it meant reaping benefits from their already existing offices in the region.

4.2. Industry history

The industry`s beginnings can be traced back to the beginning of the 1990s in Denmark, when the first offshore wind harvesting farms were built. The first offshore wind farm platform was the one in Vindeby, built by BONUS A/S, today known as Siemens wind power. [19] They were installed by a crane vessel provided by a logistics services company called MT Hojgaard A/S . However, this solution was far from ideal as the need for a more sophisticated, specialized ship for carrying and assembly of the heavy turbine structures arose. Following the Kyoto protocol, the Danish government, in co-operation with the Danish utility company, produced an action plan for offshore wind turbines on a large scale. A new idea for a ship was conceived in order to cater to the specialized demands of the offshore wind energy industry in a more efficient manner, thought out by the soon-to-be founder of A2Sea, Kurt E.Thomsen. Owner of Danish Crane Consultants, he had been working as an engineer in the crane industry for 17 years when he designed the concept for the transportation, installation, operation and maintenance of offshore wind turbines by attaching 4 legs and a crane to a ship[20], thus employing his competences from the crane business into the young offshore wind industry. After the turbine manufacturers choosing the concept as the most reliable and effective method, A2SEA was founded in 2000, with the overall aim of supplying the wind turbine industry with solutions for the transport and installation of wind turbines and foundations.[21] Part of the initial capital came from the Den Grønne Jobpulje, a fund for helping green businesses create new workplaces. [20]In 1999, the first wind farm installation vessel concept was patented[22], first as a trial retrofitted container vessel[23] and then moving on to manufacturing tailor made newbuildings. The first purposely

[18]UK Offshore supply chain – Why clusters mater, 2013, Clean Energy Pipeline Website
[19] Vindeby history, SeasNye website
[20]Gode resultater med grønne job, Interview with Kurt E.Thomsen, 2002, Information newspaper website
[21] A2Sea, Taking Windpower offshore, business report,Business review Europe website
[22]A2Sea, Pioneers in Offshore wind, Offshore Energy Denmark website
[23]Offshore Vessels technology and concept proof, Force technology website

built vessel of the latter type to enter the market in 2003 was the six legged jack-up vessel TIV Mayflower Resolution, developed as a costly (75$ million[24]) attempt for diversification from the defaulted in 2004 transportation company Mayflower Energy[25], today owned by MPI Offshore and known as MPI Resolution.. According to the offshore vessel database, 18 more ships based on a similar or advanced design are on schedule to be deployed between 2011 and 2014. [26] Both these custom made vessels and the ones already being used in other industries, such as MPVs, have their advantages and drawbacks, related to costs, installation time, ability to maneuver – for example, while the MPVs are cheaper to charter, they offer a more time-consuming and less flexible service.[27]
However, these boats were not suited for laying the cables required to connect the platforms to the grid. Soon after the founding of A2Sea, the first company dedicated to cable laying for offshore wind emerged in 2002 , established by Paw Cortes in Odense, Denmark[28]. Started with no owned vessels, the company employs now more than 160 people and a fleet of vessels dedicated to the various stages of cable installation for offshore wind.[29] As of 2013, CT Offshore is a subsidiary of A2Sea[30].
Throughout the last decade, offshore wind activities have expanded beyond the borders of Denmark - the United Kingdom is currently the leader for European offshore wind, with 57% (3736.10MW) of the total installed capacity, and another 906.20MW under construction. Germany is looking to become the second largest player in the coming years with 529.30MW installed and a substantial number of projects under construction. Whilst Denmark, Belgium and Netherlands all have a significant market share, Germany and the United Kingdom are considered the two major players due to their large project pipeline.[31] There are a number of other factors that need to be considered in order to construct a reliable assessment of the current state and future developments in offshore wind. Those will be addressed below.

4.3. Growth rates

The offshore shipping's dependency on the renewables energy industry leads to a cross elasticity and cyclicality in its demand because of the way it follows the cycles of demand for offshore energy and the complementary character of the services it provides. So in order to be able to predict its growth rate, one needs to look into the offshore wind parks number and its cumulative and projected growth over time, as well as consider the plans and intentions of public and private institutions to support this energy segment.

With the depletion of fossil fuel reserves ashore, traditional energy sources are becoming more difficult to obtain and more costly because of the increasing bargaining power of the suppliers of such fuels; there is a dire need to employ alternative ways of energy production to satisfy the ever rising demand for electricity.

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[24] Vessel supply chain shapes up for off shore wind, Marsh G. 2010
[25] Mayflower installation ship sold for just 12 GBP million,2004 Telegraph newspaper website
[26] Offshore vessels database 4COffshore, WIV data
[27] Offshore Wind Energy Installation and Decommissioning Cost Estimation in the U.S. Outer Continental Shelf 2010:32
[28] Klods Hand på kabeleventyr, Information about Paw Cortes, the founder of CTO in Berlingske Business site
[29] CT Offshore Presentation regarding their activities in offshore cable laying , 2013
[30]A2Sea's history, A2Sea website
[31] 4C Offshore wind industry report sample August 2013

EWEA expects 150GW of offshore wind capacity to be realized in 2030, an amount which would supply 14% of Europe's electricity demand, the development and diffusion of offshore wind energy technology is becoming more and more relevant for European energy policy. Wind harvesting is one of the technologies most widely associated with sustainable energy production.

Figure 2 Offshore Market Investments and capacity Source: Roland Berger offshore wind report

In theory it should make the greatest impact on achieving European 2020 renewable energy targets and create more new jobs than any other renewable energy source. However, the market is still in its infancy and therefore there is a high degree of uncertainty[32], underlined even more by the presence of other renewable energy harvesting technologies on the market, which will be assessed later on. In spite of the indicated number of growing investment and planned offshore projects, there is still an uncertainty of subsidies which, together with the Eurozone crisis, could turn out to be an obstacle to the future progress of offshore wind because of its direct influence on utility companies as main project stakeholders and subsequent impact all the rest of the contractors along the supply chain that have invested in different stages of the execution of new wind farm projects that get cancelled or delayed in time. Conversely, as the chart below indicates, the projected demand for renewable energy is projected to triple in China and the US, which could mean potential new markets for the existing companies and opportunities for aspiring entrepreneurs.

[32] European Offshore Wind 2013 – Realizing the opportunity, report by Freshfields Bruckhaus Deringer

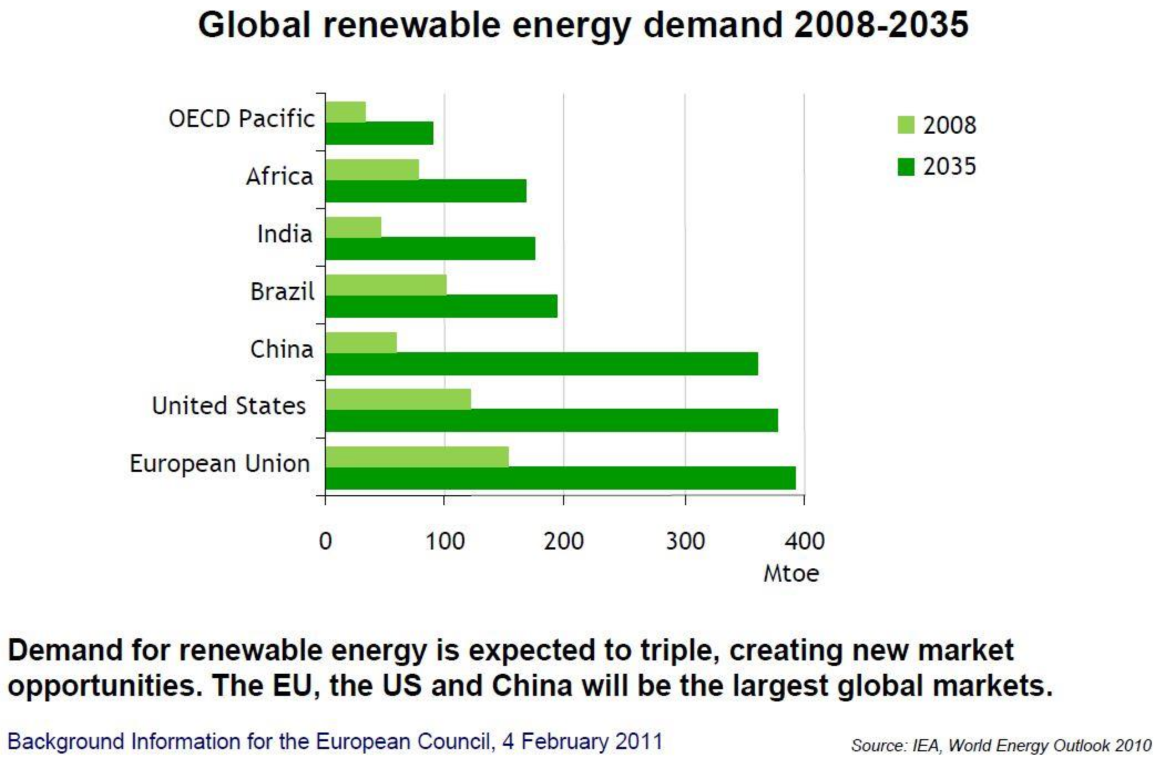

Figure 3 Global renewable energy demand 2008-2035, Source: IEA

Furthermore, there is a trend of backward integration of segment customers, which means that the market is expected to become more competitive in the near future,especially the one for WIVs. An example of backward integration along the supply chain is DONG energy, which acquired a majority share of A2Sea in 2009 [33]and owns a number of service vessels, managed by the latter.

The abovementioned delays of projects and a failure to predict the unexpectedly high development costs has led to the bankrupcy of a number of companies, most recently BARD Offshore, which had been operating at a loss for the last few years[34], the Mayflower Energy in 2004 ,Finnish turbine manufacturer WinWind[35], the German turbine developers Windreich GmbH[36] and Furhlander[37] and the cable laying Subocean[38] to name a few. Thorsten Jalk of DBB Jack-up contended that defaulting happens often in the cable laying segment, because of the project contracts, where utilities and OEMs transfer the majority of the risks over to the cable laying vessel operators, which are smaller and less financially solvent.

[33] DONG Energy buys A2Sea, DONG energy website
[34] BARD is bankrupt, Renewables International website
[35]Finland's Winwind files for bankruptcy, Offshore wind.biz website
[36] Windreich files bankruptcy, Sunwindenergy website
[37] Fuhrlander files for bankruptcy, Renews website
[38]Subocean bankrupt, bought by Technip, Newsenergy world network website

4.4. Supply side

On the supply side in offshore wind, it is important to note that suppliers are considered not only the turbine manufacturers and the shipyards, but also the whole shipping segment supplying transportation services to the offshore wind energy segment as well as the workforce suppliers needed for the offshore and onshore business activities of the shipping operators.

4.4.1. Turbine manufacturers

This chart follows the number increase of the 25 largest offshore windpark installations in Northern Europe for the last 12 years.

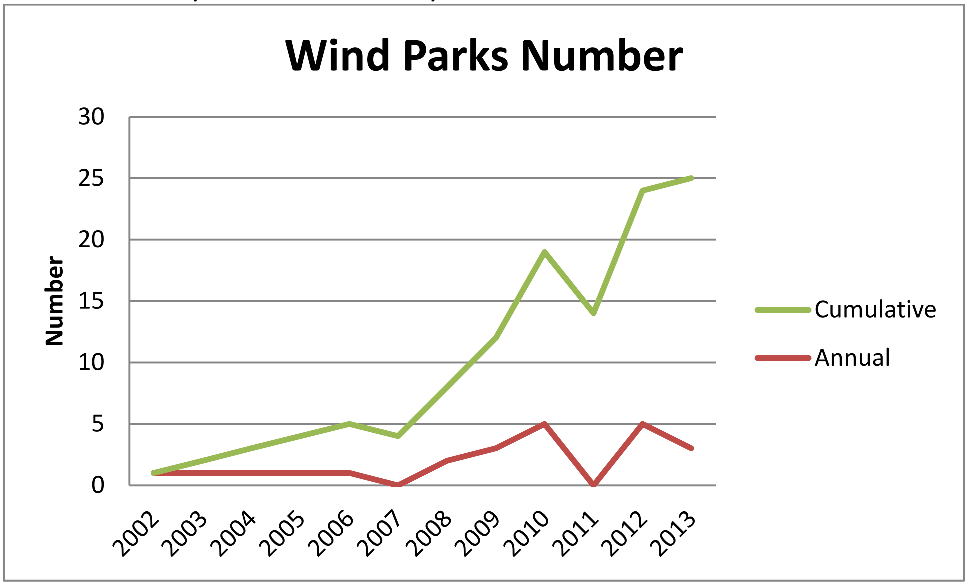

Figure 4 Wind parks number growth Source: Appendix B

It usually takes between 2-5 years for a windfarm project to be planned, permitted and connected to the grid [39]. As the graph indicates, 2007 is the year in which a relatively high number of parks became operational, which further affirms the 2000s as the landmark decade for intense growth in offshore wind.
Turbine manufacturers are often companies leveraging their know-how from the onshore wind industry and implementing it offshore. Currently, there is a growing trend to economies of scale (turbines growing larger) and increased efficiency of the overall design, adjusting it so that it fits the more challenging weather conditions of offshore wind parks. [40]Siemens currently has by far the largest (63%) share of manufactured capacity, followed by Vestas with 21 %, Repower and BARD. The small number of operational turbine manufacturers and the forward integration of Siemens ensure the company's high bargaining power as a party in managing the project and the service related to its implementation and subsequent maintenance and protects it against market volatility, as Hans Froholdt of A2Sea asserted in the interview. However, new producers have expressed interest in the offshore wind market in recent years due to the market's geographical expansion (such as Hyundai, Sony, Samsung Mitsubishi)[41] and so the market structure in the OEM segment is expected to shift towards a more competitive one in the near future.

[39] Frost & Sullivan 2009 , p.18
[40] EWEA European offshore wind stats report 2013, p.16
[41] Roland Berger offshore wind study 2013, p. 7

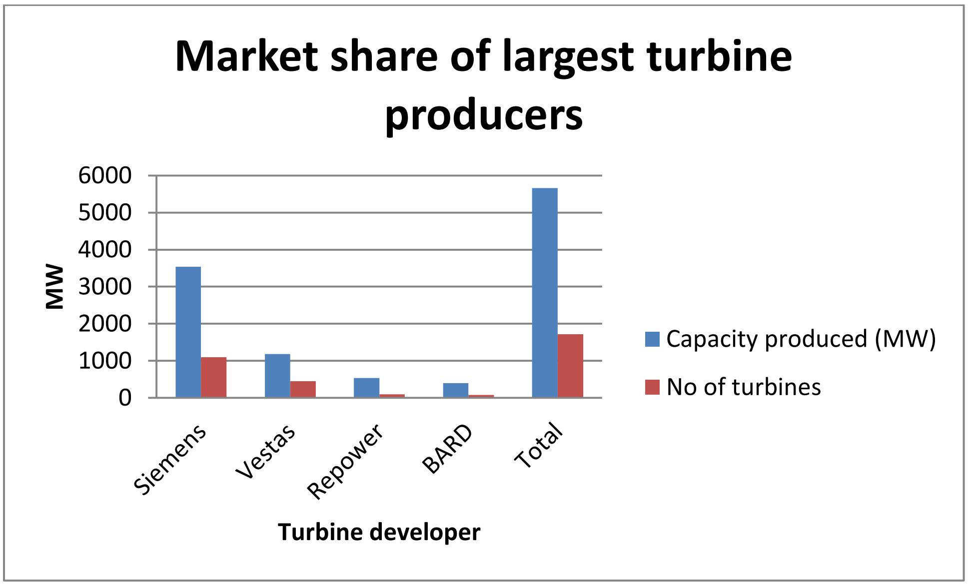

Figure 5 Market shares of largest offshore turbine producers Source: Appendix B

4.4.2. Shipbuilders

4.4.2.1. Shipbuilding in the installation subsegment

The learning curve in production of WIVs is steeper than when producing vessels that have been on the market for decades, because of the capital-intensive R&D activities related to vessel production. The large number of shipyards already manufacturing jack-up barges, MPVs and floating platforms [42] makes for a more fragmented market and lessened bargaining power of individual shipbuilders. As most of the large shipyards are situated in Asia, there are a few large ones already involved in WIV production. According to interviewee accounts (DBB Jack-up and A2Sea), Polish and German shipyards are participating in WIV production as well. The interviewees did not point out the bargaining power of shipyards as an issue of concern at present.

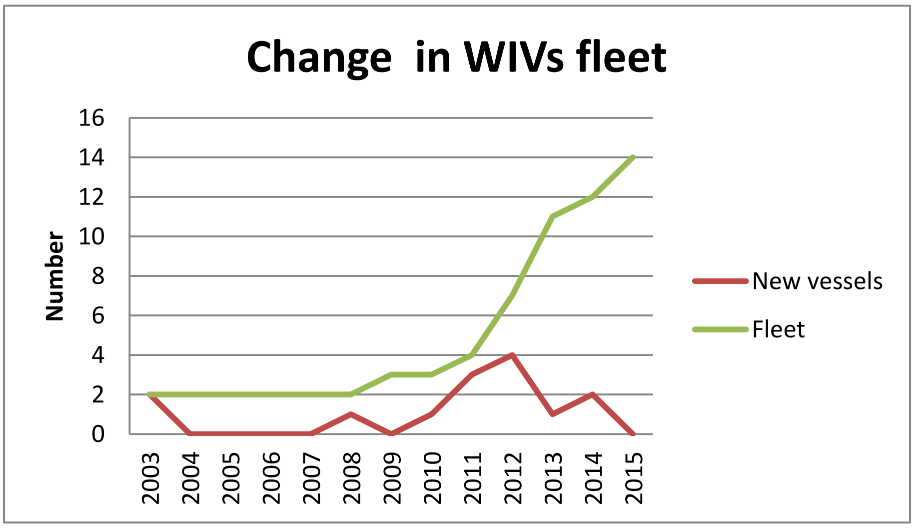

Figure 6 Number of WIVs entering the offshore wind market Source: Appendix C

[42] Final Report on shipbuilding competitiveness, Ecorys

There are currently 12 WIVs operating within the industry, with 4 to be delivered in the near future to respectively Seajacks, Scaldis, Van Oord and A2Sea within the installation subsegment. Cosco shipyard in China has the largest share of orders at present, followed by Samsung Heavy(South Korea) and Lamprell (UAE)(each with a 14 % share). With the advancement of the industry, more yards are expected to start taking orders for WIV manufacturing. Even though only a few shipyards are represented in this sample, there more are expected to become involved in WIV production, with third generation WIVs already available on the market. [43]

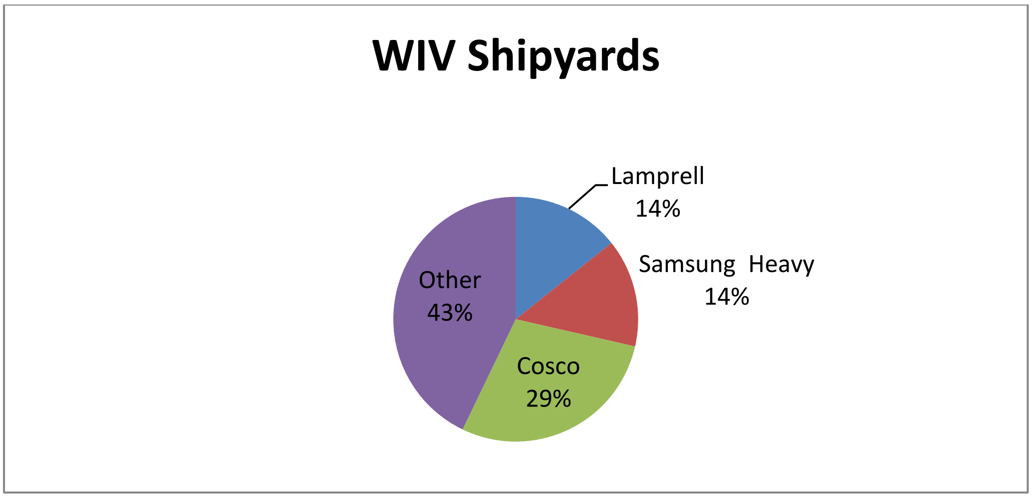

Figure 7 Shipyards building WIVs, market shares Source: Appendix C

4.4.2.2. Shipbuilding in cable laying subsegment

There are a lot of yards offering building and/or retrofitting of cable laying vessels, some of them are situated in Europe and are already receiving orders for new tonnage from companies involved in offshore wind(Van Oord), such as the German Damen [44] . Their large number lessens their bargaining power.

4.4.2.3. Shipbuilding in service and maintenance subsegment

An important distinction should be made between CTVs, which are produced in many yards worldwide such as Damen, HvideSande skibs & Bådebyggeri[45] and the new concept of O& M vessels, which are not yet standardized, such as the one used by DBB Jack-up, which are specialized in component change and maintenance operations and are not widely produced as of yet.[46]The latter have been designed in collaboration with various European and Asian shipyards, said Thorsten Jalk of DBB Jack-up. Retrofitted Ro/Ros, used for providing accommodation vessel services (C-Bed) are usually bought on the second hand tonnage market, as the interview indicated, thus in this case shipyards do not play a direct role as much as the secondhand specialized tonnage market prices do.

[43] New Trends of WIV, presentation by Samsung Heavy Industries, 2012
[44] Van Oord contracts Damen for DP2 cable laying vessel, 2013, Damen website
[45] Website of HvideSande skibs & Bådebyggeri
[46] Fleet of DBB Jack-up, DBB Jack-up vessels website

4.4.3. Marine installation services suppliers

The three main subsegments will be looked in-depth below.
Further down each of them will be reviewed separately in order to individually assess the competitive structure of each one. This is needed because most of the vessels are tailor-made for a specific value chain activity and the dissimilarities in their design lead to dissimilarities in the services they provide.

Some companies are vertically integrated, that is to say that they operate in more than one of the subsegments. In these cases, only the part of the fleet they employ for the respective subsegment is considered to belong to it. This distinction could not be made for the employee distribution in the different activities and therefore two time series were employed in each employee number change graph - one displaying the average number of employees of companies involved **only** in the respective subsegment, and a second one displaying the average number of employees for all of the operators, including the vertically integrated ones.

The new tonnage comes for the most part from WIV and service vessels. (See Appendix C)

4.4.3.1. Turbine installation shipping subsegment

Currently there are 17 companies involved in turbine installation, they operate a total of 77 vessels , the average fleet age is 11 years and the average fleet size is 5; 12 of these vessels are WIVs, while the rest of the fleet consists of jack-up barges, floating cranes, tugboats and MPVs(See Appendix D). The relatively low average fleet age is largely due to the newbuilding tonnage of WIVs, with more new capacity expected in the following years.

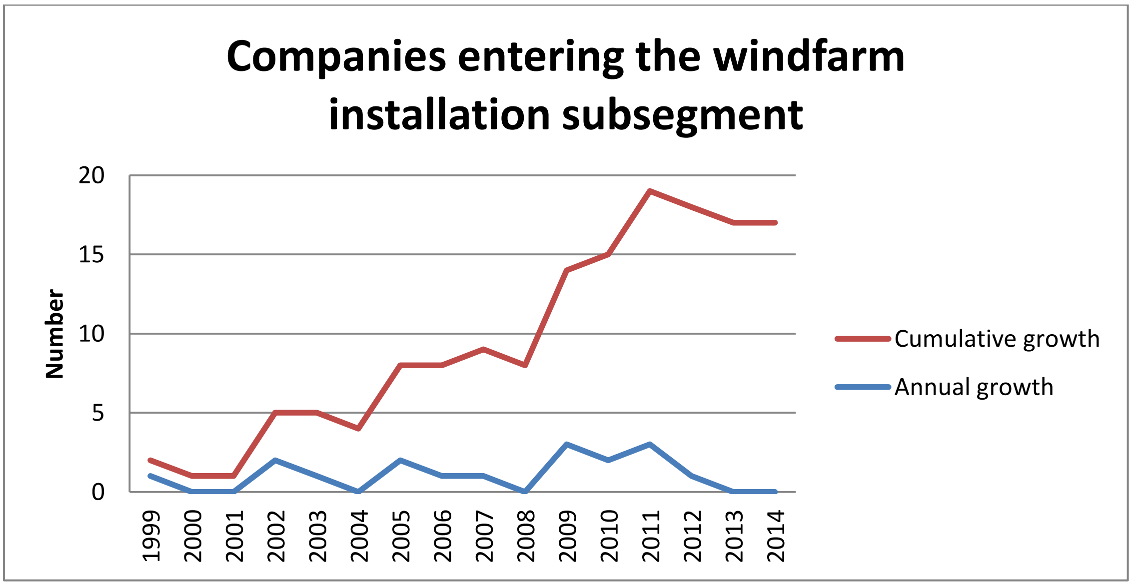

Figure 8 Companies entering windfarm installation subsegment Source:Appendix D

As it can be seen from the graph, the number of companies in this segment has increased drastically in the last decade – however, a large share of the incumbents are either spinoffs from larger organizations or horizontally integrating already established organizations(See Appendix D). So even though the company that marked the beginning of offshore wind installation shipping(A2Sea) was founded by an individual (Kurt Thomsen), the fast-paced technological advancements and growing capital requirements (all of the interviewees stated know-how and a large amount of financial capital as necessary conditions for entering this market), combined with the beginning of vessel standardization[47] in the segment have prevented smaller-sized competitors from entering this segment.

Only 3 of the companies (A2Sea, Swire Blue Ocean, Gaoh offshore) operate solely in offshore wind - the rest are involved in other industries such as oil& gas, drilling, consultancy etc. Most of these companies are situated in Denmark and the Netherlands. 4 of the companies are owned by shipping companies, 5 by engineering companies, with 3 having financial holdings, 3 construction and 3 energy companies as owners. The industries in which the owner companies operate indicate the variety of competences that could be leveraged to offshore wind farm shipping projects.

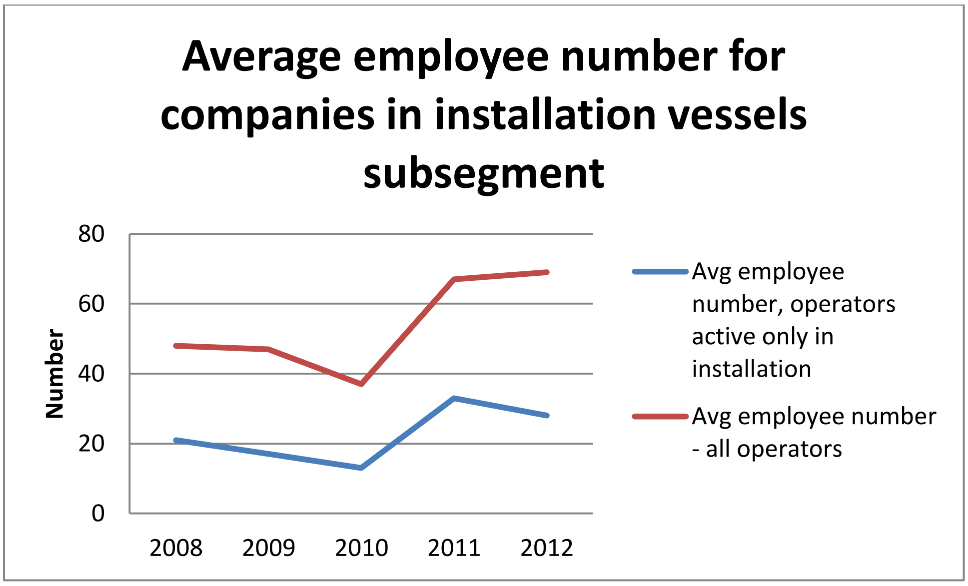

Figure 9 Average employee number for installation vessel service operators Source: Appendix D

6 of the companies(A2Sea, Fred Olsen Windcarrier, MPI, GTEC NV GeoSea,Workfox, Eiden Maritime, Boskalis offshore)are vertically integrated, i.e. active in other offshore wind subsegments(mostly service), while 11 operate only in installation. This indicates a trend of vertical integration of the installation vessel operators.

As the graph(Source: see Appendix D) indicates, the average number of employees is increasing. (Hochtief, as a large company employing over 78000 people, has been excluded

[47]Guidance Notes for Wind Turbine Installation vessels 2013, Lloyd's Register

as an outlier). Out of the 17 companies, 4 have achieved a growth in size (number of employees) in the last 5 years – A2Sea, Fred Olsen Windcarrier, Swire Blue and MPI offshore. It is interesting to note that the latter three are spin-offs/acquisitions of larger shipping companies(Fred Olsen, Swire Pacific, Vroon respectively), which coincides with the theoretical assumptions asserted in the literature regarding faster growth of companies set up by other companies operating in segments similar to that of the spinoff. However as 15 out of all companies operate in other industries as well, the increase in employee number might not be solely due to offshore activities.

In A2Sea,the only company set up in the segment by an individual, the founder is no longer a part of the company but is still on the market as a consultant for the industry, as the interview with Hans Froholdt of A2Sea indicated.

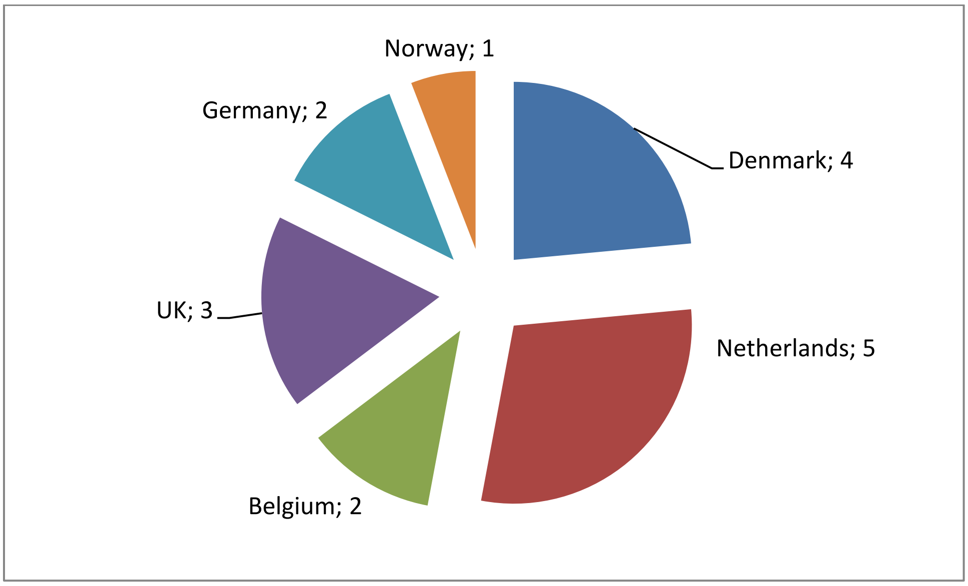

Figure 10 Geographical distribution of installation vessel operators Source: Appendix D

The bulk of these companies is situated in Denmark and Netherlands. Wind energy (holding a 32 % share of Gaoh Offshore), which is a Dutch energy company and DONG(A2Sea) are examples of backwards integration, as each of them is a subsidiary of an installation vessels operating company. This translates to an even more influential customer segment and higher entry barriers for potential new entrepreneurs.

4.4.3.2. Cable laying shipping subsegment

In cable laying, there are 13 companies owning a total of 47 vessels, the average fleet size is 4 vessels and the average age is 21 years.(See Appendix D) There is next to none new tonnage, as a lot of companies are leveraging vessels from other industries they operate in(confirmed by the interview with Kell Thyssen of JD-Contractor). Many of them have been employed in cable laying for decades. None of the companies operates solely in offshore wind except for CT Offshore. A lot of the vessels are renovated.

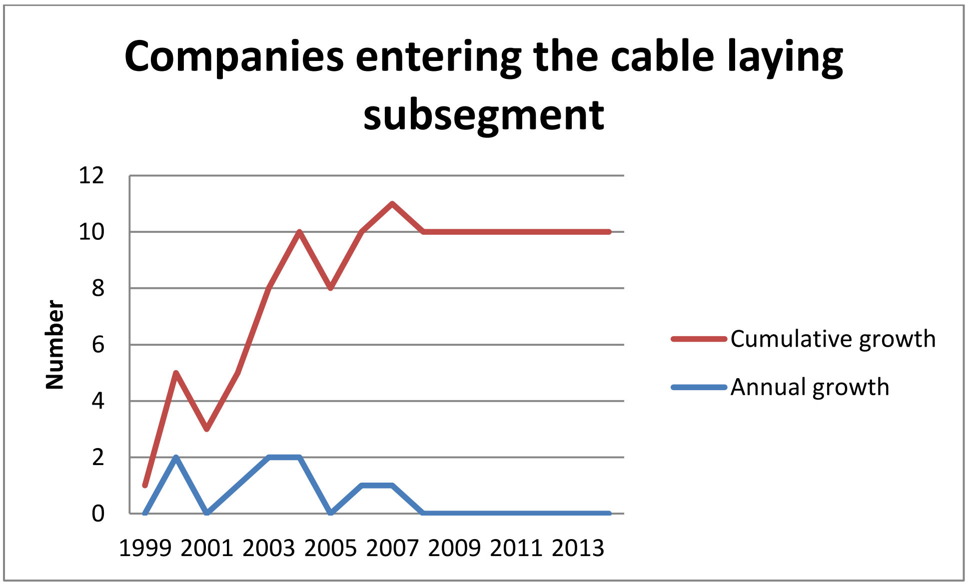

Figure 11 Companies entering the cable laying segment Source: Appendix D

The large number of bankrupts of cable laying operators, indicated by interviews, could be an explanation for the lack of companies entering the subsegment in recent years.

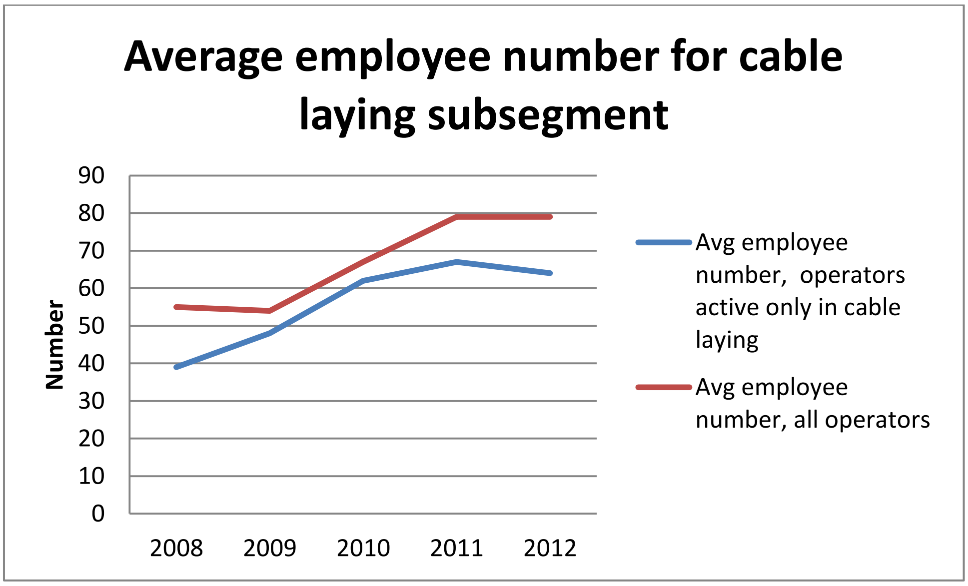

Figure 12 Average employee number for cable laying operators Source: Appendix D

As the graph indicates (Source: AppendixD), the number of employees has grown over the last 5 years. CTC Marine/Deepocean and Van Oord, having significantly higher number employees than the other companies have been excluded from the average employee number. In cable laying, all but two (Oceanteam and Dalby offshore, both operating service vessels) operators are active only in the subsegment. It could be speculated that companies with larger number of employees have a larger market share in the subsegment – however, the data was insufficient to prove this claim. Most of the firms are situated in Denmark and the UK .

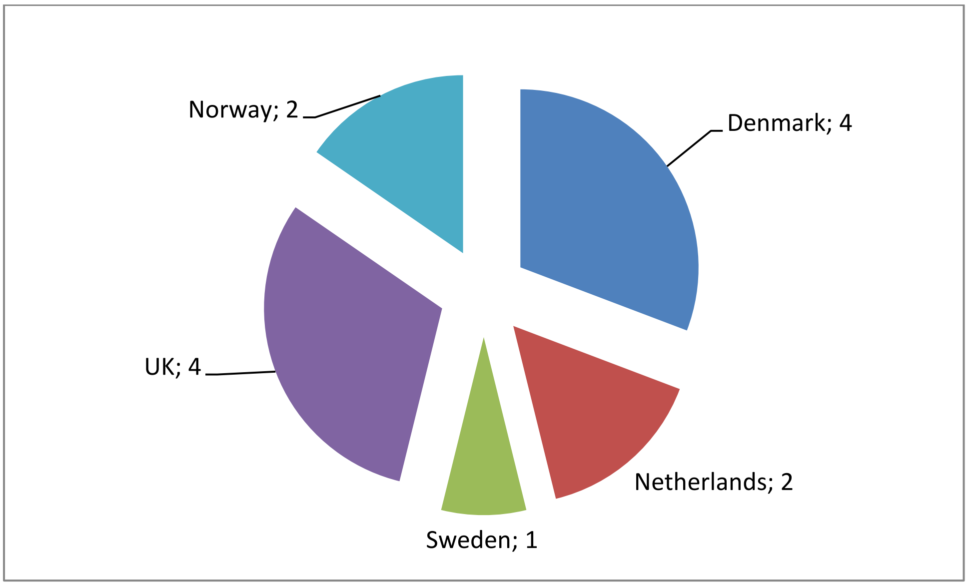

Figure 13 Geographical distribution of the companies in cable laying Source: Appendix D

Except for CT Offshore, none of the companies was established in offshore wind. 9 of them are currently owned by financial and investment companies, 3 by shipping and 1 by an energy company. Here, one company has been established by an individual – CT Offshore by Paw Cortes, a marine navigator and mechanic, who is no longer a part of it as of 2013[48]. There was no further data available regarding the establishment of the cable laying companies, but the interview with JD- Contractor showed that existing companies have entered offshore wind because they had recognized the apparent demand for such vessels, although there were novel challenges for the cable laying operators consisting in further distance from shore and maneuvering with other vessels on site at the same time.

4.4.3.3. Service vessels shipping subsegment

In service and maintenance vessels subsegment, there are 34 companies, operating a total of 279 vessels. 3 of them are jack-up vessels specifically designed for O&M activities, owned by DBB Jack-up; 4 of them serve the purpose of floating accommodation, retrofitted ferries, 3 owned by C-bed and 1 by Master Marine (See Appendix D). The average fleet age is 9 years and an average fleet size - 8 vessels. The low average age is due to the fact that the majority of crew transfer vessels have been specifically designed for work in offshore wind[49]. 11 of the companies operate only in offshore wind, the rest have commercial activities in other industries, particularly oil and gas. DBB Jack-up has grown in size and they are currently specializing only in O& M activities. A2Sea, Fred Olsen, Swire Blue, MPI Offshore are all vertically integrated. The largest fleet (30 vessels) belongs to Windcat Workboats, a service vessels company situated in Netherlands.

[48] New CEO at CT Offshore, A2Sea website
[49] WindFarm Service Vessels – an overview, 4C Offshore website

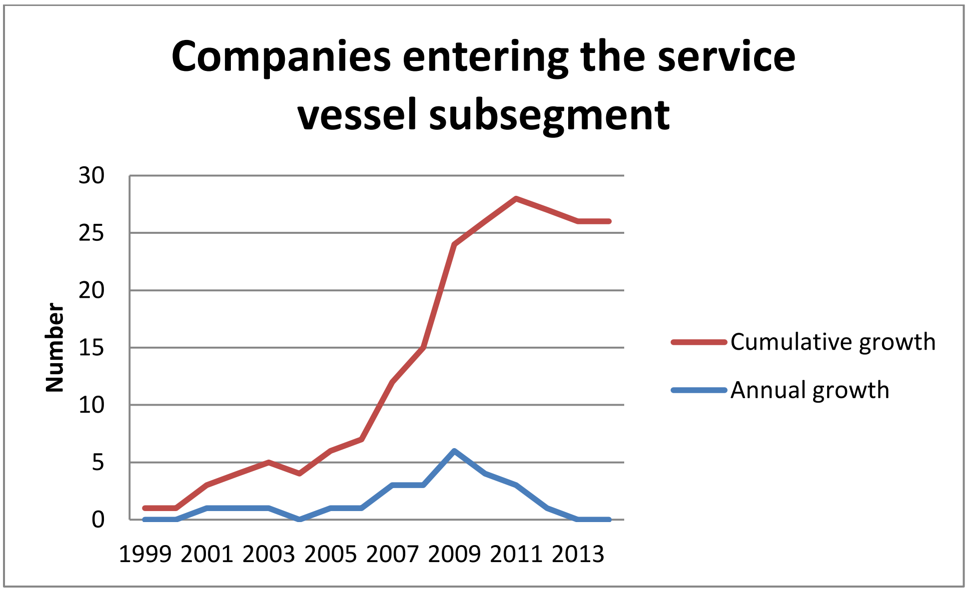

Figure 14 Companies entering the service vessel segment Source: Appendix D

There are two time series following the employee number for the service segment - one includes the operators which are vertically integrated, while the other follows the companies involved only in the service segment. In both of them there is a rise in average number of employees, which could signify growth in scale for the operators in service subsegment.

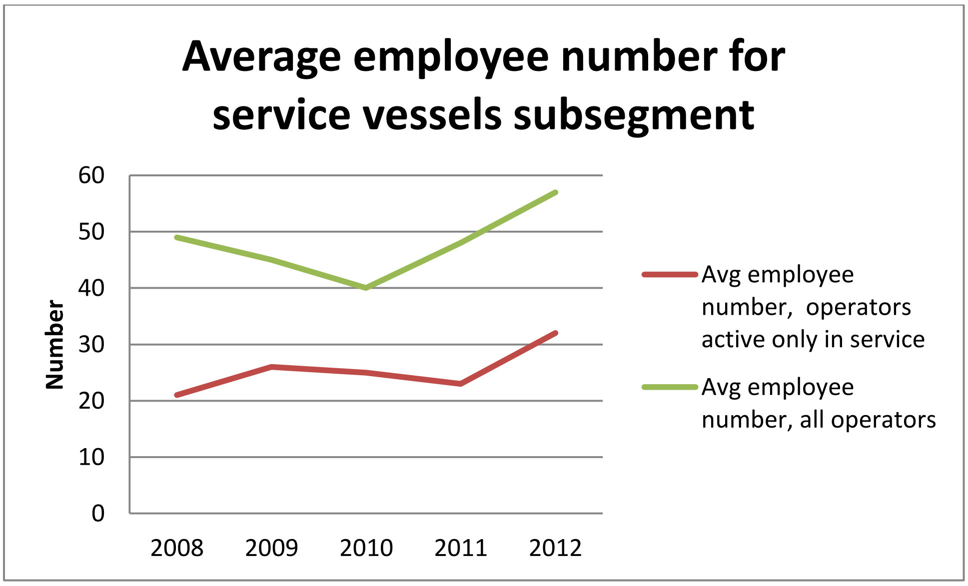

Figure 15 Average employee number for service vessel operators Source: Appendix D

Most of the incumbents are located in the UK, Denmark and the Netherlands. Unlike the cable laying subsegment, and perhaps because of these companies being established in recent years, information about the founders of those companies was available.

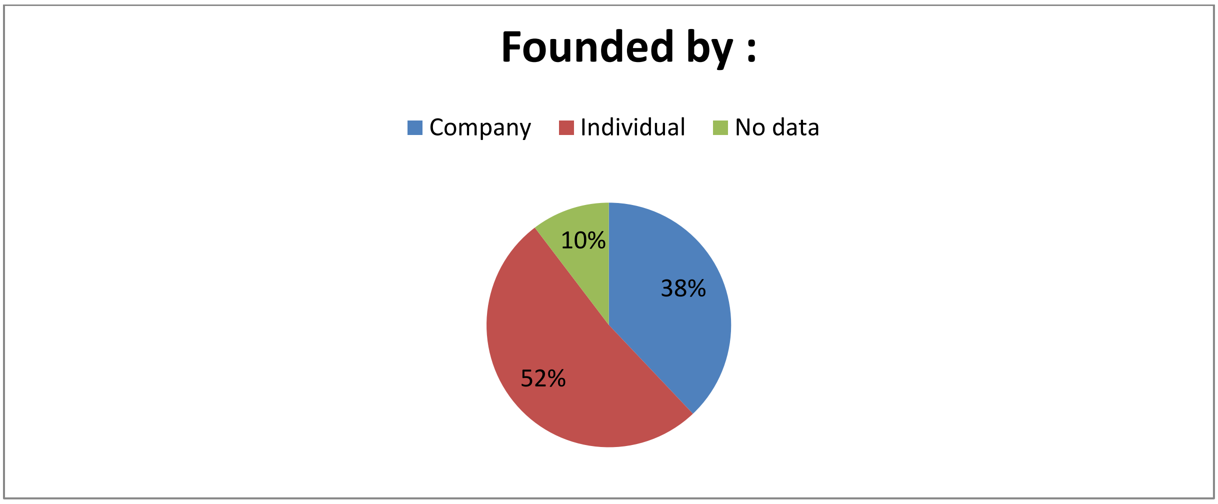

Figure 16 Company establishment information Source: Appendix E

In line with the entrepreneurial aspects of this study and due to the fact that it investigates recognition and exploitation of entrepreneurial opportunity, information regarding the background of the founder had to be gathered. 15 of the companies (46%) were founded by an individual. The background of the founder is, as follows:

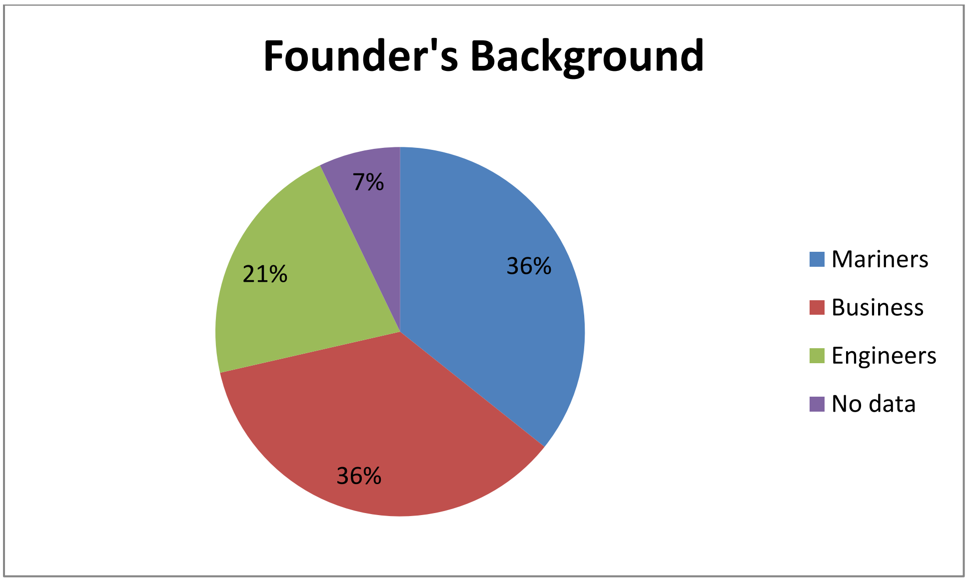

Figure 17 Founder's background for the service vessel segment Source: Appendix E

All of the founders in service vessels are still in the company. A big portion of the founders has technical or maritime professional background, which suggests that in order to set up a company in this subsegment,one might need specialized knowledge in these areas. Initially, the first boats used for crew transfer were fishing boats – this could explain the number of fishermen and skippers operating in the service subsegment[49]. The interview with a CWind representative explained that the founding of the company was linked to the implementation of a new vessel concept(CTruk 20T MPC)[50] that the founder came up with,

[50] CWind website, vessel charters

which is patented due to its utilization of resin infusion composites(interview with Cwind) , that was to improve the service offered to windfarm technician crews , which serves to further exemplify the theoretical propositions in literature that the entrepreneurs are driven by the perception that their product is superior than the ones already on the market

.Currently, most of the companies are situated in Denmark and UK.

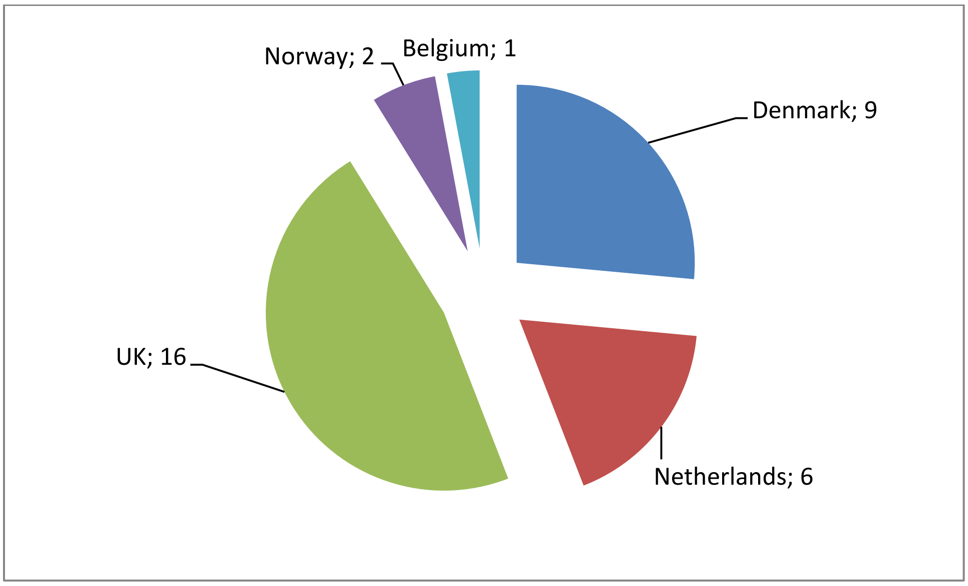

Figure 18 Geographical distribution of companies in the service vessel segment Source: Appendix D

4.4.4. Suppliers of labor

According to an EWEA report from 2012, the offshore wind sector in Europe employs over 58000 people[51]. New opportunities for employment are still emerging in this industry – a recent example is the collaboration between offshore wind industry and fishermen offering survey and guard vessel services in Kilkeel along the Northern Irish coast. [52] With a 25% share of CAPEX during installation and commissioning, and a 35% share of OPEX [53], labor is becoming an essential resource.

There is a number of suppliers of manpower, supplying turbine technicians, marine officers and skippers to the offshore wind industry - Apro Wind A/S[54], Semco Maritime[55], Q-Star Energy[56], TOS[57] , Alpha Energy [58]and health and safety training programs targeting offshore wind personnel- Falck[59]. The labor suppliers market is not a highly concentrated one –

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[51]Deep Water 2012, EWEA publication
[52]Offshore wind farms blow new energy into Kilkeel fishing fleet sails, 2014,Newsletter website
[53] Value breakdown of the offshore wind sector, UK government report
[54] Apro Wind, labour supplier for offshore wind website
[55]Semco Maritime, crew supplier
[56]Q Star energy, crew supplier
[57]Tos, offshore crew supplier
[58]Alpha-nrg, crew supplier
[59]Falck, providing health and safety training for offshore wind personnel

however, they are offering workers equipped with valuable know-how which are not easily substituted.

Having said that, every company requires different types of employees in accordance with its strategy, fleet size and service offering. Therefore, the competences a required by a certain subsegment are difficult to generalize; despite this, interviews with companies each subsegment can be utilized into giving some information about what are the most important competences the companies are looking for.

3.4.4.1. Installation vessels subsegment

The interviewee (Hans Froholdt, A2Sea) indicated the following:

'… Captains, navigators, people with construction skills, lawyers, HSEQ people… '(type of employees required)

'Again, you would have the normal, standard know-how of how to run ships, but then you will need these ships to be managed on a very high level. .... you need crew for instance, that are very trained when the ship started and that will stay with you long after that. ' (on know-how)

'if you for instance have a bulk carrier you can put crew from one place and then to another and then another. You cannot do that. You need crew that needs to be specifically trained for this purpose, you need ashore persons that are specifically trained and - There is a need for crew retention, qualified personnel is essential. ' (on crew competences)

'I mean, if it's a navy seaman, you would need some time, but if it's a captain, you will need more time. It depends on what type, but if you take the engineers, that would not take as long as it for instance takes for the captains, because for the captains it is very specified. You can take a AB seaman, a normal AB(able) seaman and you can train him within a year and then he will be able for this. But it is very different from person to person.' (on on-job training)

'(Onshore)…they are engineers, they are health and safety environment people, they are crew staff people, they are project managers, and then of course you will have some for instance business people, but that is not what is mostly needed. What is mostly needed is health safety environment people and project people and normal shipping people, technical guys. '(employees required onshore)

Here, concluding from the interview quotes, the bargaining power of suppliers of labor is relatively high because of the multifaceted building and installation projects, requiring a variety of skilled employees and involving a long training period and specific competences, so retaining them in the company is crucial for its long-term success – there are high switching costs because of the extensive training conducted by the company itself.

4.4.4.2. Cable layers

Previous experience in cable laying is accentuated (' Seafarers with long experience in this industry. All personnel are in house staff – e.g. permanent employees – they hold the relevant STCW certificates. ' – Kell Thyssen from JD-Contractor).

The fact that the personnel is permanent employees might mean that retention is as important in cable laying as it is in installation, so that bargaining power of labor suppliers is high as well .

4.4.4.3. Service vessels

Interviewee from Cwind, Petra Gonzalez, stated the following:

'Many of our offshore technicians are service leavers (formerly armed forced personnel), they come with an excellent attitude and a range of skills. '

'These (the competences) are determined by the law of the country in whose waters the vessel operates.'

'CWind's skippers and crew are employed to standards that meet or exceed those contained within the International Convention on Standards of Training, Certification and Watch keeping (STCW) 1978 (as amended) and in accordance with the MCA minimum requirements as set out in MSN 1802 and MGN 280 (M). CWind is also fully compliant with the MLC 2006. New crew member also have to undertake three days of training, shadowing existing deck hands and learning site protocols.'

On crew transfer vessels, the amount of training is not as high as it is in installation and cable. This means that the suppliers of labour have a lower bargaining power. However, this argument would not hold should service vessel operators use their highly skilled employees as a differentiation strategy in an increasingly commoditized market in the subsegment – in that case labor suppliers would have an increasingly high bargaining power.

In the floatels (accommodation vessel service providers), the interview with C-bed representative highlighted extensive expertise and know-how as an important requirement.

In O&M, Thorsten Jalk said the following:

'(on employee background) It is both… Engineering, but also business….Some knowledge on the operational side but Of course need to know the commercial risks that is involved in that industry.'

'….Varies a lot, a lot of people with a maritime background, either as a master mariner or as engineers. We have naval architects, we tend to have people in the operation department with a maritime background. Because it is still a maritime environment, and there are maritime rules and regulations that we are working under with our vessels.'(on employee background)

'You always need to have know-how on the vessels you operate. And besides it being a normal vessel that can sail from point A to B, this is also a vessel that can jack-up in the water. So it is a combination between a vessel and a jack-up, following offshore vessel rules. Of course, it is not just bringing some bulk or container from A to B.' (on know-how)

This further affirms the need of know-how and experience and the way its multidisciplinary complexity differentiates offshore wind shipping from other types of shipping. This could indicate that the labor pool is smaller than the one for the more commoditized types of shipping and thus a higher labor supplier bargaining power in offshore wind.

4.5. Demand

The demand in offshore wind shipping is largely dependent on four main factors: environmental regulations and policies, energy consumption per capita and forecasted energy demand, distribution of demand on energy sources and costs of further developments of the offshore wind technology. The energy mix strategies enforced in the European Union are motivated by security of supply, sustainability and competitiveness of the EU economy. [60] Just like oil and gas, it depends on the demand for energy , although it services a much smaller market(Weijnolst 2009).

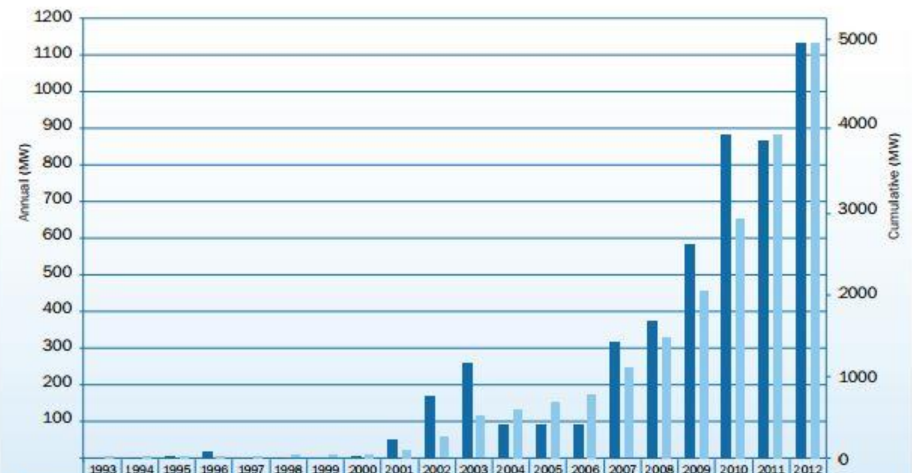
4.5.1. Environmental regulations and energy policies

The Renewable Energy Directive 2009/28/EC ("the Directive") established a European framework for the promotion of renewable energy, setting mandatory national renewable energy targets for achieving a 20% share of renewable energy in the final energy consumption and a 10% share of energy from renewable sources in transport by 2020.[61] Electricity generation from offshore capacity is planned to reach 140 TWh (roughly 12 Mtoe). However, according to a revision from January 2014, after 2020 binding country energy targets in the EU will not be mandatory, although region wide goal of 27 per cent by 2030 has been set,[62] which indicates the importance of broadening the market scope of offshore wind across Europe and ensuring the mitigation of harmful CO_2 emissions, which are set to decrease with 40% by 2030.

As shown on the graph below, the number of annual and cumulative offshore installations is growing. The figure below reflects the annual and cumulative number of offshore wind farm installations. The numbers indicate a steady growth for the past two decades.

[60] Background on energy in Europe, 2011, Information prepared for EC
[61] Renewable energy progress report, 2013, EU
[62] A policy framework for climate and energy in the period from 2020 to 2030, 2014, EC

FIG 11: CUMULATIVE AND ANNUAL OFFSHORE WIND INSTALLATIONS (MW).



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Annual	0	2	5	17	0	3	0	4	51	170	276	90	90	93	318	373	577	883	874	1,166
Cumulative	5	7	12	29	29	32	32	36	86	256	532	622	712	804	1,123	1,496	2,073	2,956	3,829	4,995

Country	UK	DK	BE	DE	NL	SE	FI	IE	NO	PT	Total
No. of farms	20	12	2	6	4	6	2	1	1	1	55
No. of turbines	870	416	91	68	124	75	9	7	1	1	1,662
Capacity installed (MW)	2,947.9	921	379.5	280.3	246.8	163.7	26.3	25.2	2.3	2	4,995

Figure 19 Number of farms and turbines installed Source: EWEA

However, according to the Commission's analysis, it may only reach 43 TWh (3.7 Mtoe) due to reduced national efforts and infrastructure obstacles such as difficulties to connect to the electricity grid. Thus, investing in "smart" electricity grids, able to store energy for longer periods of time will be a necessary infrastructural condition for the further successful implementation of offshore wind energy. [63] The scale of wind farms is increasing and with it comes a larger need for investment, thus new financing structures are needed.[32] Furthermore, reliable expectations for policies and support schemes for offshore wind could enable the investments required to achieve a high growth rate for offshore wind energy.

4.5.2. Energy consumption per capita and forecasted energy demand

The energy consumption per capita in Europe has grown over the last decade and the projections indicate a continuation of this trend, the share of renewable energy consumed is expected to rise as well. Derived by consumption, the forecasted energy demand is correspondingly growing as well, and so is the respective share of renewables production required. It is important to develop a better understanding of the role of offshore wind energy in the future energy mix.

[63] Smart grid research, EC website

FIGURE 10: WORLD ENERGY CONSUMPTION AND PRODUCTION BY AGGREGATE REGIONS

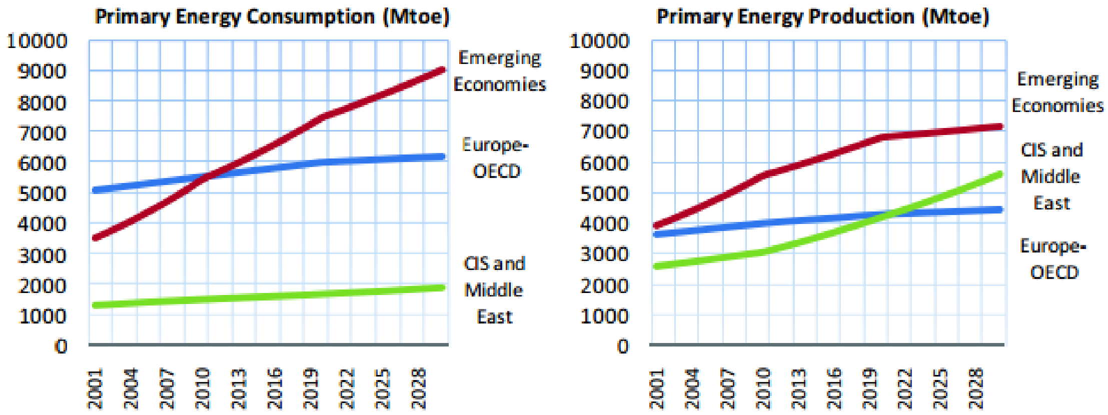


Figure 20 Projected energy consumption and production Source: EUROSTAT

It is clear from the above chart that Europe's growing consumption overrides its energy production. This makes implementing new energy sources and speeding up their developments even more critical.

In 2050, using 10 MW turbines, the energy produced in this area could meet the EU's electricity consumption by even more than four times over. [51] Efforts to integrate offshore wind energy are needed therefore on both local and multinational levels.

4.5.3. Distribution of demand on energy sources (possible alternatives to offshore wind)

Wind's importance as a source of energy is projected to grow[64]. However, as mentioned before, infrastructural modifications are needed in order to achieve better deployment of wind energy in the future. This is difficult because of the fact that developers are halting their investments because of the uncertain governmental support. This claim was confirmed also in the conducted interviews with shipping executives. [65]

The projected increase in scale for the wind projects is bound to put huge cost and efficiency pressure on the supply chain, including manufacturers of turbines, foundations and cables, as well as the high-voltage cables, not to mention the entire installation industry (EWEA 2013). Currently, even though the turbine takes a big share in the total expense (44%),the foundations, electrical infrastructure, installation and project planning account 16%, 17%, 13% and 10% of the total costs, respectively[66]. Installation costs, as the interviewees

[64] The European offshore wind industry - key trends and statistics 2013,p. 3
[65]Offshore wind – why cost reduction must now take precedence 2013, Carbon Trust UK website

[66] Renewable energy technologies: Cost analysis series: Wind power, 2012, IRENA

indicated, are expected to decrease with an increase in scale, less steep learning curve in project planning and operation.

It should be noted that each source of energy has its benefits and drawbacks, therefore an energy mix between a varieties of sources would ensure optimal energy effectiveness, where the variety of technologies could compensate each other's shortcomings.

4.5.4. Cost of further developments

The technical potential of offshore wind in Europe is estimated at 5800GW. Thus, if the strong expansion of offshore wind farms continues, it is expected that between 40 GW and 55 GW of offshore wind farms will be integrated into the grid and provide between 145 and 198 TWh of electricity to Europe by 2020 which can meet 10% of Europe's electricity demand. (EWEA) (Sun and Huang 2012) The nascent stage of this technology allows for the emergence of many new business opportunities in green energy , which are a vehicle for a variety of projects run by utilities, offshore, oil and gas companies, engineering and financial firms(Wieczorek et al 2013:295). Currently, most of the installed offshore capacity, which constitutes to a 2% of the total wind capacity of EU, concentrates within the UK, Denmark and the Netherlands. As of 2008, these three countries accounted for 85% of the EU 27 offshore wind capacity, with UK having 591 MW installed capacity with a predicted share of total EU offshore capacity(43GW) of 30%(13GW) in 2020, followed by Denmark (409MW) and the Netherlands (247MW). The high costs associated with offshore wind farms are often attributed as a cause to the relatively low share of installed offshore wind capacity (Green et al 2010:497) , with installation costs constituting a significant part of the initial costs; high cost is still the main barrier preventing the successful implementation of offshore wind power, and lowering them will be one of many developments expected to happen in the near future for this industry to continue its sustainable growth (Sun et al 2012). Another perceived obstacle is the bottlenecks in the supply chain, mostly due to the relatively limited number of installation vessels and the long queues in suppliers' order books—due to the(so far)limited production volumes of equipment and parts(Krohn etal.,2009 in Green et al 2010:496). According to a report on the German offshore wind industry state, over the next ten years, increasing turbine capacity and improved logistics, work on foundations and transformer stations and improved logistics concepts, increased competition from new market entrants in the shipping part plus faster ships with larger transport capacity will reduce the required time as well as the number of transports. Maintenance can be improved by using joint fleet and logistics (boats, helicopters) in a complementary manner in order to come up with the most time and cost efficient solution. [67]

It has been argued that many of today's installation vessels won't fit future developments due to their insufficient crane capacity and size. Thus, the European Wind Energy Association (EWEA) has joined forces with the European Shipyards Association to lobby the European Commission and European Investment Bank to support the building of new ships.

[67] Cost reduction potentials of offshore wind power in Germany,Fichter 2013, p.13

They argue that US$7.87 billion of investment in new WIVs plus substructure handling and cable laying vessels are needed for the predicted growth in off shore wind energy.[68]
It should be noted that political support is a crucial argument for attracting investors and thus indicating a stable, long-term demand from the consumer side is bound to make this industry more profitable.

4.5.5. Financial challenges

When considering profitability, it is essential to enquire who invests in offshore wind and why. The main investments come from utility companies, governments and turbine developers, but there are a lot of other actors involved along the supply chain, amongst them shipping operators, driven by opportunity recognition – as also the interviews pointed out, they perceive offshore wind as a promising business area. However, funding still is a problematic area in this industry, which is still struggling in its efforts to attract more institutional and private investors. Barriers to attracting new investments are, for example[69] :

- Construction risk – perceived or actual risks connected to the project construction, indicated also by the interviewees. As such, in the short term, the majority of construction equity will continue to be provided by a small number of utilities. Involvement of other utilities and construction companies could help mitigate this risk and enable the development of competences that would lessen the degree of this risk.
- Unbundling - The Third Energy Package reflects the unbundling of investments and prohibits ownership and/or control of both transmission and generation assets in the electricity and gas sectors, in order to prevent large vertically integrated utilities from competition-blocking behaviors.[70] This, however, affects the ability of institutional investors, like pension funds, to maintain a diversified portfolio by investing directly in both transmission and generation assets. "Control" does not require a majority interest, but will also include so called "decisive influence" which could cover standard minority rights in a shareholders' agreement. However, attempts have been made to minimize the impacts of unbundling on institutional investors by reviewing these investments on case by case basis.

- Difficult access to capital markets - The small amount of debt financing is due to increasingly stringent capital adequacy requirements which are likely to limit the volume, cost of debt capital that is available from commercial banks to infrastructure and energy projects across the board.
- Competition between incumbents preventing risk sharing – The magnitude of the projects often involves rivals competing together and sharing knowledge. The degree of competition between them could cause the undesirable consequence of unequal

[68]European vessels seek aid for offshore vessel construction, 2010,Marinelog website
[69] UK Offshore Wind Market Study GL, October 2012 , p.55
[70] European union:Unbundling rules for financial investors clarified, Lexology website

risk sharing and each incumbent trying to get ahead of the others. This could be mitigated by coordination and facilitating a greater degree of industry cooperation.

Nevertheless, there are still companies directing their investments towards offshore wind vessels. An example of companies involved in vessels funding are CTRUK, DS Marine Finance[71], Watson, Farley and Williams[72] and Shawbrook Asset Finance[73]; they can assist aspiring entrepreneurs to overcome the startup capital constraints and provide them with the capital they need by educating banks and financial institutions about the benefits and potential profits from offshore wind workboats[74].

4.5.5. Main industry customers

An analysis of the demand cannot be complete without a review of the main customers demanding the services of offshore wind shipping, as their characteristics and bargaining power are a defining factor in determining the profitability of an industry (Porter 2008). Out of all the customers participating, the biggest 3(DONG,E-ON and Vattenfall) have a share of the market larger than 50%, which indicates a rather oligopolistic structure on the demand side.

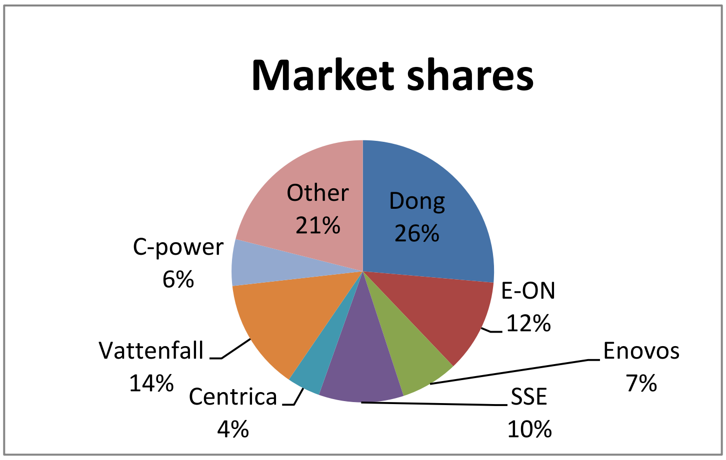


Figure 21 Market shares of main utility companies (capacity installed) Source: Appendix C

DON
G is a large Danish government-owned utility provider, specialized in wind energy. To date DONG Energy has built 17 offshore wind farms in Denmark and the UK. By 2015, the company will have built wind farms in Denmark, the UK and Germany, where DONG Energy is building its first wind farm, Borkum Riffgrund 1. This 277 MW wind farm is being constructed with 3.6 MW turbines from Siemens Energy and will be completed in 2015,it is set on building 6.5 GW until 2020[75].

[71] DS Marine finance website
[72] WFW website
[73] Shawbrook asset finance webpage
[74] Bridging the gap in workboat funding, 2013, Maritime Journal
[75] DONG energy is leading the offshore wind market, DONG website

Vattenfall is a Swedish state-owned energy company, focusing on three main markets: the Nordics, Germany and the Netherlands.[76] They are planning to invest 20 billion SEK in wind power in Sweden, Germany, the Netherlands, Denmark, and the United Kingdom. Wind energy projects under development include, Klim wind farm in Denmark, which will be Denmark's largest wind farm when it is launched in 2015. The Pen y Cymoedd wind farm in the United Kingdom is a 76 turbine development located on an area of land within the Welsh Government's Woodland Estate. East Anglia offshore wind energy project in the United Kingdom is a joint venture between Vattenfall and ScottishPower Renewables. It is located 14 km off the coast of Norfolk and Suffolk and covers approximately 6000 km^2.

E-ON - this German utility company is one of the world's largest investor-owned power and gas companies. E.ON's diversified business consists of renewables, conventional and dezentralized power generation, natural gas, energy trading, retail and distribution. They have invested 2 billion EU in offshore wind and have their fifth farm in the UK, Humber Gateway, commissioned in 2015. They are the owner of the first offshore wind project in Sweden - Karehamn. With an annual production of over 175 GWh, Karehamn will be able to supply over 50,000 Swedish households with electricity.[77]

SSE (together with acquired in 2008 Airtricity) is a large electricity and gas company, operating mainly in the UK and Ireland. It is a private company and the UK's fourth largest telecoms network company.[78] Owning more than 500 MW of capacity at present, it has already 3 operational wind farms in the UK and 5 in progress. They have launched an offshore wind research and development program. [79]

Enovos S.A., a financial holding company headquartered in the Luxembourg heads Enovos Group. Besides its energy-providing activities, Enovos Group also comprises the grid operator Creos Luxembourg S.A. and its German subsidiary Creos Deutschland GmbH. The Luxembourg Government is the majority shareholder in Enovos International S.A. with a 25.44% stake. [80] Enovos Luxembourg S.A. is a shareholder through Soler, holding a stake of between 20% and 50% in the for wind power companies above. It has holdings in a total wind power output of 46.6 MW and, among other tasks, concerns itself with technical management of the facilities.[81]

C-Power is set up by a consortium of Belgian and international shareholders to develop and operate the first offshore wind farm in the concession area on the Thornton Bank in the North Sea, on 30 km from the Belgian coast line.

C-Power makes a very valuable contribution to the European and Belgian environmental objectives concerning renewable energy and the reduction of the CO2 emission. C-Power

[76] Vattenfal corporate website
[77] EON offshore wind business areas
[78] SSE website
[79] SSE energy consortium launch 2012, SSE website
[80] ENOVOS website
[81] ENOVOS windpower activities

contributes with 7% to the renewable energy capacity needed for Belgium to meet its 2020 objective[82].

Centrica was formed in February 1997 following a demerger from British Gas plc, it is a PLC . It operates in UK and North America. It is one of the UK`s leading offshore developers and Centrica Energy's portfolio of on and offshore wind farms is capable of producing enough electricity to meet the needs of over 400,000 homes. In 2012 they have received consent for the 580MW Race Bank development and they continue to progress the project to final investment decision as well as established a joint venture with DONG Energy to co-develop up to 4.2GW of capacity in the Round 3 Irish Sea wind farm zone. [83]

New entrants, such as Statkraft[84], Statoil[85] and Shell[86], deserve attention because even though their current shares in capacity installed are significantly smaller than the ones of the main utility players, they are changing the industry's structure towards a more competitive one and that could bring about changes in customer bargaining power in the future.

However, two of the largest customers on the demand side are still state-owned companies. This means that the government has the possibility to change the conditions of doing business within offshore wind more than in other industries and so this has to be considered by new companies venturing in.

4.6. Competition structure of the offshore wind shipping segment

Because of the differing structure of the wind shipping subsegments, each of them will be looked into separately. The local concentration of certain service providers in certain areas might mean that in some geographical areas the rivalry is more intense than in others.

4.6.1. Competition in the turbine installation vessels subsegment

This subsegment is the most concentrated of the 3. A2Sea, with its vertical integration, increase in size, fleet expansion and being a subsidiary of the two largest offshore turbine projects developers on the market has paved its way towards being a leading firm in the installation segment. The exact market shares of the individual companies are difficult to determine, as it is unclear what share of their turnover comes from a particular industry/segment; however, the data indicated(See Appendix B) that A2Sea and MPI, as well as Seajacks and GeO offshore have participated into a multitude of projects, markedly more than the rest of the incumbents. 3 companies have an increase in profit and number of employees while others are operating at loss(See appendixD). The increasing fleet size of the existent operators (A2Sea, Seajacks Van Oord ordering new capacity) could well turn into economies of scale in fleet and therefore an entry barrier for new competitors.

There is a trend observed for larger companies involved in a multitude of industries to enter the wind farm installation market – either through horizontal integration or through creating

[82] C power website
[83] Centrica renewable power generation activities
[84] Statkraft`s windpower projects
[85] Statoil windpower
[86] Shell Wind

a spin-off. Examples of this are RWE, BARD, Van Oord, and Swire Pacific. In addition to that, a lot of the companies do not own custom-designed Wind farm Installation Vessels (WIVs), – instead, they provide floating cranes, jack-up rigs, etc. (Jack-up Barge).

4.6.2. Competition in the cable laying shipping subsegment

It is more fragmented than the installation services subsegment. The empirics indicate no significant dominance of a particular company; there are no stark differences in fleet size and employee number. The data available pointed out Oceanteam, CT offshore and Baltic offshore as the only 3 companies which have grown in number of employees in the last few years (See Appendix). The extensive experience of most of the companies, which have been in this industry for decades, could be an entry barrier for potential entries to the subsegment. The interviewee from JD-Contractor said that keeping costs down is an important competitive advantage in the segment due to commoditization.

4.6.3. Competition structure in the service shipping subsegment

The service vessels subsegment appears to be the most fragmented of all three subsegments, with the highest number of participants with none of the companies holding a significant advantage over the others. In this subsegment, there are three separate areas in which different companies participate and subsequently do not directly compete with each other : accommodation, operation and maintenance and crew transfer. In operation and maintenance and accommodation, there are not as many competitors as in the crew transfer services. Many of the companies are horizontally or vertically (working in other industries or providing other services related to windfarms) integrated. The rivalry is intensified by larger companies providing integrated/turnkey solutions – e.g. MPI,A2Sea,Fred Olsen Windcarrier providing installation, maintenance and crew transfer services. However, for the companies operating only the crew transfer vessels, competing in terms of scale is difficult and therefore they are to employ a different competitive strategy. The interview with Cwind indicated that they gain a competitive edge by providing a combination of robust vessels and qualified technicians, capable of mending turbines. It might be that because of the small size and scale of these companies, some of them operate only on a local level where they are not competing as fiercely as they would have if the competition was on a multinational level. The Cwind company representative pointed out that the market for service vessels is already becoming commoditized. Said she, `The supply chain is maturing and the key players have defined for themselves what they will undertake in-house and what will be outsourced`. This was confirmed by the C-Bed representative as well, although he pointed out that know-how could be an entry barrier to new incumbents in the accommodation vessel services. So, companies are prompted to differentiate in order to survive on the market.

4.7. Supply and demand balance

In line with the abovementioned tendency for turbine installations moving further and deeper offshore, the demand for specialized vessels to install the turbines at increasing depths and distances is becoming rather unsteady, because of the different type of turbine foundations design which allows of assembly onshore and then towing to the place of installation, which might not require that sophisticated a vessel for their installation. [51] However, the O&M activities are projected to require more effort with this new design. On a global level and taking into account the number of wind farms that are to be installed; the report indicates an insufficient number of WIVs capable of installing the new, larger turbine structures. [87] The shortage of CTVs can be somewhat remedied by contracts that share vessels across windfarms, as the interviewee from Cwind suggested. There is a gap between demand and supply in accommodation vessels as well; vessel shortage applies to O&Ms and crew transfer vessels. This does not seem to be the case for cable layers and heavy lift vessels, where the supply is higher than the demand. [87]

4.8. Industry profitability

The lacking data on financials for many of the companies and the fact that many of them operate in other industries and in more than one of the subsegments made it impossible to calculate their profitability.

4.9. Industry attractiveness and Porter's 5 forces analysis

Here, after reviewing the most important aspects of this industry, follows an attempt to point out the most influential forces acting within it and the way they could influence its further developments.

There are three subsegments: one of the vessels laying the cables that connect the turbines to the grid, one of the vessels installing the turbine structures and substructures and one of the vessels responsible for turbine maintenance, crew transfer and accommodation. Although each of them is providing services to the same customers, the type of services offered differ and so does the competitive environment – therefore it might be that the industry forces influence them to a varying degree. The data fed into this analysis is gathered from company analysis as well as interviews and therefore triangulates qualitative and quantitative data in order to find a valid account of the current state of the offshore wind industry.

4.9.1. Threat of entry

The future projections indicate a number of new offshore projects that will take place in Northern Europe. However, does this mean that there is still an opportunity for new entrants to penetrate the market and how high are the entry and exit barriers?

4.9.1.1. *Installation vessels subsegment*

There are many companies leveraging existing capabilities and know-how from other industries, such as the oil and gas. The switching costs are high, as Hans Froholdt from A2Sea indicated in the interview. Increasing amounts of newbuildings are being acquired. Vertical integration along the supply chain seems to be present more in the installation

[87] Global evaluation of offshore wind shipping opportunity 2015, Navigant, p.71-86

vessels niche than in the other subsegments , as in the case of A2Sea acquiring CT offshore and MPI, Boskalis, Fred Olsen offering service vessels as well. This could be interpreted as an attempt to coordinate the various stages of the supply chain and decrease the number of negotiations. Supply side economies of scale are observed to an extent , as many companies are ordering new and more sophisticated vessels, (see A2Sea, MPI offshore, Van Oord) or demand side, when companies are patronized by a large number of buyers (A large number of wind parks is being installed by MPI,A2Sea, GeoSea). Capital requirements are projected to grow with the scale of wind projects increasing; there are already regulations on classification WIVs need to comply with, which indicates the beginning of a standardization process.[14]

4.9.1.2. Cable laying *vessels subsegment*

There is a higher threat of potential entry because of the large amount of companies operating cable layers and the ability to deploy existing vessels to enter the industry; furthermore, the possibility exists to leverage know how from telecommunications and oil and gas industries, and here it is even more viable than in the other subsegments. Seemingly there are no scale advantages on the supply side. However, the number of cable laying companies that have gone bankrupt indicates that operating those vessels might be too expensive to be covered with the income from offshore wind. In the cable laying, experience is key. Even though the vessels are suitable for undertaking the operations involved in cable laying, because every new site differs and every new type of operation requires different skillset, it is important for cable laying operators to understand what does it take to invest and operate in offshore wind. [88]

4.9.1.3. Service vessels subsegment

Although some of the incumbents have entered the segment as a result of intrapreneurship (A2Sea, DBB Jack-up, KEM, Nord Marine, Nordic Offshore, Stemat, Master Marine), it has to be noted that more than a half are established by individuals (although some data on founding was lacking and thus the percentages are approximations). Most of them have engineering or maritime background, with a few involved in business management. The threat of entry is higher compared to the other two segments, again because of the opportunity to leverage competence from other industries (fishing, engineering), lower capital requirements for operating the rather standard, small-sized crew transfer vessels, no switching costs plus the offering of a rather commoditized service and the virtual lack of economies of scale on supply side apart from the vertically integrated companies. This might differ in the O&M and accommodation vessels as there is evidence from the interviews that there is a steep learning curve which could be difficult to overcome when entering without any industry knowledge. Capital was raised through borrowing from private investors (CWind) .

[88]Offshore cable O&M critical for offshore wind success, Wind energy update

4.9.2. Intensity of rivalry

4.9.2.1. Installation vessels subsegment

There is quite a large number of companies competing for the same customers, as the customers are a few large companies. Even though it cannot be considered a perfect oligopoly on the demand side, there are a few companies with a market share larger than that of others. With five operating vessels, A2SEA has surpassed the installation of 1000 turbines in June 2013 and now holds a 48% market share. MPI, the nearest competitor with 395 turbines installed, will continue to have a high rate of installation due to a number of back-to-back contracts being awarded throughout 2013 and 2014.[31] It has to be noted that some companies are specialized in foundations installation, so that not all companies are in direct competition with each other. Hans Froholdt of A2Sea said in the interview that cooperation between rivals does exist and sometimes they even become stakeholders in each other's projects. Exit barriers might vary according to the assets a company has, as there is a secondhand market for the barges, but not yet for WIVs. The current capacity expansion might make the rivalry more intensive.

4.9.2.2. Cable layer vessels subsegment

The market is closer to a perfect competition with none of the incumbents holding a significantly larger share than the others. Said the interviewee from JD Contractors, the market for cable laying is becoming increasingly commoditized. Exit barriers should not be as high, as these vessels have been in production for decades and therefore have an established secondhand market. New developments on the market and a potential specialized tonnage increase might lead to more intensified competitive situation.

4.9.2.3. Service vessels subsegment

Here the number of competitors is quite large, with none having a marked advantage over the other. It should be noted that MPI and A2Sea are competing in this market as well. The exit barriers are lower because of the lower price of these vessels (esp. CTVs). The increased number of new entrants in recent years could lead a zero-sum situation, where one firm's gain is another one's loss, especially so in crew transfer services. A mix of product diversification and targeting strategies could serve to improve this, for example highly skilled technicians (CWind), experienced component maintenance and replacement personnel (DBB).

4.9.3. Pressure from substitute products

Substitutes fall into one of two categories – they are either direct or indirect. Indirect substitutes are different power generation technologies, while replacements for the vessels used by the shipping operators qualify as direct.

4.9.3.1. Offshore wind energy substitutes

There is a number of alternatives that are currently being developed - solar, tidal, natural gas, onshore wind, fossil fuels, nuclear power. While it is not possible to predict with certainty which type would the government choose to favor, one could evaluate their attractiveness to potential investors by assessing their cost, environmental impact, current demand and supply balance, development stage, governmental policies.

The traditional energy sources can offer a much more competitive price and enjoy a higher certainty in demand; however, in recent times this has been contested by highlighting the need to minimize carbon emissions from energy production and its overall impact on the environment. Yet their intensive exploitation continues in some parts of the world. The dependence on coal for economic growth is particularly strong in emerging economies. This represents a fundamental threat to a low-carbon future. China and, to a lesser extent India, continue to play a key role in driving demand growth with a respective shares of 46% and 11% of global coal demand in 2011.[89]

It should also be noted that there are certain public concerns regarding further developments and growth in offshore wind harvesting – example of those are that the turbines are considered a source of noise and vibration, which could have a negative impact on marine species[90]; they could also be potentially harmful to the sea birds population – an issue which has been amongst the reasons for cancellation of offshore wind projects. [91]

Fracking (extraction of natural gas from the shale)[92] could also be considered a substitute for offshore wind harvesting as a source of energy; however, it is usually referred to as a 'bridge fuel' – a temporary but not a sustainable long-term solution. Shale gas extraction is not encouraged by the EC, but it is not banned either – further developments in fracking are therefore a possibility. [93]

Even when only considering decidedly more environmentally friendly sources of energy emitting less greenhouse gases , offshore wind faces competition in the face of solar, hydro/tidal, biomass and nuclear technologies, which are all moving towards optimizing their effectiveness. Some of them face issues such as intermittency of supply (solar, wind), lack of effective storage technologies, difficult grid connection and inability to currently address the transportation sector's fuel needs; this means that other types of energy including traditional fuels need to be deployed in combination with renewable sources. In order to compare the attractiveness of the variety of alternative energy production technologies, a widely used tool is the LCOE. The LCOE (Levelized cost of energy) analysis is used to evaluate the costs of a certain type of energy and compare it to others. The formula shown[94] displays in a simplified way how LCOE is calculated and the parameters it includes:

[89] Tracking Clean energy progress 2013, International Energy Agency
[90] The environmental implications of offshore wind generation, Vella G 2000
[91] Offshore wind industry slowed by birds, bombs, sharks, Feb 2014, Bloomberg
[92] Facts about shale gas, API website
[93] Environmental aspects of unconditional fossil fuels, EC website
[94] The levelized cost of electricity, Vasudev A. 2011, Stanford university

$$\text{LCOE} = \frac{\text{Total Life Cycle Cost}}{\text{Total Lifetime Energy Production}} = \frac{I - D + C - S}{E}$$

I represents the initial investment, D represents a depreciation tax shield, C represents annual cost, S is the salvage value of any physical assets at the end of life-cycle and E is the total energy production. The equation can be used for conducting a cost/benefit analysis for an investment in energy and the way it would evolve in the future. This is done through using a discount rate for future periods.

The table below reflects a comparison between the different types of energy production technologies, their characteristics, capital costs and LCOE.

TABLE 2. STATUS OF RENEWABLE ENERGY TECHNOLOGIES: CHARACTERISTICS AND COSTS

Technology	Typical Characteristics	Capital Costs (USD/kW)	Typical Energy Costs (LCOE – U.S. cents/kWh)
Power Generation			
Bioenergy combustion: Boiler/steam turbine Co-fire; Organic MSW	Plant size: 25–200 MW Conversion efficiency: 25–35% Capacity factor: 50–90%	800–4,500 Co-fire: 200–800	5.5–20 Co-fire: 4–12
Bioenergy gasification	Plant size: 1–10 MW Conversion efficiency: 30–40% Capacity factor: 40–80%	2,050–5,500	6–24
Bioenergy anaerobic digestion	Plant size: 1–20 MW Conversion efficiency: 25–40% Capacity factor: 50–90%	Biogas: 500–6,500 Landfill gas: 1,900–2,200	Biogas: 6–19 Landfill gas: 4–6.5
Geothermal power	Plant size: 1–100 MW Capacity factor: 60–90%	Condensing flash: 2,100–4,200 Binary: 2,470–6,100	Condensing flash: 6–13 Binary: 7–14
Hydropower: Grid-based	Plant size: 1 MW–18,000+ MW Plant type: reservoir, run-of-river Capacity factor: 30–60%	Projects >300 MW: <2,000 Projects <300 MW: 2,000–4,000	2–12
Hydropower: Off-grid/rural	Plant capacity: 0.1–1,000 kW Plant type: run-of-river, hydrokinetic, diurnal storage	1,175–3,500	5–40
Ocean power: Tidal range	Plant size: <1 to >250 MW Capacity factor: 23–29%	5,290–5,870	21–28
Solar PV: Rooftop	Peak capacity: 3–5 kW (residential); 100 kW (commercial); 500 kW (industrial) Capacity factor: 10–25% (fixed tilt)	2,275 (Germany; average residential) 4,300–5,000 (USA) 3,700–4,300 (Japan) 1,500–2,600 (Industrial)	20–46 (OECD) 28–55 (non-OECD) 16–38 (Europe)
Solar PV: Ground-mounted utility-scale	Peak capacity: 2.5–250 MW Capacity factor: 10–25% (fixed tilt) Conversion efficiency: 10–30% (high end is CPV)	1,300–1,950 (Typical global) Averages: 2,270 (USA); 2,760 (Japan); 2,200 (China); 1,700 (India)	12–38 (OECD) 9–40 (non-OECD) 14–34 (Europe)
Concentrating solar thermal power (CSP)	Types: parabolic trough, Fresnel, tower, dish Plant size: 50–250 MW (trough); 20–250 MW (tower); 10–100 MW (Fresnel) Capacity factor: 20–40% (no storage); 35–75% (with storage)	Trough, no storage: 4,000–7,300 (OECD); 3,100–4,050 (non-OECD) Trough, 6 hours storage: 7,100–9,800 Tower, 6–15 hours storage: 6,300–10,500	Trough and Fresnel: 19–38 (no storage); 17–37 (6 h. storage) Tower: 20–29 (6–7 hours storage); 12–15 (12–15 hours storage)
Wind: Onshore	Turbine size: 1.5–3.5 MW Capacity factor: 25–40%	1,750–1,770 925–1,470 (China and India)	5–16 (OECD) 4–16 (non-OECD)
Wind: Offshore	Turbine size: 1.5–7.5 MW Capacity factor: 35–45%	3,000–4,500	15–23
Wind: Small-scale	Turbine size: up to 100 kW	3,000–6,000 (USA); 1,580 (China)	15–20 (USA)

Figure 22 Status of renewable energy technologies Source: Renewables 2013, global status report

It can be seen from the table[95] that offshore wind still has relatively high capital costs and LCOE compared to Solar PV, onshore wind and biogas.

Improvements and developments in other energy sources should not be overlooked, as those might tip the scale in their favor as a preferred source of energy in the future. Substitutes are also the traditional sources of energy, which, albeit being finite and have a rather harmful to the environment production process, have a well-developed infrastructure which allows for lower prices of energy produced that way. It might decrease or increase in future years, as with the amount of installed capacity the costs are expected to decrease. However, that is a long term process and until cheap fuels and cheaper renewable energy is available, there will always be a question mark on the utilization of this resource.

The interviewed shipping executives all agreed that the costs of offshore wind are not low enough yet compared to other energy sources for them to make for an attractive investment proposal. Those are expected to decrease with an increase of scale and technological advances, but nevertheless, higher capital costs input a higher risk. Investments in newer technologies need to be encouraged by implementing the right policies, that would ensure a higher return on investment. The currently implemented support programs will be reviewed in the government role chapter.

4.9.3.2. Vessels substitutes

An important substitute can be a different turbine design that would allow for installation without a jack-up vessel, which could render the existing vessels not as useful, but could also be an opportunity for implementing new vessel designs[16].

With the turbines going further offshore, the role of helicopters for crew transfer could increase. As already mentioned, fishing boats were used for crew transportation and that could imply that they are a potential substitute to the crew transfer vessels, especially for sites located closer to shore.

4.9.4. Bargaining power of buyers

The customers purchasing services from the offshore wind shipping industry are mostly large utility companies (E.ON, DONG, SSE, Vattenfall). Their high bargaining power is acknowledged in the industry as the interviews showed; the interviewees expect it to increase even more. Therefore, come countries have prompted for the suppliers to work together with the customers in order to negotiate mutually beneficial power. One such union is Carbon trust. It can be argued that buyers are quite price-sensitive, as the transportation costs constitute a relatively large part of the overall wind park installation costs.(Kaldellis, 2012) Depending on their information and current profits, and if the industry does not offer much differentiation in terms of services and the switching costs are low, their bargaining power might exponentially increase and even succeed at backwards

[95] Source: Renewables 2013, global status report, p.54

integration (DONG A/S buying A2S), BARD (albeit somewhat unsuccessfully) entering shipping.

The few buyers are purchasing high volumes, and this coupled with the high fixed costs of maintaining an installation vessel can lead to an increased bargaining power of buyers. However, as the interview with Hans Froholdt of A2Sea indicated, high importance is placed by the customers on service that adheres to the requirements of minimizing environmental impacts and ensuring safety at sea and therefore cost might not be the most important argument for shipping service supplier selection.

4.9.5. Bargaining power of suppliers

In terms of suppliers, currently the wind turbine manufacturers (a supplier structure resembling market oligopoly) have high bargaining power, but come new market entrants that is liable to changes. Siemens is offering overall offshore wind farm solutions and is a vertically integrated company, acquiring a share in A2Sea. [96] Shipyards gain their main profits from shipping companies, so that their profit is quite dependent on getting new orders, therefore their bargaining power might not be that high. There is an increasing number of shipyards offering WIVs, plus there are potential substitute vessels that could be employed in the installation process. The shipyards are seemingly not interested in forward integration. However, shipping companies are collaborating with yards on new vessel designs.[97] The labor pool is difficult to determine. The workforce suppliers have a particularly high bargaining power at the installation vessels subsegment. Service suppliers from installation have a higher bargaining power than O&M, because of the higher concentration of the subsegment.

4.9.6. Government as a force in industry competition

The government plays an undeniably important role in offshore wind's past, present and future activities. As (Porter 2008) argues, its impact should not be judged as negative or positive, but instead an assessment should be made by reviewing the policies it implements in regards to the particular industry. CO2 emission constraints, support for specific technologies, environmental standards, energy efficiency, licensing and approval, market dynamics, electricity price are all to be considered when determining the government's effect on offshore wind. [98]

It is also important to consider that even though the overall strategy reflects energy security and climate change, each government is liable to implementing different policies, therefore the local development conditions might vary.

In this industry, because of the EU targets to turn to renewable energy sources for 20% of its energy use, subsidies are given for development. Some governments in the EU are overall supportive of the offshore wind industry, offering subsidies and feed in tariffs.

[96] A2Sea website, ownership data

[97] Seajacks and Samsung to build world's largest offshore WIV, Renewable Energy Focus website

[98] OECD 2010 energy report , p.166

The table in Appendix F indicates the different policies implemented in order to subsidize renewable energy production. For each country, a different mix of measures was implemented, but all countries of EU have made steps, albeit small, towards adjusting their energy mix towards sustainability and increased usage of renewable energy sources.

Subsequently, a comparison tool was used to see what are the different support programs implemented specifically for wind energy. [99]

- Subsidies – subsidies covering a portion of the expenses for the eligible investments and studies.
- Loans– Loans given to local initiatives dedicated to construction of wind energy plants, sometimes with a preferential interest rate.
- Feed-in tariffs - payments to ordinary(small-scale) energy users for the renewable electricity they generate.
- Premium tariffs - bonus over the feed-ins, premiums on top of the wholesale price to promote the generation of electricity from renewable energy sources.
- Quota system - Each country has a cap on its carbon emissions. The introduction of tradable green certificates allows for collaboration between countries and transferring a small portion of the emissions in return to green certificates.
- Net-metering - Net-metering applies to clients who are at the same time producer of electricity, which are connected to the electricity grid through a connection with a throughput value smaller than or equal to 3*80A. The producer benefits from the compensation mechanism for the period between two meter-readings.
- Tax regulation mechanisms - Generators of electricity from renewable energy sources that use the electricity they consume (own consumption clause) may be exempt from or have a lessened tax levied on electricity consumption (Energy tax).

These policy instruments are not the only way in which the government can influence this industry - many of the utility companies are state-owned and their strategy depends on governmental decisions– should the government withdraw their support on using offshore wind as an energy source, the industry is bound to reach a halt. Second of all, these companies are the main customers in this industry – they are the engine for its progress and their orders are what prompt further developments.

There is a difference between public and private investors and their motivation for investing in projects. This is why policies targeting each group are crucial in lowering the costs of development and execution of offshore wind projects and attracting a larger amount of private funds by decreasing the risk and increasing the returns. This can be done by ensuring a long-term demand and the smooth up scaling of the industry. This would facilitate not only quantity but also quality of investment that moves the economy towards mitigation of carbon emissions.

[99] Legal sources on renewable energy

As considering the potential markets in US, an important factor, as also Thorsten Jalk from DBB indicated, is the Jones`act, which concerns cabotage and requires the use of vessels registered under the American flag and having 75% of US personnel aboard. However, in the context of offshore wind projects, the act does not apply to the initial component delivery, and the installation and assembly phase which is carried out entirely offshore. This supposes the possibility of European installation vessel operators being able to play a part in the emerging market in the US[100].

4.10. Industry attractiveness

As the interviews indicated, all 3 segments are moving towards commoditization. Just like with crude oil shipping, there is a high bargaining power of consumers - however, unlike the oil majors, which are outsourcing their shipping activities(Stopford 2009), here the utility companies are moving towards backwards integration along the supply chain. The industry is heavily dependent on the demand for offshore wind.

- In installation vessels, there is a trend towards consolidation, already emerging economies of scale. However, the service they are offering is a very specialized ones still, so they fall in the category of industry shipping. Because of the young age of the vessels there is still not a second hand market. With the growing degree of standardization, a shift towards contract shipping is likely. Success constitutes in the ability to meet capital requirements, plan and operate accordingly, move towards size increase and vertical integration. The interview showed that there is still no standard contract terms for installation, which, together with the emerging economies of scale in fleet puts it in the category of industry shipping.
- In cable laying, industry is more fragmented. There are virtually no economies of scale, so cable laying lies somewhere between specialty and commodity shipping. The interviewee informed that they have a standard contract, which points towards a more commoditized form of shipping. Important here is for companies to be able to leverage their knowledge from other industries while moving towards the learning curve of offshore wind which has its own specificities .
- The service vessels segment is characterized by the highest degree of commoditization of all three, especially so are the operators offering crew transfer vessels services. However, it still serves a small niche and therefore it is not as commoditized as it would be on a larger market. There is however a standard contract form that is usually used – this does not apply to the O&M and accommodation sectors, where commoditization is much less of an issue due to the small number of incumbents. Important in this sector are access to distribution channels, trained crew as means of differentiation. The figure below shows the positioning of the three subsegments compared to other types of shipping in terms

[100] The Jones Act – one more variable in the offshore wind equation, 2010, Lexology

of economies of scale and differentiation. [101]

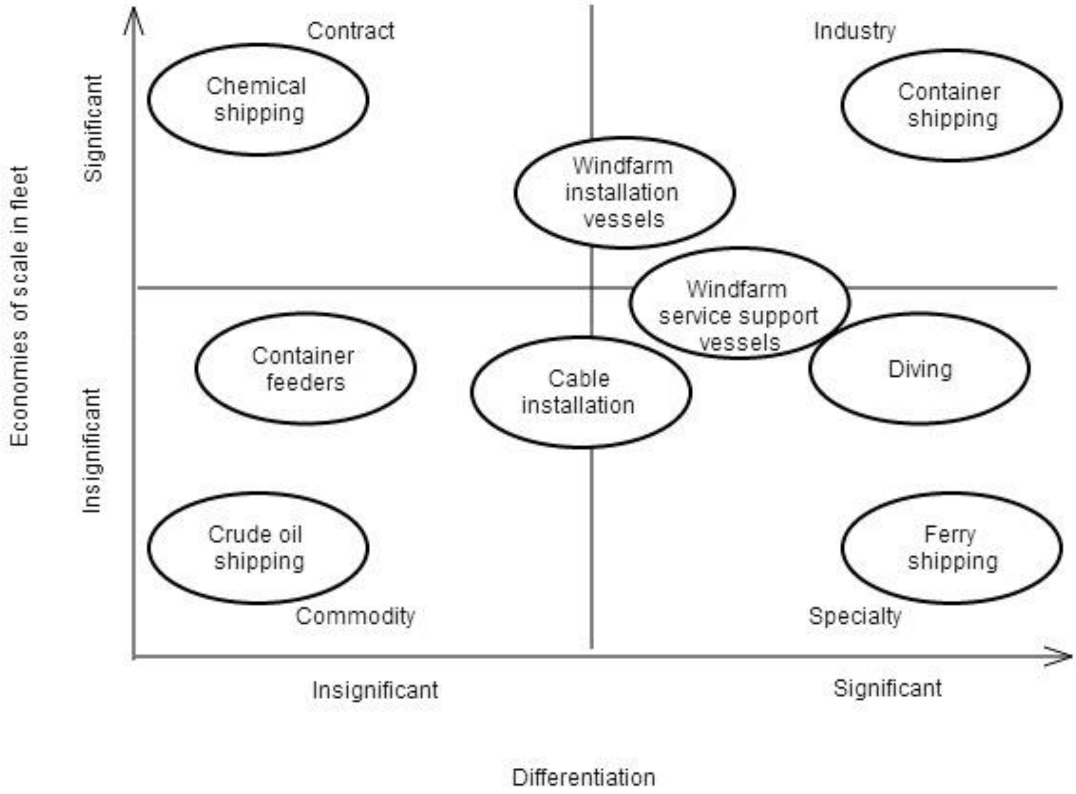


Figure 23 BSG shipping matrix Source: Industry analysis conducted by this study

[101] Wijnolst et al 2011, 107

5. Discussion and findings

The dataset and its analysis contributed to new insights about the specifics of offshore wind shipping and opportunity recognition and exploitation in this industry. The findings will be interpreted using the reviewed literature.

5.1. Entrepreneurial individuals, organizations and their activities in offshore wind

Exploration of entrepreneurship in a particular segment involves inquiry of the following: reasons and motivations for carrying out entrepreneurial activities, description of the actors that have engaged or could engage in them, delimitation of the required resources and their proper utilization for achieving commercial success in a short and long term perspective. Motivation is linked to economic choice for individuals and organizations alike – there is a perceived utility to creating an enterprise that surpasses the pecuniary benefits derived from not attempting to change the existing economic situation. In offshore wind, those benefits are facilitated on a macro and microeconomic level by environmental concerns leading to an increased demand for renewable energy, globalization creating competitive markets where a large number of companies participate in providing cost and resource effective solutions that could substitute fossil fuels as a sole source of power generation.

Offshore wind shipping, as a nascent segment of shipping, reflects a transition to knowledge economy, placing high importance on intellectual capital, because of the complexity of the offshore wind projects which require equally sophisticated vessels and service offerings as well as talented employees and good ideas. But even in a knowledge economy, the access to information is not perfectly distributed – its variance is facilitated through patents, specific knowledge, competences and experience. Exploitation of the opportunities recognized is further aided by the influence of enterprise discourse, which serves to underline the importance of entrepreneurial initiatives to the economy, both internally and externally to organizations, creating a rise in self-employment and enterprise creation where new ideas are being developed and commercialized, aided by financial institutions and government subsidies providing initial funding(see industry analysis), not only helping aspiring entrepreneurs to overcome the initial capital constraints, but also inspiring managers in already established companies facilitate an atmosphere where new ideas can be fostered and intrapreneurial efforts encouraged. The interviews underlined the beneficial influence of entrepreneurs to the offshore wind shipping segment, the flexibility of small enterprises and their capability to disseminate new knowledge (DBB jack-up).

The triangulation of quantitative and qualitative data showed that offshore wind shipping is a dynamic industry, strongly influenced by energy policies, growing standardization of service offerings and intensifying rivalry in all three segments .This accentuates the need for competitive strategies such as economies of scale (fleet size) and scope (differentiation). In an industry as old as shipping, creating differentiation in traditional business models is a relevant concern for many already established incumbents.

As mentioned earlier, in every industry opportunity recognition and exploitation activities have certain distinguishing contextual characteristics. Innovation in offshore wind shipping can be defined as the introduction of a radical or (more often) incremental, demand-driven, usually concerning vessel design and/or service offering, based on differential access to information. The latter is often protected by patents (especially when regarding vessel design) and acquired either through the founder's own intellectual capital or through expanding the knowledge base by knowledge exchange and hiring skillful, experienced employees – all the interviewees acknowledged the importance of vessel design and functionality to their successful operations.

Similarly to innovation, entrepreneurship differs in the sense that it requires specific capabilities, knowledge and access to resources, it is expressed through creating commercially viable new means-ends frameworks by leveraging competences from other knowledge domains/industries, which will be reviewed below. Entrepreneurship in offshore wind is a resource-intensive process, as it requires, apart from intellectual capital, mobilization of traditional production factors, such as capital and labor, both identified by the interviewees as crucial to doing business in the segment. Land/natural resources, the third main production factor should also be taken into account – as the initial entrepreneurial efforts that gave rise of the industry, triggered by changes in energy policies and a broader shift towards environmentally friendly power production were founded upon the abundant supplies of offshore wind in the North sea and their perceived potential as a source of energy. They were also driven by the EU targets for renewable energy and the directives targeting alternative energy production. The latter caused the emergence of an opportunity to build the first of its kind and therefore radically new vessel design – the wind farm installation ship. They also mark the start of the offshore wind shipping segment, where innovation is still present, but rather as a vehicle towards equilibration of the market as opposed to the initial disequilibrating activity that marked its commencement. Even though an eventual supply and demand equilibrium could mean a closure of the opportunity window ,as climate preservation and sustainable energy production are issues of global relevance, offshore wind harvesting is developed outside of Europe as well - even if currently in smaller capacities, new markets are opening in China, US and Asia Pacific; this could mean a new locational opportunity for the shipping operators once the EU market becomes saturated - an opportunity particularly relevant for the companies offering installation vessel services, but holding potential for the service and cable laying subsegments as well.

Due to structural differences, the entrepreneurial individuals and organizations in each subsegment have diverging characteristics; those will be addressed below.

The empirical data analysis indicated that entrepreneurial activities in terms of enterprise creation are more likely to be carried out by individuals in the service vessel subsegment and by organizations (intrapreneurship) in the installation and cable laying subsegments. The entrepreneurial individuals have predominantly maritime and engineering background, which, as also the interview with a service vessel operator (Cwind) indicated, helped them establish and lead the new firm. Another argument for individuals entering would be the lower capital requirements in service vessel subsegment and the potential utility from self-employment exceeding that of ordinary employment, combined with a belief that they can provide a better product/service than the ones already existing on the market (Cwind interview). Even though the data gathered was not sufficient to create an econometric model and trace certain variables' influence on the probability of one becoming an entrepreneur in the industry, odds do seem higher for people that have been formerly employed as fishermen/marine navigators, captains and engineers. Given the uncertainty of demand in this industry, underlined both by the interviews and by secondary data sources, it is also likely for the individuals venturing in this segment to be more prone to risk-taking than their employed peers. The strong commitment to offshore wind in the service vessels subsegment, expressed in a number of firms operating only in this industry, and further affirmed by DBB jack-up shifting the focus of its operations from installations to maintenance services (according to interview accounts) could indicate that it is indeed the one providing most business opportunities for individuals out of the three.

The installation subsegment , on the other hand, as the interviews and quantitative data point out, is moving towards consolidation and a new entrant would need both scale and social capital such as access to a number of distribution channels(including but not limited to suppliers of ships , qualified labor force) and long-term relationships with customers, working together with them on finding the most optimal solutions (A2Sea interview); with the already observed trend of backwards integration of some of the utility companies, new incumbents that do not have access to the distribution channels and to the industry's know-how would encounter high entry barriers, enforced further by the sophisticated, third generation vessels, more than a decade of practical experience and limited supply of workforce skilled enough to operate the specialized ships. This highlights the meaning of intellectual and social capital for entrepreneurs in offshore wind shipping – building relationships and knowledge base are an important factor for a shipping operator's commercial success in offshore wind.

The abovementioned applies to a large degree in the cable laying subsegment. Even though there is a seemingly fairer distribution of market shares than in installation, Kell Thyssen of JD-Contractor pointed experience and ability to provide less costly services as an important competitive advantage, which could imply a competitive market environment in the subsegment. There is an ongoing trend of vertical integration as well (some operators provide crew transfer services), and only one of the companies (CT Offshore) has been established specifically to service offshore wind. The rest of the companies have diversified from other industries due to having identified a demand (JD-contractor interview), which aligns with the theoretically stated assumptions that new developments in shipping are more often than not demand-driven because of high costs and failure rates.

Literature pointed out that technical specialists and high level employees are more likely to drive intrapreneurial efforts such as spin-offs and diversification, and that may well apply in offshore wind, but there was no proof in the empirical data gathered. In line with the topic of corporate entrepreneurship, operators from other shipping segments already have the resources to not only recognize but also exploit a promising new opportunity - this helps explain the motivation of already established shipping companies to create spinoffs or diversify in offshore wind(especially ones operating in oil& gas). General knowledge of the maritime business environment is no doubt valuable, but in offshore wind, other skills are required as well - there are also construction, financial and engineering companies entering the cable laying and installation segments through diversification and equity buy-in, and this indicates the plethora of competences that can be utilized in offshore wind shipping , as it, unlike other types of maritime transportation, involves activities such as construction, crane operations, marine spatial planning. It also confirms the increasing interest in alternative energy technologies. The entrepreneurial companies come from a variety of industries, therefore expanding offshore wind industry's social and intellectual capital base by linking it to other business areas such as the construction, power production, investing and engineering industries; however, there are still many dilemmas regarding offshore wind activities and even though some answers can be sought in the incumbents' extant knowledge base, a number of challenges (technical and otherwise) remains to be solved.

5.2. Innovation challenges, drivers and strategies in offshore wind

Innovation is therefore essential in terms of overcoming these challenges and ensuring the industry's progress in the long run, as also the interviewees asserted. The interviewed representatives from offshore wind shipping companies addressed flat organizational structure, decentralization and frequent discussions with employees (DBB and JD-contractor), a separate department dedicated to innovation (A2Sea), collaboration with customers (CWind) and with competitors on different projects (A2Sea) as means of facilitating the flow of new ideas. The role of managers as enablers of creativity was confirmed in the interviews as well. Although an open innovation system, involving extensive knowledge exchange between companies was not considered a viable strategy at present, there exists a number of trade organizations where actors from different stages of the supply chain can cooperate together , such as Offshore Wind Accelerator and RenewableUK in UK(according to interviewee accounts), Offshore Wind Denmark in Denmark . The main drivers for innovation in shipping, stated by (Wijnolst et al 2009) apply here as well: laws of nature and physics - adapting the vessels for different sites of operation and weather conditions; regulations and standards – operators are bound to ensure their compliance to the plethora of requirements, linked to the vessels` complexity and specificity; innovations in offshore wind such as different foundations design, larger turbines are an influential driver for innovation in wind shipping – for example, larger turbines require larger and more robust installation vessels. Cost minimization in offshore wind shipping, which is a part of the overall strategy of decreasing production costs in offshore wind, is a very influential driver for innovation and is a subject of extensive R& D activities, as the interviews and secondary data indicated. New, more efficient design concepts drive innovation in all three segments, with new and improved capacity as a means for competitive advantage and better service offerings. This is especially so in the installation and service vessel subsegments, where there is a larger degree of commitment to offshore wind.

Researchers (Wijnolst, 2009) have argued that clusters act as enablers of innovation in shipping .In offshore wind, well-defined cluster structures have not yet evolved, and thus their influence cannot be assessed. However, there is an evidence of industry actors cooperating together in UK and Denmark, and because of the geographical concentration of the segments, clusters, facilitating ongoing collaboration between academia, practitioners and governments are likely to emerge in areas of offshore activities in the following decades, bringing about a more robust knowledge exchange system.

It has to be noted that even though know-hows and skilled employees are crucial to market success, as shipping is a relatively slow-moving industry with long-lasting trade cycles, asset management remains an important activity– these are all asset -heavy subsegments where physical resources and their proper utilization have a significant impact on profitability. This poses certain challenges e.g. covering the fixed and variable costs associated with owning and operating a ship, but they are an innovation trigger in their own right – an opportunity for product and process optimization. In order to ensure profitability and long-term success, shipping operators employ a number of strategies which will be reviewed below.

Compared to installation and cable laying, the service vessels subsegment employs a larger average fleet size – this allows for flexibility and scale and a likely local monopolies trend for the service vessel operators .On the other hand, economies of scope (vertical integration) are observed in the installation and cable vessels operators segment, where many of them offer both crew transfer and installation or alternatively cable laying and crew transfer services, with A2Sea involved in all three subsegments, providing cable laying(through CT offshore), crew transfer and installation. The abovementioned service offering is an evidence of the divergence between individuals and organizations entering offshore wind shipping – while entrepreneurial individuals can offer specific vessel designs and skillful employees as a means of differentiation (interview with Cwind), venturing organizations have the resources and capabilities to provide a more complex, integrated service solution and better coordination along the value chain. Even though in both instances the offerings are business- to- business, organizations are more likely to offer a more complete, turnkey value proposition. Smaller enterprises are likely to turn to specialization (focus on a single subsegment) because of the high costs of innovation and the potential difficulties caused by collaboration for smaller companies (DBB Jack-up).

As concerning leader firms, A2Sea appears to have an advantage over the others in number of executed projects and economies of scope. Their position as a leader in the industry could be deployed in the future to enforce health and safety requirements offshore and raise the segment`s quality standards.

5.3. Energy policies and their relevance

Energy production and transmission is crucial for all sectors of the economy – this is why its decarbonisation is pointed out as an important step towards sustainable economy that mitigates its impact on the environment. The demand for alternative energy technologies is growing. However, the share of offshore wind in the future energy mix is still rather unclear. The presence of substitutes such as solar, tidal and biomass serves to further increase the demand uncertainty and makes attracting investments in all stages of the value chain a difficult task. While existing shipping companies can fund the new ventures (spinoffs, diversifications or acquisitions) with equity, new entrants have to rely on different sources of startup capital - obtained through government subsidies (A2Sea) and bank loans (CT Offshore). A large part of the turnover in offshore wind shipping comes from the wind farm owners – utilities and/or turbine developers, leveraging finance from other segments where they are active. This gives the latter a higher bargaining power, making it difficult for marine contractors to negotiate contract terms, as also indicated by the interviews. The unequal risk distribution could well have caused the recent bankruptcies of some of the smaller companies. The gathered data indicated that a different financing structure where the degree of risk is lessened and legal barriers for investment are lowered would attract funds from private and institutional investors alike and therefore make the industry less dependent on governmental support .

It should also be noted that even though different investors have different rationales for selecting a project, costs, efficiency, position on the power market, grid connection efficiency, as well as public and governmental support are all factors involved in choosing one investment over another, as both literature and secondary data indicated, and as such are aspects that should not be overlooked when considering optimizations in offshore wind.

Governments are accelerating the process by implementing various policy instruments that support the growth of this industry and encourage public support and financial flows, such as feed-in tariffs, tax regulation mechanisms, quotas, subsidies. Their impact has so long been a positive one, however, the interviewees all indicated enforcing these and similar measures in a long-term perspective as a crucial factor for attracting long term public support and success to these segments. Sudden policy changes, redirecting efforts to a different type of power production technologies could lead to projects delays and cancellations stifle growth and yield heavy financial losses for all the stakeholders involved. Another issue requiring consideration is the large amount of regulatory bodies in the power production industry - the multitude of actors involved makes for a more complex and less predictable legal environment. On a local level, in each country the state of the industry is changing at a different pace under different policies and governmental decisions. The recent abolishment of individual country targets by the European Commission could have a negative impact on the growth and development of offshore wind in the individual countries where potential substitutes enjoy larger public support. This further highlights the need of consistent and coordinated actions of the regulating actors involved and its significance to the industry's future in particular and the economy in general.

Utility companies, especially the state-owned ones (the data indicated that state-owned utilities own a large share of the current capacity), act in coordination with governmental policies and are likely to invest in projects that enjoy both public and governmental support. As they are a main stakeholder in offshore wind, redirecting their activities to different renewable energy technologies would have a decidedly detrimental impact on the rest of the participants in the industry. The utilities currently involved in the industry have announced plans to expand their activities in offshore wind, and recently new utility entrants have diversified their activities to offshore wind, but they are liable to redirecting investments in accordance with change in governmental energy policies and/or public support.

5.4. Opportunity window

The abovementioned is one of many indications that the industry has not reached maturity yet - a claim supported by the interviewees' opinions. This and the limited financial data available pose an obstacle to determining its profitability and at the same time imply difficulties in predicting variations in risk and demand. On the other hand, maturation of a shipping segment usually brings about commoditization that could stifle opportunities for organic growth and potential new entries, bringing novelty to the market.

As a response to the pressure from customers to drive down costs, increasing consolidation is predicted – without economies of scale, the numerous expenses accumulated from running a shipping company could prove difficult to manage.

As established earlier, energy regulations are a trigger in shipping and could drive the establishment of new niche segments serving the needs of the power production industry. In this context, the locational opportunity was initially opened in Northern Europe, in line with the shift towards clean energy production. Locational opportunity is time- constrained, so after the entrants threshold is reached, the opportunity is likely to move in spatial terms. In order to determine whether this is the case in offshore wind, the opportunity window will be evaluated separately for each of the subsegments, as the conditions and competitive structure in each of them differs.

This table is based on conclusions emerging from the industry competition analysis and briefly reviews the most important criteria argued by literature as critical for assessing the potential costs/benefits of an entrepreneurial entry for each of the subsegments.

Subsegment	Installation	Cable laying	Service vessels
Continuity of demand	Expected to decrease	Yes	Yes
Established large competitors	Yes	Yes	Vertical integration
Intense rivalry	Expected to increase	Increasing	Yes
Market shares	Expected consolidation	Closest to a perfect Competition structure of all three	Close to perfect competition ,possible local monopolies
Threat of entry	Low	Higher than installation	High
Differentiation	Yes	Yes	Yes
Economies of scale	Expected	No	Yes

For installation vessels, the continuity of demand, even with continuous governmental support is uncertain unless they turn to other markets where there are opportunities for capacity installation. New opportunities for shipping are likely to emerge in Asia Pacific, China and US, where developments in offshore wind are emerging – however, aspects such as regulations, weather conditions should be taken into account. There is a lot more capacity to be installed and maintained, should there be support and market growth in China and US This is different for cable laying and service operators, which can still participate in maintenance and repair activities required by the already installed parks.

As far as rivalry is concerned, its intensity is expected to increase with the upcoming consolidation in installation vessels and intensify in all three segments because of the growing commoditization of service offerings. This is aided by some of the companies integrating vertically in services, thus claiming a market share in the subsegment as well.

Market entry, especially in a newly emerged industry, has proven risky for a number of offshore wind incumbents .Even though an interview with a company that went bankrupt in offshore wind was not conducted, the secondary data available led to the conclusion that market failure was caused by lack of extensive market research in order to be able to predict the operational costs and potential expenses, not enough initial investments that led to insolvency at a later point, product (service) delivery time longer than expected, ineffective risk management and inability to hedge the risks transferred by the contract with utilities (also indicated by interviews).

The threat of entry appears to be highest in service vessels segment and lowest in installation vessels.

Even though the maturation of the markets in all three segments is something to be expected, at least in Northern Europe, the saturation of demand on a local level does not mean that there are no more opportunities in other locations or activities – providers of O&M vessels and floating hotels(where the incumbents are not that many, according to interviewee accounts) , as well as companies involved in cable and turbine repairs, crew transfer services and decommissioning are likely to enjoy demand continuity even in the already established markets. The existing companies are seeking certainty and commitment, but it is demand predictability that would indicate closing of the opportunity window and mark the beginning of commoditization and a decrease in entrepreneurial activities.

It is interesting to note that the entrepreneurs who set up companies in installation(A2Sea) and cable laying(CT offshore) are no longer in the companies, both of which have marked a growth in employee number and profits over the last 5 years. The larger organizations are likely to rely on the CEOs to lead the company toward sustainable growth. As it was indicated both by literature and the interviewees, CEOs and managers need to take initiative and assess the opportunities and create a sustainable strategy for the company's future, as well as ensure that their organization is able to adapt to the market demands and at the same time foster a creative atmosphere within the organization, enabling new ideas and intrapreneurship.

A review of the most important competences required by the offshore shipping segments is essential to determining the part that human and intellectual capital plays in the segment. In the segments of installation, a plethora of competences is required both onshore and offshore, they need captains, specially trained crew for the installation vessels, HSEQ people, and employees with technical background. In cable laying, experience and operational know-how, combined with the ability to plan and manage the activities to ensure financial and technical efficiency are crucial. In service vessel s segment – navigation of the vessel, technical competences concerning vessel design innovation and reparation of the turbines as well.

5.5. Present challenges and areas of optimization and future potential

Triangulating the quantitative and qualitative data indicated that the main challenges the segment is facing are, as follows:

- Access to qualified personnel - All the segments have grown in terms of average employee number for the last 5 years. As companies grow, more qualified manpower is required. Job opportunities will help the organic growth of the economy as a whole – however, the specificity of offshore wind shipping activities brings about a narrower labor pool, especially for seafarers (esp. in installation and cable laying segments). The extensive training required for the sailors and captains aboard the

WIVs makes employees an ever important asset for these companies.

- Up scaling – The turbines are growing in size; the market is expanding geographically as well. The shipping operators are facing the dilemma of supplying with new capacity and at the same time evaluating the opportunity in new markets.
- Bargaining power of customers - The interviewees all agreed that the influential customers are able to influence the shipping suppliers and have high bargaining power. Backwards integration of utilities and strong OEMs (from Siemens) could prove harmful to the shipping segments' profitability. This is changing as new turbine manufacturers and utilities are entering the expanding market.
- Cost minimization issues – Following the latter, those are an important part of ensuring the long term demand for offshore wind. These include improvements both in the product and process areas in offshore wind shipping, working in installation and maintenance segment in order to ensure that maximum efficiency is reached in all phases. Ports and storage facilities should be worked on.
- Financing - Mitigating the risks associated with offshore wind and attracting more heterogeneous investors is a key challenge for the segment stakeholders.
- Differentiation strategies – Standardization of the segments is soon to follow after the maturation of the industry. Thus companies are prompted to follow different ways of retaining their market share – either through economies of scale or through differentiation, integrating horizontally or vertically.
- Innovation and know-how are a part of the differentiation strategies of the companies and have an entrepreneurial element in terms of introducing new means ends frameworks in order to improvement service offering and production process. Know-how and patents. Patents are important, as they protect a company's exclusive right to use a certain sophisticated technology, usually concerning vessel design. There are patents in service vessels as well. This accentuates the role of knowledge. A2Sea has patent, and the others have as well. So they are competing in these areas, but collaborating in others.
- Governmental and public support - Their inconsistence is a continuous source of discontentment for the shipping operators. Collaborative effort, consistent long term energy resource allocation strategies and collective decision making involving all the value chain stakeholders are thus essential to helping the industry keep its balance.
- Adhering to a variety of international regulations and standards is a traditional challenge in shipping. Here the requirements appear to engage a lot of effort in all segments (interviews). Standardization of contracts, the interviewees said, could aid the industry`s progress.

6. Conclusion

Coordinated collaboration between the different project stakeholders is particularly important when optimizing the overall logistics process – in which governments, port authorities, turbine developers and utilities as well as marine contractors all play a part. A few aspects could prove particularly important for process improvement – crew training programs, in order to ensure a steady supply of competent labor force, standardization of contracts that would allow for terms and conditions protecting the interests of both parties involved and the introduction of standards in service offerings, enabling a greater degree of safety and effectiveness offshore. Another important measure is cutting down the costs through up scaling and achieving balance between technical and business resource effectiveness. All of the abovementioned issues indicate a service market that is still young and growing and thus changing at a faster pace than the ones that have already matured.

The analysis indicated two important trends that are bound to influence the future of offshore wind industry and its shipping segment alike. The first is turbines increasing in size and going deeper and further offshore; the second - new markets (and demand for offshore shipping services) opening in the rest of Europe, Asia and US. This would inevitably provide new opportunities for the incumbents, but it would also prompt revisiting the current product, cost, capacity and risk management strategies. In a way, it will pose a challenge upon the company's existing resources and capabilities, as it is likely that in the new markets, the challenges regarding locating and training personnel, coping with suppliers, customers, rivals and regulatory bodies would still be relevant just like macro and microeconomic trends would still be influential engines for change.

One should not forget that in offshore wind shipping, as operation and management of vessels is involved, a lot of the shipping dynamics apply. Managing physical assets with high fixed costs implies that profitability is reached through a high rate of utilization. This is prone to make the rivalry even more intensive in the long run. In all segments, future investments in capacity will be required in order to stay on the market, especially with the farms moving further offshore and with the floating foundations gaining popularity, which would require new approaches to installation and O&M.

Larger energy and shipping companies could make an entry through spinoff or diversification in the installation segment as an attempt of in-housing the shipping activities or vertical integration in order to further increase their bargaining power of the former and leverage existing resources to exploit potentially profitable opportunities for the latter. The upcoming consolidation and ongoing vertical integration would make entry difficult for new incumbents.

In the cable laying, entrance(especially for already established cable layers) is still possible - considering the high average age of the fleet new tonnage could well be a competitive advantage for new incumbents. The interview with JD-Contractor and the secondary data showed that even though the vessels they already have can be utilized for offshore wind tasks, extensive site inspections and careful planning is required in order to ensure that the expenses and time plan is carried out in the most efficient manner.

The service vessel segment, especially the crew transfer services market, remains the one most frequently selected by entrepreneurial individuals because of the lower entry barriers and opportunities to employ their maritime and technical knowledge(acquired from former educational or professional experiences) throughout the value creation process.

The ever changing energy policies hinder predicting and planning investment allocation within renewable energy and respectively offshore wind. This makes investors hesitant to spend funds where return is uncertain and risks are too high – however, this could change in the future together with the advancement of cost optimization and scaling activities.

Although it is not possible to measure profitability accurately, its roots could be traced to governmental and public support, customer acquisition and retention and sustaining a competitive advantage. In the three shipping subsegments, different strategies are executed by the companies in order to deal with and transform these forces – those have been elaborated upon in the analysis and discussion chapters of this study.

The segment does provide plenty of entry opportunities on a global level, especially with the ongoing developments in new geographical areas. Enterprise creation is possible for individuals and organizations alike in the service subsegment, and mostly for extant companies in cable laying and installation. A caveat for future entrepreneurs should be that albeit offshore wind shipping is a promising young market, it also exhibits characteristics traditionally attributed to shipping – it is internationally competitive, asset-intensive, less profitable in the short run, permeated with regulations, strong customers, requiring specific competences offshore and onshore for ensuring the efficient management of a complex supply chain; in addition to that it is influenced to a large degree by changing governmental energy regulations issued by different regulatory bodies.

The main contribution of this study to entrepreneurship research is that it extends the application of entrepreneurship theory to niche segment shipping and aids a better understanding of the rationales, approaches and challenges of opportunity recognition and exploitation in the segment, documenting entry by individuals of predominantly maritime and engineering background, multiple cases of corporate venturing, and a locational shift in entrepreneurial opportunity. It furthermore advances the study of maritime economics by identifying areas of convergence between niche segment shipping and traditional shipping trades such tendencies towards commoditization and growing rivalry in all three main subsegments (installation, cable laying and service), heavy reliance on traditional production factors, but also ones of dissimilarity, e.g. the importance of social and intellectual capital to offshore wind's future development. The dependency of the shipping segment on alternative energy production prompted a review of the relevant energy policies - an issue of utmost importance to incumbents and society alike.

7. Areas of further research

Throughout the process of finding answers to the main research questions new inquiries emerged. Those can be classified in 3 main areas: the evolution of know-how and business model innovation, new markets and entrepreneurial entry, clusters and collaboration between companies.

Know-how is becoming an increasingly significant production factor, as well as a competitive advantage and a potential barrier to enter the segment. Thus, a thorough exploration of the implications of differential access to information to niche shipping entrepreneurs and their potential to leverage novel competences from other industries to succeed in offshore wind could prove beneficial. Furthermore, an investigation of the impacts of organizations from other industries diversifying in offshore wind on the evolution of offshore wind's knowledge base could help understand its future direction.

Another important development is the ongoing **spatial movement of locational opportunity** and emerging offshore wind markets in the USA and Asia. An issue of relevance would be exploration of the new markets and the ability of existing incumbents in the three subsegments to penetrate them. Evaluation of the market environment and opportunity window would help assess that. Further to enterprise discourse, regional public support and governmental policies regarding offshore wind and their impact on geographical distribution of entrepreneurial activities in offshore wind shipping should be evaluated. The market expansion brings about changes in the financial environment. The effects of changing financing structures and their potential influence to aspiring entrepreneurs' market entry and performance would also be an interesting area of enquiry.
As argued earlier, **clusters** are particularly important for entrepreneurship and innovation in shipping, facilitating cooperation between value chain actors and knowledge spillovers. Following the development of cluster structures in offshore wind and their influence on the industry's innovation and entrepreneurship practices as well as the influence of trade organizations, academic research and governmental policies on developments of the latter would enrich both the entrepreneurship and offshore wind knowledge domains.

All of these areas reflect the complexity of the offshore wind value chain and influence its potential growth or decline - therefore they should be reviewed and studied thoroughly in order to determine the present and future state of the industry in general and the shipping segment in particular and the role of entrepreneurship within it.

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Appendices

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Appendix A : Interview guides and transcripts

Interview guides and transcripts – service vessel operators

Interview guide service vessels

What is the company founder`s educational and professional background?

Why did he choose to establish a company in the offshore wind shipping sector?

What is it that influenced your choice of headquarters location?

What are your biggest challenges at the moment?

Do you interact and/or collaborate with industry rivals or other actors in the supply chain? Would you say that the rivalry in this sector is intense?

How do you facilitate and manage innovation?

Do you have a standard contract?

Do you usually sign a contract with the OEMs or with the project owners? How do these contracts differ from one another?

In your opinion, what is needed in order to be successful in this industry?

What is the background of your employees? Do you have employees that are key, particularly important because of their knowledge/skills/experience?

Do you have your own personnel on the boats? What competences does the crew need to have?

Are you planning to increase capacity?

Do you think the market is becoming commoditized?

How do you differentiate from the competitors?

Have you considered expanding your activities beyond Europe?

How do you see the future of renewable offshore energy and its growth in the next decades?

What in your opinion can help for the sustainable growth of this industry?

Interview with Thorsten Jalk, CEO of DBB Jack-up (Operation and Maintenance services)

Q:How did the idea of entering offshore wind come up? Who was the person that came up with the idea?

A:It was the founder of the company that decided to take this route. We are a company with traditional trades of salvage, diving, etc. We have been in this business since 2007 when the first vessel of this kind was purchased.

Q::Do you think specialized knowledge is required for recognizing business opportunities in the offshore shipping industry?

A:It is very specialized. We are a small company so we try to. It's important to have deep knowledge. I think this is the main barrier for a new company, minimum you need to have people with sufficient knowledge and background within the industry.

Q: Is it engineering, business?

A: It is both… Engineering, but also business….Some knowledge on the operational side but Of course need to know the commercial risks that is involved in that industry.

Q: OK. Are there particular strategies for encouraging entrepreneurial activities and innovation? How do you and your team generate new ideas?

A:We have not yet formalized it that we have a special procedure. We are a small company, so we can take decisions quite fast, we like to be in a close dialogue with the customers, also to develop materials that fit their demands, that's the most important.

Q:How does the decision making process work? Can employees offer direct suggestions?

A:We have a very flat organization structure and sometimes….It is not always the highest educated engineers that come up with the best solutions. It can also come from the youngest man on the floor or from a deck man on the vessel, so everybody is… we have a very low organization structure, it is easy to call me. We can have a close dialogue about for instance a good idea.

Q:What is the educational/professional background of your employees? What competences are crucial for people working in this industry, in your opinion?

A:Varies a lot, a lot of people with a maritime background, either as a master mariner or as engineers. We have naval architects, we tend to have people in the operation department with a maritime background. Because it is still a maritime environment, and there are maritime rules and regulations that we are working under with our vessels.

Q: Is there a specific know-how required for operating this type of vessels?

A: You always need to have a know-how on the vessels you operate. And besides it being a normal vessel that can sail from point A to B, this is also a vessel that can jack-up in the water. So it is a combination between a vessel and a jack-up, following offshore vessel rules. Of course, it is not just bringing some bulk or container from A to B. So, yeah.

Q:What is it that influenced your choice of headquarters location?

A: That was more or less a coincidence. This is an international business, so exactly where you have your location or main office is not that important. Of course you need to be in an area where you can attract the right people and we are based in Aarhus and Vestas is also based in Aarhus, some of the other players are situated in Frederecia and even Copenhagen. Often, a company ends up in a place due to some people living there that started up the company.

Q: OK.Is offshore wind different   than other industries you`ve worked in and how?

A:The offshore wind industry is, well…You have the common thing with operations in water, which is common with oil& gas and shipping in general. The difficult part in offshore wind is….well, one of them at least… is that it is still a very young industry so that there is a lot of people coming into that industry in all levels in the supply chain, with or without any knowledge about what 'operational vessels' really means, what it means to be in that kind of environment, it is being offshore . This gives a lot of need for customer education – i.e., you need to train your customers. to educate your customers, so they have sufficient knowledge to take right decisions, of course.

Q: OK. You have mentioned that you were in the installation industry before and now you are only in maintenance and operations.

A: Yeah, I think that the industry has reached a point now, after being out there 10-15 years more or less in big commercial scale, we have reached the point now where we have to specialize to optimize. When you start a new industry, it's very normal that we try to see what do we have, how can we use that, when you start in the pioneering phase. As soon as you move into a more industrialized phase as we are now in (just started), we need to specialize and optimize, as I normally say. We have chosen to set down a strategy, saying that there is a lot of companies who have invested big money in installation vessels, so they are competing quite heavily there, while there were very few focusing on the 20-30 years of maintenance and life of these turbines and we chose to put down a strategy saying that we want to specialize on being the best to help with the main component's change – gearboxes, main shaft, so on.

Q: So the rivalry in that subsegment is not as intense as in the installation vessel services?

A: I say it is much more complex to do the O& M operations, because you have very short planning time. When you have a turbine breaking down, the owner is interested in getting it up and running as fast as possible. Therefore, we have a very very short time to prepare, because imagine the situation - we can be at one site with one company in one country, repairing one type of turbine, and then we need to move within 14 days to another country to another owner to another type of turbine and we have to be able to be very flexible in our project planning, execution and also with loading these components onto the vessel. So it is a little bit more complex than installation, because in installation you have much larger planning time – 2-3 years, when you have installed the first 2-3 turbines then you have the full learning curve kicking in, and then you just repeat the process.

Q: But each O&M process differs greatly from the last one? Isn't there a learning curve as well?

A: Of course, you learn by repeating many different operations. We have changed some gearboxes, we have changed some blades, we have changed some main shafts and generators and so on. Of course, the more often you do a certain process, the better you get at it. It's about training.

Q:Do you have your own personnel offshore or do you only charter out the vessels? Is specific know-how/experience needed for the operation of these vessels?

A: No, we have our own personnel on the vessel. It's not normal shipping so we cannot take any seaman standing on the quayside, so we have all of them directly hired from the shipping company (DBB) and it is very high-skilled people, so we like to have them… and keep them coming, so.. and the majority of our people are Danes. But that can change if we are working in Germany, etc.

Q: On average, what is the duration of your contracts? How do you go about customer retention?

A: That varies a lot. Some are 2 weeks, we have just started operating a 3-year contract. We have just signed a 12 month contract. We are working on signing a new 3 year contract, so it can be everything from 1-2 weeks to 5 years.

Q: OK. Is there a standard contract form or is the contract based on negotiations?

A: Not really. For a lot of companies, the industry has used BIMCO standard contracts, BIMCO supply standard 2005, has been used a lot. It is not …. It can be adjusted to fit the industry. We have now one player in the market that has made their own contracts, but we have seen that BIMCO… that they have come up with a Wind term standard contract that goes for all the small boats going in and out (crew transfer vessels). So, I think that there also will be in BIMCO organization that we'll find a contract also for … to cover this maintenance of components, or even perhaps one day also installations. But installation contracts, as we see today, are fitted contracts.

Q: OK. Are already there certain standards you need to adhere to in terms of vessel design, safety, contract regulations?

A: For this type of boats? You cannot say that there is a standard, perhaps on market demand, on customer demand, what kind of capabilities the vessels are intended to… what type of water, how big should the crane be, what kind of weather should you be able to sail in, what kind of weather should you be able to jack in, up and down, how strong should your dynamic positioning system be, and so on and so forth. Of course, you need to live up to the flag state demands and you need to live up to the specification society's notations. When we are talking about this, you are entering into notations for offshore, so some of the areas of the vessel are offshore class. That of course gives you high demands on steel, strength, traceability and all that stuff in the vessel. It's quite a complicated vessel to build.

Q: So what it specific about your vessels that differentiates them from the rest of the vessels operating in the maintenance market?

A: We have small , flexible vessels. You have two types of vessels – the big installation vessels – you have generation one and now also the ones we call generation two - the generation two vessels is the vessels purposely made from the keel up. Generation one was existing vessels that were converted to do some of the installation work. In offshore wind, service and maintenance vessels were also initially rebuilt or a smaller installation vessel was used for that. We are now coming up with the first purposely built vessel, which will be delivered next summer, which is the first purposely built, from keel, O&M vessel for main components replacement. That is the difference.

Q: was it somebody from your company that came up with this (vessel design) concept?

A: Yeah, myself and my engineers. Because we built it on the basis of our experience, operational experience. We've built it with the input from some of the biggest operator out there, to have their inputs for the design, so we could try to meet their requirements and demands, so … It's not just about building A couple of years ago, everybody thought that it (the design) doesn't matter, that it was just about building a crane and legs to go with it, that it was enough. It is not.

Q: Would you say that the market for the services you are offering is becoming commoditized, a lot of companies offering same service. ? How do you attract new customers and differentiate from the competition?

A: No, I wouldn't say that. There are a lot of companies operating vessels to transfer the technicians to the site on a daily basis. But correcting failures is more limited, because, first of all we do not have the scale yet in the industry – and without having scale, nobody will invest, that's quite certain. If we have started the installation curves prediction, you will always see that 4 years ahead it always looks good. But we see now a slowdown for the next three years, that's why we see an overcapacity in installation vessels for 2014, 2015 and probably into 2016. So, I don't se a lot of people coming in because I think that , there will be, over the next period, there will be a consolidation of the industry. We will see that, we will end up perhaps with a handful of utility companies that really mean offshore wind , we see DONG energy, the Danish utility company, they are really big on offshore wind. We will see perhaps only a handful of installation companies, and I think we will see 3 O& M providers, component change, and we will see a lot operators of smaller crew boats for O&M people. That's I think what we will see over the next 2, 3, 4 years. And all will be much more specialized.

Q: OK. So there is a trend for turbine parks to go deeper and further offshore.

A: There is.

Q: Are your vessels equipped to handle this kind of change?

A: We have designed the newbuildings to meet the demands for all the turbines that will be installed, as we can see in the crystal ball, that will be installed in bigger water depth. We can, and we have put that into the design, we can extend the legs further 10 meters, so we can go on 55 meter water depth, so that has been taken into the design criteria.

Q: What is the scrapping age for this kind of vessels ?

A: Normally in shipping you would say that 20 years it's a scrap, but we see a lot of vessels that are 25 and 30 years old, but that depends on the industry development, because in oil & gas, you have certain customers that wouldn't accept vessels over 5 years of age or over 10 years of age, so I think the lifetime , the depreciation…. We calculate it for 20 years. And after that, it's an upside.

Q:How do you see the future of offshore wind energy and its growth in the next decades?

A: I think we will still see a good growth, but it is also very important that the politicians take their decisions in due time, because one thing you can have some political ideas, that you want to do so and so and so much renewable, but if you are not able to give your terms and conditions for the utility companies, so that they can see that it is a good business case, then it will not happen. So I think it is a combination of what we see, a transition from the traditional oil& gas, fossil fuels and so on, to more renewable energy, but oil & gas will still be there, it's gonna be a mix, we are not going to see the wind or solar taking over a hundred percent, that will not happen; but we will see a wider range of different sources for energy and I think we will still see some sustainable, steady growth within the offshore wind. And today, the main driver in Europe is of course still UK and Germany, and we've also seen Asia - China is picking up to be a big driver there, they also need power big scale. We see some of the other bigger countries, like France, Spain also, perhaps most are a little bit down due to the recession we have seen in 2008 and so on, but in general, I think that we will see a steady growth, a growth rate that will last , as suggested by May consult, one of the leading consulting companies for market, they presented a market growth annual 18%, I think that's still a sustainable, good growth rate.

Q: What would you say are the biggest challenges your company is facing right now?

A: Our biggest challenge is commitment. We need commitment from the industry, we need commitment from customers, a long term commitment, because this can lower our risk and also give us a better financing for the investments to come, because when you know about the vessel – when you start designing till you have the vessel – that's at least 2,5-3 years project. So you also need to be able to predict and have sufficient commitment from the industry before you put the bottom for the next vessel to be built 2,5-3 years later. So our biggest challenge is that still, we do not have a sufficient scale in the industry, we are still waiting for that, and that could be beneficial for us as a small shipping company, to see more commitment, to see the big players taking more responsibilities., because we need to develop the industry in steps, the ideal solution is not born on the first day, it is going to be developed over the years.

Q: So , you'll need a higher demand certainty?

A:Bigger demand and just a commitment, where the end customers, the utility companies, and the big O&Ms for the turbines, like Siemens, Stroma, say, 'OK, we will guarantee you a certain amount of work', and we will sign a contract, we will take the risk by having overcapacity for a certain period, but it is important for us as team players that you, DBB, will be able to raise the capital needed for next generation, so that you can follow our expansion and development. And of course, going further offshore, again, demands, new inventions, new designs and so on so forth… that's how I see it.

Q: Both of your vessels are developed in European shipyards?

A:Yes.

Q: Are interact and/or collaborating with industry rivals, in order to find a solution to common challenges etc?

A: No, not really. Not really. There is of course some organizations, for instance Barge owners organisations and the Danish shipowners organisations or something like that, but that is mostly a helicopter perspective of the industry, we don't have any cooperation together with direct competitors on how to develop things. I don't think the industry is there yet, it takes a high degree of comfort to really open your books, more or less, in the supply chain. That goes between either competitors or customers in the supply chain. So, we're not there yet, still a very immature industry, so we still have a long way to go before we are fully matured.

Q: In line with the collaboration question, are you collaborating with other companies, universities, institutions?

A: We don't at the moment collaborate with any universities, apart from me sitting here. We are quite limited by… We don't have the resources to go that far yet, but it surely would be very interesting to have that. Sometimes, we have some students working on projects, for instance trying to see how can we improve the transfer situation from the jack up to the turbine, or could you try to see how can we optimize the hull shape or could we optimize the jacking system or something like that. That's definitely something we have in mind and we hope that someday we can make enough resources in order to focus on that part of the development.

Q:Are you planning to enter new markets in the future, for example emerging markets outside of Europe, vertical integration ?

A: Of course, we have looked into the United states and we are also looking at Asia, which are two potential big growth areas, but so far there is not a steady commitment over there, there's not a steady growth; the first time I was in the US , which was in 2002, we discussed how to install the Cape Wind project, which is still not installed. So it's been 11 years on the way. That is the first offshore site in the US and … But if you go into the US, you need to take into consideration that you will be met by Jones' act, and Jones act is securing US shipping and so you need either to have a waiver towards the Jones act, or you need to build, operate and own the vessels through a US company. SO that's a challenge, because you need some real volume before you go out and buy a vessel. Going to China, of course, we are up against some cheaper workforce and so on, but again, it's a matter of bringing in the right technology that could put the opportunity there for a certain amount of time.

Q: Apart from the vessel that you are going to have delivered in 2014, are you thinking of expanding your fleet further?

A: Yeah, we also have… I bought one in South Korea last summer, a jack-up that we made , it is a conversion and it will be delivered here at the beginning of 2014, so next summer we will have 3 specialized vessels for this. And some can go on very shallow locations, some can go in high water, some can go faster and some slower, but it is mostly for these vessels that we can stand up there with unlimited survival criteria, meaning that you have to be able to withstand a 50 years storm, if that should occur in that area where you are. So yeah, we are expanding, together with the development of the industry of course.

Q: Well, I think that's pretty much it.

A: Did you get all you needed? Good. What are you trying to describe in your thesis?

Q: Entrepreneurial efforts within this industry.

A: So far, it has been very driven by entrepreneurs. I think it will be for a long time because, with the big operators out there, they are big triple E container vessels, but as soon as they take the course, you cannot turn it. But for those, it is a big benefit to have small, multi flexible companies. Because, if you have a multi super tanker trying to operate with another multi big supertanker, it can be difficult, because none of them can turn. They have set their course, and they have set that course to collision. But if you have a big tanker and a small one, that can maneuver all the way around, and always adjust – I think that's much more suitable for these big industries .

Q: There are a lot of larger companies creating smaller spin-offs in the new industries?

A: Exactly.

Q: Shipping can be a challenging area for a start-up company?

A: Yes, demanding a lot of cash . It's high risk industry, sometimes a lot of entrepreneurs take too much risk, and that's also something we blame a little the industry for, the utility companies, the OEMs of the turbines, that they are transferring in the contracts too much risk on the smaller companies, where the latter are standing there, risking the company's existence. That is not good, because they will not gain anything with the evaporation of an installation company. We have seen that many times in the cable laying. A lot of them went bankrupt during an installation. So they start up with a cheap offer of installing the dredge cable, or the offshore cable, but it ended up to be very expensive, it ended up to be a huge problem for the full installation, because without the cable installation you cannot get power on the turbine, then power is not installed … and then it ruins the whole business case. So even though it was cheap to begin with, it ended up with a disaster. That is very important, and that we have seen it 's caused by the big players; they simply are putting too much risk on smaller contractors.

Q: They have a lot of bargaining power.

A: Yeah, exactly. And that's not fair. The risk has to be more balanced. You have a company with 1 billion EU turnover and you have a company with 3 mln EU turnover, the risk has to be balanced accordingly to the balance sheet. We have seen so many , I know for sure there is a, I don't know for sure how much you are into the industry, but this… what's the name of it, in UK…..Carbon Trust, has also put out a document that has tried with some of the operators and O&Ms to , where they have simply signed under this document that they will not put too much risk on the small players in the market, because they have seen too many companies going bankrupt, and that's bad.

Q: I thought that cable companies operate in a variety of industries where they get a chance to leverage the risk from offshore wind.

A: That is the theoretical idea, that you can swap… A lot of companies say, We can just go to oil and gas. If it was that easy, they wouldn't be in wind, because the markets are much bigger in oil and gas. Then they would have been out long time ago. So that's an illusion. If you can convince your bankers that the jack- up you're building, if I can't utilize it in wind, I can just switch to oil & gas. It should be the other way round. If you cannot find a job in oil and gas, then you can go to wind, because the margin is much bigger in oil and gas.

Q: Can those vessels be operated in both industries?

A: They can, but you have to secure that they are non-explosive. So it's going to be a much higher price to build them. So you have to say that from the very first day of the design stage. The only vessels I know that have done that are Swire Blue ocean vessels. They are built to do Oil and gas also.

Q:They are a part of a larger company.

A:Yes, the one in Singapore. Too much money over there.

Q:They can hedge risk easier.

A:Yes. Should anything else pop up, give me a call.

Q:Alright Thank you for agreeing to be interviewed.

Interview with Petra Ernst-Gutierrez, Marketing & Communications Manager at *CWind*.

Q:What is the company founder`s educational and professional background?

A: Andy White is the founder of both CTruk and CWind. He is a naval architect by training.

Q:Why did he choose to establish a company in the offshore wind shipping sector?

A:Any White lives on Mersea island (just across from Brightlingsea, where CTruk is located. Brightlingsea was used as a basis for the construction team for Gunfleet Sands. He started to talk to the teams involved to try and see if there was a role for local business in the offshore wind industry. At that time crew transfer vessels were by and large ships that had been built for a different purpose and thus were not perfect for the task. He was asked if he could come up with something better. He thought he could. He started to amend an existing aluminum catamaran which worked well but, he felt, resin composite had additional benefits to offer and thus he started to build the now well-known CTruk 20T MPC (you can find further information about this on their website www.ctruk.com.

Once the vessels were operating the creation of CWind was a natural step, it made more sense to offer the vessels on charter complete with a team of technicians to support offshore wind farm developers…

Q:What is it that influenced your choice of headquarters location?

A:Andy White lives on an island just off Brightlingsea. Brightlingsea has a long tradition of ship building which came to an end at some point in the last century. It was easy to find a skilled workforce and it was the basis for one of the offshore wind farms in the UK.

Q:What are your biggest challenges at the moment?

A:There is not enough clear and long-term political support for offshore wind to give developers the financial incentives and stability to develop more offshore wind. Construction in the UK is slowing down over the next few years. Companies will have to look at other markets to make up for that shortfall.The next round off offshore wind farms is further offshore in deeper water, transport methods have to reflect this change.

Q:Do you interact and/or collaborate with industry rivals or other actors in the supply chain? Would you say that the rivalry in this sector is intense?

A:We do interact with competitors in trade association such as RenewableUK, or EEEGR. We also exchange knowledge about transportation and transfer methods. Overall, however, there is competition of course and it is unlikely that information that will affect a company's market position is likely to be shared…just like other sectors.

Q:How do you facilitate and manage innovation?

A:We look at issues that hinder faster and more efficient construction and maintenance of offshore wind farms. The answer to the issues can lie in a variety of solutions. CTVs that operate on more than one fuel can be one solution, contracts that share vessels across wind farms in one region can be another.

Q:Do you have a standard contract?

A:No, our contracts are largely driven by clients, some prefer standards such as bimco, others insist on using their own template.

Q:Do you usually sign a contract with the OEMs or with the project owners? How do these contracts differ from one another?

A:Our clients include both categories. We can't comment on the content of contracts.

Q:In your opinion, what is needed in order to be successful in this industry?

A:Hard work, and an increasingly sophisticated supply chain.

Q:What is the background of your employees? Do you have employees that are key, particularly important because of their knowledge/skills/experience?

A:Many of our offshore technicians are service leavers (formerly armed forced personnel), they come with an excellent attitude and a range of skills. However, this is not a requirement.

Q:Do you have your own personnel on the boats? What competences does the crew need to have?
A:Yes, I can send you a list for the requirements but basically these are determined by the law of the country in whose waters the vessel operates.

Q:Are you planning to increase capacity?

A: Yes

Q:Do you think the market is becoming commoditized?

A;Yes we do think that will happen. The supply chain is maturing and the key players have defined for themselves what they will undertake in-house and what will be outsourced. Combinations like ours of vessel and technicians are still rare but they are successful so it is just a question of time…

Q:How do you differentiate from the competitors?

A: We offer a comprehensive solution. For example we offer generator management, we provide the generators for rent, the vessels to transport and refuel and decommission them and the technicians to maintain and repair them.

Q:Have you considered expanding your activities beyond Europe? Asia for example?

A:We have, watch this space.

Q:How do you see the future of renewable offshore energy and its growth in the next decades?
A:Growth is going to be slower than originally hoped for largely due to political obstacles but it will be sustained.

Q:What in your opinion can help for the sustainable growth of this industry?

A:Firm and long-term political support, financing for innovation and skills development

Interview guide and transcripts – installation vessel operators

Interview guide

What is it that influenced your choice of headquarters location?

Do you collaborate with the shipyards on vessel designs?

What are you currently struggling most with?

Do you interact and/or collaborate with industry rivals?

How do you facilitate innovation? Do you collaborate with other companies, universities, institutions.

How does decommission differ?

Can you instal converter stations?

Do you have a standard contract?

What is the driving force of this industry"?

What is needed to be successful in this industry?

How are you planning to overcome infrastructure (port, etc) difficulties?

What is the background of the employees? Do you have employees that are key, particularly important because of their knowledge/skills/experience?

Is there specific know how required for the installation vessels and the O&Ms?

Are you planning to increase capacity?

How long are the contracts and how do you go about customer retention?

How do you communicate your vision and mission within the company and outside it?

How are you coping with the standardization processes. What do you think is your key advantage?

Why are your vessels better than the jack-up barges, what are their advantages?

Is there already a second hand market for WIVs?

How do you see the future of renewable offshore energy and its growth in the next decades? Do you think the demand for installation vessels will increase?

Does the decomissioning process differ starkly from the installation ?

Do you think the industry will continue to flourish without existing governmental support? What in your opinion can help for the sustainable growth of this industry?

Are you considering vertical integration in terms of ports development etc.

Wouldn`t the trend towards wind farms going deeper and further offshore and implementing self-installation designs render the installation vessels useless?

Which countries do you think are important for the development of shipment industry

Interview with Hans Froholdt, Head of services and Logistics at A2Sea

M: Would it be possible to conduct the interview now?

HF: Yes, it is possible. But some of the time has gone, so we'll need to hurry up then.

M: OK.I will make it as quick as possible.First question is, how is the offshore wind industry different from other industries you have worked in ?

HF: How it differs or if it differs?

M: How does it differ?

H: It is different a lot, because it is a combination of project… of very heavy lifting project at sea and then normal shipping, so it's a combination. So it's not at all similar to any other types of shipping.

M:OK.

HF: Because of the offshore cranes and cables and everything else that is not as… But at the same time we do it with ships, so, you know, you have normal shipping, and then you have this project on top of it and that is what makes it very different.

M: OK. What do you think is needed in order to be successful in this industry? For a company to be a success.

HF: What is needed? You need money and you need shipping know-how…But you also need project know-how… How to handle these building projects, for instance, It is a very heavy building industry, so you will need to, you know, like, you need the competences like onshore technicians has ,like building bridges and building buildings, so you need these competences as well. So you need both.

M: OK. Could you elaborate more on shipping know-hows? What kind of know-how specifically?

HF: From shipping? Again, you would have the normal, standard know-how of how to run ships, but then you will need these ships to be managed on a very high level. .. So, you could not.. I mean, you need crew for instance, that are very trained when the ship started and that will stay with you long after that. You cannot just … I mean, if you for instance have a bulk carrier you can put crew from one place and then to another and then another. You cannot do that. You need crew that needs to be specifically trained for this purpose, you need ashore persons that are specifically trained and last but not least, you need a very high HSEQ, health, safety , environment and quality coordination, which is like you see in the oil industry, so if you have competences as you would have in the oil industry, you would be probably doing good in the wind industry.

M: Ok, how long does it usually take to train an employee to work (there)?

HF: It depends on… Depends on if it is a… What type of employee you are talking about. I mean, if it's a navy seaman, you would need some time, but if it's a captain, you will need more time. It depends on what type, but if you take the engineers, that would not take as long as it for instance takes for the captains, because for the captains it is very specified. You can take a AB seaman, a normal AB(able) seaman and you can train him within a year and then he will be able for this. But it is very different from person to person. I don't know if you are thinking about an onshore or an offshore person.

M: I was mostly referring to offshore.

HF: Yeah. So it is different from position to position.

M: How about the employees onshore, what is their background? Are they mostly business people?

HF: No. They are engineers, they are health and safety environment people, they are crew staff people, they are project managers, and then of course you will have some for instance business people, but that is not what is mostly needed. What is mostly needed is health safety environment people and project people and normal shipping people, technical guys.

(Electric power outage on my end)

M: How do you facilitate innovation? Do you collaborate with other companies, universities, institutions?

HF: We need to look for innovation all the time. So what we do is, we talk into our customers, we looking at what we are doing, and then we bring it home and we have our own department that is looking for different new ways to do things. So we have that specific department that does that.

M:OK. Do you collaborate with universities or other institutions?

HF: Not so much. But we do institutions, but specifically institutions, like for calculating different specific matters – for instance, how can we stand, how can we jack up in this position, how is the side quay capable of carrying us, how will the ship react if it is in deep sea mode and stuff like that. So we do not spend much time with… the research industry, but we spend time with suppliers.

M: So have you often collaborated with shipyards on vessel designs?

HF: Yes, yes, we have done that a lot – Danish, Polish, Chinese, a lot of shipyards.

M: Are there a lot of shipyards offering this kind of vessels?

HF: Yes, there is. Right now there is. Because we are looking at different types – we are looking at supply vessels, we are looking at crew vessels, smaller vessels which bring people out to the platforms, we are looking at the crane installation vessels, we are looking for cable layers, so we have a lot of different vessel types that we need , and a lot of suppliers are now looking at this area, because they think that there will be the need for a lot of ships to be built.

M: OK.Do you interact and/or collaborate with industry rivals, with competitors?

HF: Yeah, we do. A lot. That is needed. We directly collaborate with some of our competitors in order to fulfill the requirements of our customers, sometimes we even have competitors as shareholders in order to solve the larger projects. Yes, we do.

M: Has that proven to work well or…?

HF: Yeah, it works quite OK. I mean, always, on the commercial level it works fine, but when it comes to the operational level it will always be my way and your way, but at the end of the day we do it well . Yes.

M: Are you able to install stations?

HF: I do not understand the question.

M: Hmm… Let me just try another question. Are you planning to overcome infrastructure difficulties because I have read that special type of ports are needed for this kind of vessels?

HF: Sorry, I didn't get that either. You need to repeat that.

M: You know, ports, where you have to with the ship. Is there a special type of infrastructure needed for this kind of vessels (WIV)?

HF: Special type of ports to service these vessels?

M:Yeah.

HF: Yeah you would need the ports, but that is not to service the vessels, that is to service the projects, so in each specific ports that are capable of having large areas of storage, because you install all the turbines and substations and everything, and you need to have large areas. Also, some of the suppliers of wind power stations, they put a lot of bits and pieces together while on the port, so specifically, there are great demands for the ports, but also for the roads, for the infrastructure, from a larger perspective could be trains, but the factories are not always stationed very close to a port, so if you look for example at Danish highways, you will see a lot of those wind transportations, which are very huge because these wings are more than a 150 m long. You see, it's big transportations going on and...

(Power outage on my end)

M: I'm sorry, I had a power outage and my computer switched off. Is it possible to continue?

HF: Alright. That's alright.

M: I was just about to ask….How long are your contracts typically?

HF: That is very different. Some contracts are two days, and some are 15 years. So it depends. But our longest - so that is from 2 days to at least 10 years. Right now I am negotiating a contract of 15 years. I am also negotiating another contract in 2 days. So that is different

M: How do you go about customer retention?

HF: Customer retention?

M:Yeah.

H: I mean, it is still a very immature industry. So it is more or less the same customers we see again and again, and that also means that you have a pretty high customer retention rate. But there has been a difference in the last 2 years that more suppliers have arrived to the scene, so that means you have a more competitive scene but also means that customers, they gyrate, circulate more between the suppliers . So you will see a customer that we had yesterday will go back to a competitor tomorrow and we will get him back the day after, so that is what happens. So we have a high retention rate, but in between you will see customers using another supplier and then come back.

M: Well, would you say that there are high switching costs or not?

HF: Yeah, you could say so. I mean, I would say so, but for the customers – yes, there is, but they have not seen it yet. So there are high switching costs, and this is probably why you have this dilemma, you know, when you have quality or cheap price, and we believe in quality and that means that some customers try somebody else for a certain price, so yes, there are relatively high switching costs.

M: Would you say that the bargaining power of the customers is high in this industry?

HF: Yeah, again it depends on which area. Generally,I mean, it is increasing. A few years ago, the bargaining power of the customer was very low but now it is increasing, and that of course has to do with that the industry is maturing. That is why the bargaining power is getting higher, and also because the main customers…there`s only a few main customers and they…. You know, Siemens for instance is a main customer, you cannot say that many, but they are the main customer and also a main producer, so they more or less have a 90% of the market, so they have high bargaining margin in the market. So yes, that is high.

M: Are you planning to increase your capacity, I mean, in terms of fleet, your fleet size?

H: Yes, yes, we are, but we are ready to increase the capacity. We have already two crane ships under construction, we have already taken delivery of one and another that will be delivered straight. We are expecting for smaller vessels, crew service vessels, we would expect an increase of 200 or 300% the next 10 years, so…and for cable laying vessels, yes, we would increase that fleet too, we are quite sure.

M: So you are planning to enter cable laying as well.

HF: We have cables. We have a 69% ownership in CT Offshore, which is a cable laying company, and it is owned by us.

M: So A2Sea operate that fleet through CT Offshore.

HF: Yes yes, we own them. It is a daughter company, and for instance, some of our, for instance, group safety and security are run for the whole company unit. Also CTO, we cooperate in most things, we share a lot of things, so theirs is a competence very close to us. We offer projects where we offer cables and installation and service.

M: OK. How about the wind installation vessels? How do they differ, how are they better than the jack-up barges that are sometimes used to install turbines?

HF: We have both. We have jack up barges and we have installation vessels. The installation vessels , they can maneuver on their own, whereas the barges need sub boats to be positioned, and then they need cables to stay in position, or the sub boats, so that is the main difference. Some barges … At our company, you know, we do not man them very differently, we still have a cheap offset even on the barge. But other companies, some of our competitors, they man it down and they do not have the same competences, because they don't need to. But we run our barges up to the same level, we even have ESM, ISM and ISTS involved. We run them up to the same level as if they were a ship.

M: Ok, how about decommissioning? Have you thought how are you going to handle decommissioning?

HF: Yes, I mean,right now, there is not a decommissioning, but we have our first… there is a turbine that has burned and they need to decommission that and put up a new one. So yes, we have thought about decommissioning, but still ,the oldest parks, they are only 10 years old and, I mean, we will not see real decommissioning in the first 10 years, I don't think so.

M: But you already sort of know how it works.

HF: Yes, yes. We have thought about it , but it will not be… you know. We have actually tried decommissioning mid-March … but yes, we have thought about it.

M: Is there already a second hand market for WIVs?

HF: Yeah. Not for installation vessels, but for barges, yes.

M: So it is possible to sell it if one wishes to exit.

HF: Yes, it is. We have two vessels for sale right now, so yes, there is is also for installation vessels, we have. So, for the 1st generation installation vessels we have, one of them is for sale.

M: Are there a lot of standards that you need to adhere to when introducing a new vessel?

HF: We need to live up to the normal shipping standards, so that means the normal IMO laws and SOLAS rules right. But then of course, we need to look into local quality standards, because when you are a jack up you need to follow the rules which are for land, because as soon as you put down the legs, you are not a ship anymore, you are on land. You are seen from a local authorities point of view, so that means that we will also need to look into specific rules and regulations in the different areas we operate.

M:Do these differ from country to country?

HF: Yeah, they do.

M:So you have to comply with all of the standards.

HF: Yes, and that is very difficult because you know the industry is still immature . Some of us just want to follow IMO standards, but when it comes to the countries, they… some countries want to follow their own standards which are not maritime standards and that sometimes makes it confusing. We are actually trying to set the right requirements. We at A2Sea do not have any problems with requirements; we want to comply to them, as long as they are the same all over in all the countries. We had a very high standard from the beginning, and that is why we want the requirements, but we want them standardized.

M: Would you say that the market for these shipping services is becoming commoditized?

HF: Yeah, it is actually becoming commoditized. But I would t say it will not become really commoditized unless this industry is spreading across Europe. Right now you have north sea and Baltic sea and irish sea right? We can see indications that it is spreading to far east and even in the USA. And if it is spreading to other areas of the world, I am thinking we will see more… we will see that it will become more commoditized, yeah. But t is going in that direction, but it will not go all the full way until we see a larger market.

M: What are you doing specifically to differentiate from the competition?

HF: I think we… Some of our competitors, they… A lot of our competitors, I mean there is a lot of … We are in an industry that subsupplies, right? You can deliver cables, you can deliver installation services, you can deliver installation substations, you can deliver after services, you could deliver crew vessels. What makes us different is that we deliver it all. So we, A2sea… the larger customers like DONG and all the suppliers of electricity, they would actually need some standards, they look for companies that can cover the whole, to cover everything. We can differentiate in a way that we own ships in all areas, we can also assist in operating other companies' ships when we have larger customers. And this is how we differentiate.

M: There is a trend towards wind farms going deeper and further offshore.

HF: Yeah, that will happen.

M: There is also a trend for implementation of floating turbine foundations. So, are your vessels equipped to handle this kind of trends?

HF: Yeah, we,you know, our vessels at the moment, they would be able to install some of what is coming but I think that if it does go much deeper…We have in our development department constructed some very, very large ships that can handle very , very large substations and we do that in cooperation with other companies, but at the moment we are still waiting to see this market related spread to the deep position and we are not sure yet. But we already, I mean we always save some time until decisions are made, so we have more or less all types of ships ready. So if anybody wants them, we can do it. But, as you know, it is not that easy because it is in a very young industry, when you build a ship it is supposed to last at least 20 years. But nobody gives us 20 year contract and we cannot see 20 years ahead and I think this is one of the main issues right now.

M: So, what are you current biggest obstacles, the things you are struggling most with?

HF: The obstacles right now are that the customers are waiting. The German .. there is a lot of things that should have been started in the German market, but because of the seas over there and because of some real problems with the electricity grids here ashore, these projects have not been started and the whole industry has been expecting these projects to be started. Within 2020, the Germans have promised themselves to have 20% of their power from alternative energy sources. And that means that we need to install as many turbines and subpower stations as we have until now and we only have 8 years left. So, the capacities are more or less ready to do it but the process is delayed. And that Is the biggest obstacle, but it is also an opportunity, because some of our competitors have not survived ,so I think the opportunity is for some of the groups to … I think you will see some of the newcomers, some of them will go together in larger groups.

M: Hmm..Consolidation?

HF: Yeah, I think there will be some consolidation in the market. On the supply side.

M: Do you have your own standard contract? Is there a standard contract at all?

HF: No,it depends again on what kind of project we deliver. We have a standard BIMCO form like all other shippings, but if for instance we deliver a very big installation project, we will .. the different customers will have different contracts. Siemens for instance has their own contracts. So the contract forms are very customer oriented.

M: Are you planning to enter markets outside of Europe or are you …

HF: Yeah. We are looking into that.

M: For example Asia, US?

H: Asia and the US, yeah.

M: Ok, how about the founder of A2Sea?He is not at the company anymore, but do you still collaborate with him…?

HF: The who?

M: The founder of the company.

HF: Yeah, I just talked to him today. We are collaborating. I talked to him 3 hours ago. He is still on the market doing different things. In fact, I have a meeting with him the day after tomorrow.

M: Is he a competitor?

HF: No, he is more or less an advisor in the industry. He knows the industry in and out. He is still collaborating with us and also with others, but there is a good relationship with him.

M: OK. How do you see the future of renewable offshore energy in the next few decades?

HF: I think it depends a lot on from the government to support it because it is going to be more expensive than for example, coal. It's a public matter, more or less. I mean it's up to the consumer. If they are willing to pay a bit more , they will hire support via governments. Because we would be able to bring cost down , some will come when the industry is commoditized but at the moment we cannot compare to coal and oil. So it all depends on the public debate. Do we see that as a way to reduce oil products or is it not. So I think it is public opinion that would be the drive for this. Of course, you will need some new sources of energy because there is a limit for coil and there is a limit for oil so you will need it and it is a good way to do it at sea – there is so much space out there. That is my personal opinion. We will get the prices down, but we will never get it… Eventually, we will get down to the oil prices, because at the end of day, oil will increase. So in 20 years' time, the price for a production of this kind of will be equalized to coal, or at least to oil. But right now it is too expensive.

M:But you are working on it.

HF: Yeah yeah we are , but still we are 3 times more expensive for KwH than other sources and … Of course, we will bring it down when the industry matures , we will get the prices down like other sources. But still, it is a long way to go, and I think, with time we will levelize the price of energy when you compare it with other sources, because of course these sources wil increase their prices when they dry out, that is for sure. So I think it is more longer…it is a very long term project. This is the first industry that has .. that is maturing with alternative energy sources , right? And now we are trying to see, we learn a lot. I think it will last, but it will take longer than we thought when we started.

M: OK. I think that is all of the questions that I had.

HF: Alright, I hope you got all the information that you needed, and now it is up to you and your writing.

M: Yes, thank you very much for the interview. Have a nice evening.

Interview with Michael Rix, head of shipping at Monjasa/ C-Bed

Q:How did the idea of setting up a company like C-Bed come up? Who is the founder and is he still working at the company?

A:The idea came in late 2007 when we first saw the distance from port to project getting bigger.

There was three founders, and the two is still the owners. The third was bought out after approx. one year.

Q: Do you think specialized knowledge is required for recognizing business opportunities in the offshore shipping industry?

A:Yes indeed. The offshore industry asks high skills and performance together with innovation. The time where "cowboys" could make business in Offshore Wind is more or less over.

Q:Are there particular strategies for encouraging entrepreneurial activities and innovation at C-Bed? How do you and your team generate new ideas?

A: It's all about following the market development and requirements. The industry doesn't quite know what they require, but what issues they are facing. If you are able to solve those issues and provide a possible cost reduction at the same time, there is a good chance to make business.

Q: What is the educational/professional background of your employees? What competences are crucial for people working in this industry, in your opinion?
A:We have many different employees with different background. Very tough question to answer.

Q: What is it that influenced your choice of headquarters location?
A: The right man at the right spot. In addition, Amsterdam/Rotterdam is quite big in Shipping and it is very central in Europe.

Q:How long have you personally been working within the offshore wind shipping industry?
A: Since May 2008
Q:What are the biggest challenges your company currently is facing?
A: That the industry doesn't know what it wants – it just know it want' it all in one solution. In addition, they only want to pay half of what the rates is today. That is a mismatch indeed.

Q:On average, what is the duration of your contracts? How do you go about customer retention?
A:Between 5-12 months. They come back because we are the best in the marked at the time being at what we do.
Q:Are your contract rates fixed or negotiable?
A:Depends on the contract.
Q:Do you have your own personnel offshore or do you only charter out the vessels? Is specific know-how/experience needed for the operation of these vessels?
A:We have full package – vessel + crew. The operation of the vessel requires know-how AND experience.

Q:Are there certain standards you need to adhere to in terms of vessel design, safety, contract regulations?
A:Yes – too many. From flag state, class etc.
Q: Would you say that the market for the services you are offering is becoming commoditized?
A:That is a very hard question to answer. Needs elaboration
Q:What is the scrapping age for this kind of vessels and are you planning to expand your fleet with newbuildings and/or retrofitted ships?
A: We are looking to expand the fleet every day, but most probably not new buildings. For what we do, it's too expensive.
Q:How do you see the future of offshore wind energy and its growth in the next decades?
A:BIG question mark. Depends on subsidies from governments.

Q:Do you think that competition is/might become intense in the near future within the accommodation vessels segment?
A: Yes indeed. We see more and more competitors.

Q: Do you interact and/or collaborate with industry rivals?
A:Yes
Q: Do you collaborate with other companies, universities, institutions?
A:Yes

Q:Are you planning to enter new markets in the future (emerging markets outside Europe, other industries where personnel might need offshore accommodation, etc)?
A:Yes

Interview guide and transcripts for cable laying vessel operators

Interview guide
Why did your company choose to operate in the offshore wind shipping sector?

What do you think is needed in order to be successful in cable laying?

How does cable laying in offshore wind differ from cable laying in other industries?

Are you able to leverage competences from other industries you operate in to offshore wind?

What are your biggest challenges at the moment?

Do you interact and/or collaborate with industry rivals or other actors in the supply chain? Would you say that the rivalry in this sector is intense?

How do you facilitate and manage innovation?

Do you have a standard contract?

How long are your contracts usually?

Is the bargaining power of your customers high?

What is the background of your employees? Do you have employees that are key, particularly important because of their knowledge/skills/experience?

Do you have your own personnel on the boats? What competences does the crew need to have?

Are you prepared to meet the requirements of cable laying for wind farms going further and deeper offshore?

Are you planning to increase capacity?

Do you think that that the market for cable laying services is becoming standardized?

How do you differentiate from the competitors?

Have you already done cable maintenance and decommissioning activities in offshore wind?

Have you considered expanding your activities beyond Europe?

How do you see the future of renewable offshore energy and its growth in the next decades?

What in your opinion can help for the sustainable growth of this industry?

Interview with Kell Thyssen, International projects director at JD-Contractor

Q:Why did JD-Contractor choose to operate in the offshore wind shipping sector?

A:JDC is an offshore construction company, where cable laying to and within offshore wind farms is just a part of the business. There was a requirement from some customers for cable laying work, - and then we got involved

Q:What do you think is needed in order to be successful in cable laying?

A:Competent crew and right equipment

Q:How does cable laying in offshore wind differ from cable laying in other industries?

A:Normally it is some distance from shore, and normally with other vessels on site at the same time, and off course with several monopiles, etc in place.

Q:Are you able to leverage competences from other industries you operate in to offshore wind?

A:Cable laying expertise from other projects can be utilized, and general knowledge of construction work and planning for same.

Q:What are your biggest challenges at the moment?

A; Documentation requirements

Q:Do you interact and/or collaborate with industry rivals or other actors in the supply chain? Would you say that the rivalry in this sector is intense?

A:No comments

Q:How do you facilitate and manage innovation?

A:Innovation are normally facilitated in sessions where engineers and seafarers gather together for new projects and new ideas on working and new equipment

Q:Do you have a standard contract

A:Normally Logic or Fidic is used

Q:How long are your contracts usually?

A:They can be from 1 month to one year

Q:Is the bargaining power of your customers high?

A:Yes

Q:What is the background of your employees? Do you have employees that are key, particularly important because of their knowledge/skills/experience?

A:Seafarers with long experience in this industry

Q:Do you have your own personnel on the boats? What competences does the crew need to have?

A:All personnel are in house staff – e.g. permanent employees – they hold the relevant STCW certificates

Q:Are you prepared to meet the requirements of cable laying for wind farms going further and deeper offshore?

A:Yes – our equipment and vessels can carry out this work as well

Q:Are you planning to increase capacity?

A: Yes by natural growth

Q:Do you think that that the market for cable laying services is becoming standardized?

A:yes

Q:How do you differentiate from the competitors?

A:Flexible, and proactive – focusing and solving any problems that might occur best possible to keep costs down

Q:Have you already done cable maintenance and decommissioning activities in offshore wind?

A:We have done several cable repair works in Scandinavia and Northern europe

Q:Have you considered expanding your activities beyond Europe?

A: Not for the time being

Q:How do you see the future of renewable offshore energy and its growth in the next decades?

Growing but easing in 5 -10 yeasr time

Q:What in your opinion can help for the sustainable growth of this industry?

Stadardize documentation requirement at a reasonable level – it seems like several consulting companies I trying to empose new documentation requirements

Appendix B: Largest 25 Offshore wind projects in Northern Europe

Name	Location	Number of turbines	Size (MW)	Owner	Official start of operations	Installation vessels	O&M Vessels	Cable	Accomodation	Source	Manufacturer
London Array	Outer Thames estuary, England	175	630	DONG (50%), E-ON (30%), Masdar(20%)	2012	MPI, A2Sea	Windcat Workboats, Fred Olsen Sea carriers, MPI offshore, Turbine Transfers, Gardline, Dansk Offshore Transport, Northern Offshore Services, Ctruk boats Ltd, Enviroserve, Solstad, Dalby Offshore, Windcrew workboats	Stemat, Solstad Offshore as	C-bed	From site http://www.londonarray.com/ , http://www.londonarray.com/wp-content/uploads/20120916-Vessel-data-matrix.pdf	Siemens
Greater Gabbard	Suffolk, England	140	500	Airtricity (acquired by Scottish and Southern Energy (SSE) in February 2008)	2012	Seajacks, Seaway heavy lifting, Bonn & Mees, A2Sea	Offshore Wind Services BV, Windcat Workboats,Dalby Offshore	CT Offshore, Farstad Shipping AS, Volstad Maritime AS	C-bed	http://www.sse.com/Greatergabbard/	Siemens

Anholt	Kattegat, Denmark	111	400	DONG	2013	A2Sea, Jumbo Offshore, Ballast Nedam Offshore, Seaway Heavy Lifting	Hvide Sande Skibs- & Baadebyggeri, Northern Offshore Services, Dansk Offshore Transport, Offshore wind services, BV, Fred Olsen, A2Sea, TP Offshore, Seacat services.	Stemat , Kreuz Offshore Marine		http://www.dongenergy.com/anholt/EN/Pages/index.aspx	Siemens
BARD	Borkum Island, Germany	80	400	Enovos	2013	Jack up barges, Hochtief, Fred Olsen Windcarrier, BARD,	BARD, Turbine transfers, Fred Olsen Windcarriers, EMS Offshore, SeaZip Offshore , MARINECO UK, Maritime Craft Services	Offshore marine management , CTC Marine, Seabed shipping	No data	http://www.bard-offshore.de/en	BARD
Walney	Barrow-in-Furness, England	102	367,2	DONG(50,1%), SSE(25,1%), PGGM and Dutch Ampère Equity Fund(24,8%)	2012	Ballast Nedam, Seajacks, Van Oord, GeoSea	A2Sea, Turbine Transfers, Swire Blue,MARINECO, East coast charters, Wildcat marine, Windwave	Stemat	Blue water shipping, Jumbo offshore	http://www.dongenergy.com/SiteCollectionDocuments/wind/walney/Walney_Offshore_Windfarm.pdf	Siemens
Thorntonbank	Thornton bank, Belgium	52	325	C-Power(RWE, EDF, Marguerite, DME, SRIW, Z-Kracht, Socoffe)	2009(1), 2012(2), 2013(3)	Scaldis, GeoSea	Windcat workboats, Turbine transfers, Maritime craft services, Njord , P& O Maritime	Global Marine Systems, Visser &Smit Marine contracting	Windcat workboats	http://www.c-power.be/	RE Power

Sheringham Shoal	Scira, England	88	315	Starkraft and Statoil	2012	A2Sea, Seaway Heavy Lifting , Seajacks , Gulf Marine Services , Ballast Nedam, van Oord	MPI Offshore, Fred Olsen, KEM Offshore, Wildcat ltd, Maritime Craft services, Tidal Transit , East Coast charters, SureWind Marine , Excel Marine Services.	Visser &Smit, Sealion Shipping, Volstad Maritime, Jack up barges, Nico Middle East	C-bed, AS Tallink grupp	http://www.scira.co.uk/construction/vessels.php	Siemens
Thanet	Kent, England	100	300	Vattenfall	2010	A2Sea, MPI	Gardline, Hochtief,Excel Marine, Delby Offshore, DBB Jack-up, North Sea Logistics , Offshore wind power marine services	Technocean AS, CT Offshore, Red7Marine, Solstad offshore, Reef Subsea, CTC Marine , Stemat	No data	http://www.vattenfall.co.uk/en/thanet-offshore-wind-farm.htm	Vestas Wind systems
Lincs	Lincolnshire, England	75	270	DONG Energy (25%), Centrica (50%), and Siemens Project Ventures (SPV) (25%)	2013	MPI, Seacore Limited	Fastnet shipping, Windcat workboats, Turbine Transfers, A2Sea, Windpower support, Cwind	CT Offshore, Reef Subsea, Global Marine Systems, CHRISTOFFERS onshore and subsea,Anchor marine transportation, Seloy Undervannse	C-Bed	http://www.centrica.com/index.asp?pageid=923&project=project5&projectstatus=operational#project5	SIemens

								rvice			
Horns Rev 2	Blavands Huk, Denmark	91	209	DONG	2009	Peter Madsen Rederi, A2Sea, Vroon BV	Northern Offshore, SureWind, KEM ,A2Sea	Global Marine Systems, Stemat, JD-Crafts A/s	C-Bed	http://www.dongenergy.com/Hornsrev2/EN/about_horns_rev_2/About_the_Project/Pages/about_the_project.aspx	Siemens
Rødsand 2	Lolland, Denmark	90	207	E.ON	2010	A2Sea, Eide Contracting	Northern Offshore	JD-Crafts A/S,NSW Hans Schramm	No data	http://www.eon.dk/Om-EON/Om-energi/Om-Rodsand-2/	Siemens
Robin Rigg	Solway firth, Scotland	60	180	E.ON	2010	A2Sea, MPI, Peter Madsen rederi	Turbine transfers, Windcat workboats, GeoSea	Subocean, CTC,	No data	http://www.lorc.dk/offshore-wind-farms-map/robin-rigg?free=robin+rigg	Vestas Wind systems
Gunfleet Sands	Essex, England	48	172	DONG Energy (50.1%), Marubeni (49.9%)	2010	A2Sea, Seacore Fugro, Ballast Nedam, KS Energy Services	MPI, A2Sea, Offshore wind power marine, East coast charters, Excel Marine services, Seajacks, Windwave, DBB Jack-up	CT offshore, Oceanteam, Ballast Nedam, Red7Marine	Nodata	http://www.lorc.dk/offshore-wind-farms-map/gunfleet-sands	Siemens
Nysted / Rødsan	Lolland, Denmark	72	166	DONG Energy (42.75%), Stadtwerke	2003	A2Sea, Eide Contracti	A2Sea	JD-Crafts A/S	No data	http://www.dongenergy.com/Nysted/EN/Pages/index.aspx	Siemens

d 1				Lübeck (7.25 %) and PensionDanmark (50%)		ng					
Belwind	Zeebrugge, Belgium	55	165	Belwind NV	2010	Ballast Nedam, Jack-up barges	No data	Global Marine systems, van Oord, Nexans	No data	http://belwind.eu/en/home	Vestas Wind systems
Horns Rev	Blavands Huk, Denmark	80	160	DONG	2002	Ballast Nedam, DEME, A2Sea,DBB Jack-up	KEM Offshore, Fred Olsen Windcarrier	Global Marine Systems, JD-Crafts	No data	http://www.dongenergy.com/hornsrev/DA/Pages/index_DA.aspx/index.en.html	Vestas Wind systems
Ormonde	Barrow-in-Furness, England	30	150	Vattenfall	2012	GeoSea, Scaldis, Kreuz Offshore, A2Sea	Windcat Workboats	Stemat	No data	http://www.vattenfall.co.uk/en/ormonde.htm	REPower
Princess Amalia	Egmongaan Zee, Netherlands	60	120	Eneco Energie	2008	Van Oord, A2Sea	Turbine Transfer, Dalby Offshore, Offshore Wind power, MPI, Windcat Workboats	Global Marine Systems, Nexans, Stemat	No data	http://www.q7wind.nl/	Vestas Wind systems
Lillgrund	Oresund, Sweden	48	110	Vattenfall	2008	A2Sea, Eide Contracting	Svensk Sjoentreprenad AB	Baltic Offshore, Peter Madsen Rederi, Boskalis Sweden AB, Seloy	No data	http://www.lorc.dk/offshore-wind-farms-map/lillgrund	Siemens

OWEZ	North sea coast, Netherlands	36	108	joint venture of Nuon (Vattenfall) and Shell	2006	Ballast Nedam, A2Sea	Windcat Workboats	Global Marine Systems, Nico Middle East, DeepOcean		http://www.nuon.com/company/Innovative-projects/noordzeewind.jsp	Vestas Wind systems
Kentish flats	Kent, England	30	90	Vattenfall	2005	MPI, A2Sea	Excel Marine, North sea Logistics, Offshore wind power	DBB Jack-up, Stemat	No data	http://www.vattenfall.co.uk/en/kentish-flats.htm	Vestas Wind systems
Lynn and Inner Dowsing	Lincolnshire, England	54	194	owned by Centrica Energy (50%), TCW (50%)	2009	MPI	MARINECO, Windcat workboat, Windwave, Workships contractors, MPI, Stemat, DBB Jack-up	Subocean	No data	http://www.lorc.dk/offshore-wind-farms-map/lynn-and-inner-dowsing	Siemens
Scroby Sands	Great Yarmouth, England	30	60	E.ON	2004	Van Oord, A2Sea, Seacore	Norfolk Marine, Enviroserve, Iceni Marine	Stemat, Oceanteam	No data	http://www.power-technology.com/projects/scrobysands/	Vestas Wind systems
Alpha ventus	Borkum, Germany	12	60	joint venture of EWE (47.5%), E.ON (26.25%), and Vattenfall (26.25%)	2009	Hochtief, GeoSea, Bugsier, Jack-Up Barges BV, Heerema	EMS Maritime, A2Sea, Jack up barges	Stemat, CTC Volstad, Oceanteam,	No data	http://www.alpha-ventus.de/	Repower, Areva

Manufacturer	Capacity produced (MW)	No of turbines	Manufacturer
Siemens	3540,2	1094	Siemens
Vestas	1183	451	Vestas
Repower	535	92	Repower
BARD	400	80	BARD
Total	5658,2	1717	Total

Utility project owners

Company	Capacity(MW)
Dong	1492,604
Vattenfall	773,75
E-ON	651,75
SSE	592,1672
Enovos	400
C-power	325
Centrica	232
Other	1190,929
Total	5658,2

Appendix C: WIVs entering the market

Name	Company owner	Manufacturer	Source	Year produced	Age
Brave Tern	Fred Olsen	Lamprell Energy Ltd	http://www.windcarrier.com/brave-tern	2012	1
Bold Tern	Fred Olsen	Lamprell Energy Ltd	https://exchange.dnv.com/Exchange/Main.aspx?EXTool=Vessel&VesselID=30798	2013	0
Pacific Osprey	Swire blue ocean	Samsung Heavy,Geoje Shipyard	http://www.4coffshore.com/windfarms/vessel-pacific-osprey-vid257.html	2012	1

Pacific Orca	Swire blue ocean	Samsung Heavy, Geoje Shipyard	http://www.knudehansen.com/data/images/pdf%20-%20offshore%20vessels/swire-blue-ocean.pdf	2012	1
MPI Resolution	MPI	Shanghaiguan	https://exchange.dnv.com/Exchange/Main.aspx?EXTool=Vessel&VesselID=23494	2003	10
MPI Adventure	MPI	Cosco		2011	2
MPI Discovery	MPI	Cosco	http://www.offshorewind.biz/2011/09/22/mpi-discovery-undocks-in-cosco-nantong-shipyard-china/	2011	2
Aeolus	Van Oord	Sietas Shipyard	http://www.vanoord.com/activities/offshore-wind-equipment	2014	0
Wind Lift 1	BARD	Western Shipyard		2010	3
Seafox 5	Seafox	Keppel Fels Singapore	http://www.workfox.com/index.php?option=com_content&view=category&id=42&layout=blog&Itemid=36	2012	1
Sea worker	A2 Sea	Labroy Shipbuilding & Engineering PT. Nanindah Mutiara Shipyard	https://exchange.dnv.com/Exchange/Main.aspx?EXTool=Vessel&VesselID=29876	2008	5
Seajack	A2Sea	Ravestein B.V., Scheepswerf	https://exchange.dnv.com/Exchange/Main.aspx?EXTool=Vessel&VesselID=23791	2003	10
Challenger	A2Sea	Cosco	http://www.a2sea.com/fleet/newbuild-002/	2014	0
Sea Installer	A2Sea	Cosco		2011	2

Appendix D: Offshore wind shipping operators, sorted by subsegment

Installation vessel services subsegment

Name	Fleet size	Fleet age (average)	Offshore wind activity	Other activities	Turnover/Net profit for the last 5 years					No of employees for the last 5 years					Year of entry	Ownership history	Headquarters Location	Founded by	Source
					2012	2011	2010	2009	2008	2012	2011	2010	2009	2008					
A2SEA	4	13	Installation and service	Not indicated	1.137.206 /38.050	954.431 /164.512	586.651/86.108	613.091 /47.171	n.a./11.888	308	251	216	204	167	2002	Part of DONG energy group since 2009, owned by DONG 100% (DONG is a 76% state owned company) , established in 2000; owns 67% of CT Offshore , founder is not in the company since 03/2006	Fredericia, Denmark	Individual	NN Markedsdata , A2sea website
Svendborg bugser	9	20	Installation	towage, salvage, marine constr	n.a./-989	n.a./ -3.635	n.a./1.324	n.a./ -47	n.a./-418	35	75	15	49	53	1999	owned 100% by NHSvendborg holding Aps, which is a financial	Svendborg, Denmark	No data	Orbis, NN, company site

				uctions, oil industry as well.											holding company, since 2004.			
Fred Olsen Windcarrier	2	1	Installation and service	Not indicated	n.a./- 6.175	n.a./ - 2.279	n.a./- 1.724	n.a./ -389	n.a.	35	n.a.	1	0	n.a.	2011	owned 50% by Global wind service A/S, which is a construction trade contractor company, since 2012, and Fred Olsen Windcarrier Norway 5%, which is a Norwegan maritime transportation company	Fredericia,Denmark	Company	Orbis, NN, company site
Swire Blue Ocean	2	1	Installation	Not indicated	n.a./- 10.726	n.a./- 8.736	n.a./ - 4.268	n.a./ - 272	n.a./- 625	7	3	2	0	1	2011	Owned 100% by Swire pacific offshore ltd (shipping company in Singapore) since 2011,	Copenhagen, Denmark	Company	Orbis, NN, company site

MPI Offshore	3	5	Installation and service	oil and gas decommissioning as well	24,091,587 /-60,796	16,391,396/733,732	13,890,936/476,710	14,669,312/1,517,193	10,661,766 /-266,500	36	19	15	41	40	2006	Established by Suzami BV (Netherlands), owned currently by MPI sservices stocksley ltd (a management holding company) since 03/2012, subsidiary of Vroon Group	Stockton on Tees UK	Company	Orbis, Company site
Seajacks	3	3	Installation	oil & gas industry as well	204,897	751,116	612,326	299,214	1,599	38	31	21	13	7	2007	Riverstone acquires the company in 2010, 2012 acquisition by Marubeni & INCJ, as of 2013 owned by Seajacks international Ltd, which is a financial holding company	Great Yarmouth, UK	Company	Orbis, company site
GTEC NV Geosea	8	18	Installation and	drilling	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2012	Subsidiary of DEME group, a marine engineering	Zwijndrecht, Belgi	Company	Orbis, company site

			service													and dredging company	um		
Jack-up Barge BV	7	no data	Installation	Oil gas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2011	Owned by Van Es Holding BV (a real estate management company) since 2006	Sliedrecht, Netherlands	Company	Orbis, company site
Workfox	1	1	Installation and service	activities in oil & gas as well.	71,097 /4,181	n.a.	n.a.	n.a.	n.a.	61	n.a.	n.a.	n.a.	n.a.	2005	Currently owned by Seafox consolidated limited (since 2008), which is an English shipping company.	HOOFDDORP, Netherlands	Company	Orbis, company site
Gaoh offshore	1	1	Installation	Not indicated	n.a.	-2,744,291	-3,878,372	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2010	WIND ENERGY SA (a wind energy company) (32%),CREDIT SUISSE SECURITIES (EUROPE)(financial insurance) LTD(8,18%), shareholders	London,UK	No data	Orbis, company site
HGO Infrasea	1	1	installation	oil and gas as well	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4	1	n.a.	2009	Jointly owned by GEO@SEA(Ult	Bremen,Ger	Company	Orbis, company site

solutions																imate owner: DREDGING, ENVIRONMENTAL & MARINE ENGINEERING) BE 50% and HOCHTIEF SOLUTIONS AG(Ultimate owner: ACS, ACTIVIDADES DE CONSTRUCCION Y SERVICIOS, S.A.) 50%. (constructioncompany) Since 2012	many		
BONN & MEES BV	5	30	Installation	vessels are used in a variety of industries	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2002	Owned 100% by BONN & MEES DRIJVENDE BOKKEN BEHEER B.V., which is a shipping company holding	Rotterdam, Netherlands	Company	Orbis, company site

Hochtief AG HGO Offshore	4	4	Installation	soil investigation and a variety of activities in other industries.	192,105,067 / 1,180,539	175,564,130/-1,191,611	153,873,134/2,161,380	136,517,041/1/1,459,648	138,259,441/1/1,152,851						2005	Controlled by ACS, ACTIVIDADES DE CONSTRUCCION Y SERVICIOS, S.A. (55%), which is a construction company	Essen, Germany	Company	Orbis, company site
Eiden Marine Services	17	30	Installation and service	oil & gas industry as well	35,793,213					n/a					n.a.	Owned by Eide Marine Services Holding AS (not founders) , a shipping company	Hoylandsbygd, Norway	Individual	Orbis, company site
Scaldis salvage and marine contractors	1	18	Installation	oil and gas, decommissioning, salvage	215,778,147/28,879,842	260,220,343/26,570,397	293,802,623/20,759,411	272,992,421/22,245,984	286,396,157/33,451,855	30	24	24	20	21	2009	Currently controlled by DREDGING, ENVIRONMENTAL & MARINE ENGINEERING (54%)	Antwerp, Belgium	Company	Orbis, company site
Jumbo Offshore	2	7	Installation	Oil& gas, LNG, petroleum, cranes,	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2010	no data	SCHIEDAM, Netherlands	No data	Orbis, company site

				rolling stock															
BOSKALIS OFFSHORE MARINE SERVICES B.V.	7	26	Installation and service	oil &gas, ports, infrastructure	266,162/74,838	270,554/42,107	245,764/16,786	248,389/43,687	399,089/77,242	n.a.	n.a.	n.a.	n.a.	n.a.	2009	Owned by SMIT INTERNATIONALE BEHEER B.V., which is a salvage and towing shipping company, which is owned by Royal Boskalis Westminster NV	Papendrecht, Netherlands	Company	Orbis, company site
										n.a.	n.a.	n.a.	n.a.	n.a.	2009	Owned by SMIT INTERNATIONALE BEHEER B.V., which is a salvage and towing shipping company, which is owned by Royal Boskalis Westminster NV	Papendrecht, Netherlands	Company	Orbis, company site

Cable laying vessel services subsegment

Name	Fleet size (CLV)	Fleet age (years)	Offshore wind Activity vessels	Other activities	Turnover/Net profit for the last 5 years					No of employees for the last 5 years					Year of entry	Ownership history	Headquarters Location	Founder/s	Source
					2012	2011	2010	2009	2008	2012	2011	2010	2009	2008					
CT Offshore A/S	2	30	Cable laying	Survey , consulting services.	n.a./ - 18.217	n.a./38.881	n.a./32.114	n.a./40.845	n.a./2.504	160	127	128	30	n.a.	2004	Established by PS Offshore Aps, currently owned by offshore shipping A2 SEA (67%) and PC offshore ApS (33%), founder is not in the company since 06/2013.	Odense, Denmark	Individual	http://www.ctoffshore.dk/about-ct-offshore-as/track-record-map.aspx, NN markedsdata
JD Contractor A/S	11	36	Cable laying	salvage operations, pipelines	n.a./57.401	n.a./112.915	n.a./44.158	n.a./33.085	n.a./19.783	94	102	66	53	42	2000	Owned by G.N. Underwater invest(100%), which is a	Holstebro, Denmark	Company	Orbis, NN, company site

				, ROV, embedding, constructions, inspections, explosive works											financial family-owned company			
Nordic offshore	1	37	Cable laying	Ship management, diving, survey, grid maintenance	n.a./ 2.662	n.a./- 2.539	n.a./ - 1.422	586	1.170	n.a.	35	7	55	36	2006	Nordic offshore holds 65%, it is a financial holding company. It has recently created a subsidiary in UK by the same name (10/2013).	Faaborg,Denmark	Company	Orbis, NN, company site
Peter Madsen Rederi A/S	6	38	Cable laying	piping, stone,diving, salvage, towing.	90.144/ 7.162	52.176/1.066	112.715 /22.052	87.284 /11.960	62.187 /3.960	14	12	12	11	8	2002	Owned by JHM Holding, RY APS(33%), VHM Holding ApS(33%),Coin invest 2011 APS (31%), which are investment holding companies	Hojbjerg, Denmark	Individual, family business	Orbis, NN, company site

Van Oord	1	27	Cable laying	Dredging, offshore oil& gas, marine engineering, soil improvement, infrastructure	12,516,999/734,685	12,749,410/876,659	11,843,933/1,239,302	10,645,277/899,399	13,942,431/1,400,030		4,869	n.a.	3,457	n.a.	2003	MerweOord bv, (78.5%), the Van Oord family investment holding ,ConsOord B.V. (10.75%), a consortium of three Dutch investment companies (Janivo, Breedinvest, Rinkelberg) Cobepa, (10.75%) a Belgian investment company	Rotterdam, Netherlands	Company	Orbis, Company site
VSMC (Visser and Smit marine contracting) and Stemat	4	27	Cable laying	Inspection, repair, also in oil & gas .	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	78	43	16	4	2004	Owned by VISSER & SMIT MARINE CONTRACTING HOLDING B.V., a financial investment company since 2012, joint venture of Boskalis and VolkerWessels	Papendrecht, Netherlands	Company	Orbis, Company site

Dalby Offshore	1	6	Cable laying and service	oil & gas industry as well	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2007	Owned by private sharesholders since 2011.	Bridlington, UK	Individual, jointly owned	Orbis,company site
CTC Marine /Deep Ocean	1	3	Cable laying	oil & gas industry as well	770,539/-14,779	926,25/-452,247	884,816/-247,209	1,234,403/43,170	841,69/-58,753	114	120	161	156	168	n.a.	Owned by Deepocean AS (norway) since 2006,it is a company providing shipping services in the oil / gas industry	Darlington, UK	No data	Orbis,company site
Global Marine Systems	7	18	Cable laying	oil&gas, telecommunications	n.a.	1,027,368 /-108,394	1,720,749/-17,788	1,699,976/41,926	659,66/ -13,675	450	428	415	392	377	2000	Controlled by Bridgehouse marine (A group engaged in the installation and maintenance of submarine telecommunications cables) since 2004	CHELMSFORD, UK	No data	Orbis,company site
Reef Subsea	3	5	Cable laying	Oil& gas,procurement , dredging	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	GC Rieber Shipping (shipping company) and Hitec Vision	Richmond, Surrey, UK	No data	Orbis,company site

																(energy capital investment)			
Seloy Undervannservice	5	no data	cable laying	activities in oil & gas as well.	108,322,493/3,985,754	77,438,023/483,436	102,403,727/7,353,413	81,209,798/7,035,369	62,770,269/7,313,547	54	52	n.a.	n.a.	n.a.	n.a.	Owned by Seloy Holding AS, which is a financial business services company	Heroy, Norway	No data	Orbis,company site
Oceanteam	3	4	Cable laying and service	oil and gas as well	376,54/-67,649	351,677/12,445	263,744/-1,066	208,971/-511,851	569,718/-227,755	182	175	100	100	168	n.a.	Currently UBS AG (a bank), is the largest shareholder, together with Clearsteram Banking, Citibank, Pareto securities.	Bergen, Norway	No data	Orbis,company site
Baltic Offhore	2	48	cable laying	jointing, testing, trenching	125,152,727/20,111,578	50,450,533/5,430,529	44,116,004/6,684,573	28,876,108/1,975,688	29,589,106/4,679,585	15	13	15	14	13	2003	Owned by Baltic Offshore AB, which is a financial holding	Kalmar, Sweden	No data	Orbis,company site

Service vessel services subsegment

Name	Fleet size	Fleet age (y	Offshore wind Activity	Other activities	Profit margin =Turnover/Net profit for the last 5 years	No of employees for the last 5 years	Year of entering wind industry	Ownership history	Headquarters Location	Founder/s	Source

		ea rs)																	
					2012	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2008**					
A2SEA	4	3	Installation and service	Not indicated	1.137.206 /38.050	954.431 /164.512	586.651 /86.108	613.091 /47.171	n.a./ 11.888	308	251	216	204	167	2002	Part of DONG energy group since 2009, owned by DONG 100% (DONG is a 76% state owned company) , established in 2000; owns 67% of CT Offshore , founder is not in	Fredericia, Denmark		NN Markeds data, A2sea website

																the company since 03/2006			
DBB Jack-Up Services A/S	3	7	Service	Offshore salvage, heavy lift, towing, consulting and survey services in oil industry as well	n.a./26.916	n.a./21.304	n.a./-1.796	n.a./11.682	n.a./19.372	26	15	11	20	n.a.	2007	currently owned by Oy Finans ApS (Danmark) >5% ,Dansk Bjergning og Bugsering Holding ApS (Danmark) 25%, Jack-Up Holding A/S (Danmark) 56% - shipping company	Aarhus, Denmark	Company	NN Markeds data, Company website
J.A. Rederiet	5	<u>45</u>	Service	Heavylift, salvage, diving, towin	n.a.	n.a.	n.a.	n.a.	n.a.	1	1	n.a.	n.a.	n.a.	2009	The founder is still the owner.	Stenderup, Denmark	Individual	Orbis, NN, company site

				g, offshore support, sidescanning															
KEM OFFSHORE ApS	7	17	Service	Not indicated	n.a./1.496	n.a./1.098	n.a./-419	n.a./-303	n.a./827	15	3	1	26	n.a.	1995	Owned by Knud Moller Aps(77%), which is is a shipping maritime fishing company, and Nordisk marine service APS(23%)	Esbjerg,Denmark	Company	Orbis, NN, company site
Nord-Marine	2	46	Service	Marine bio research, passenger transport, towag	n.a./-1.023	n.a./-382	n.a./85	n.a./1.368	n.a./-1.717	3	5	4	7	5	2001	Wellejus & Boesen APS (72%) since 2004, which is a	Gilleleje, Denmark	Company	Orbis, NN, company site

				e, diving operations, marine engineering												management consulting company			
Northern Offshore services	17	6	Service	Paint services, Survey and diving, refueling	n.a./37.534	n.a./5.636	n.a.	n.a.	n.a.	35	15	n.a.	n.a.	n.a.	2010	Northern offshore company AB of sweden, which is a passenger shipping company, holds 100% of the shares since the founding of the company.	Esbjerg,Denmark	Company	Orbis, NN, company site

Fred Olsen Windcarrier	2	12	Installation and service	Not indicated	n.a./-6.175	n.a./ -2.279	n.a./-1.724	n.a./ -389	n.a.		n.a.	1	0	n.a.	2011	owned 50% by Global wind service A/S, which is a construction trade contractor company, since 2012, and Fred Olsen Windcarrier Norway 5%, which is a Norwegan maritime transportation company	Fredericia,Denmark		Orbis, NN, company site

MPI Offshore	8	2	Installation and service	oil and gas decommissioning as well	24,091,587 /-60,796	16,391,396/733,732	13,890,936/476,710	14,669,312/1,517,193	10,661,766 /-266,500		19	15	41	40	2006	Established by Suzami BV (Netherlands), owned currently by MPI sservices stocksley ltd (a management holding company) since 03/2012, subsidiary of Vroon Group	Stockton on Tees UK		Orbis, Company site
GTEC NV Geosea	8	18	Installation and service	drilling	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2012	Subsidiary of DEME group, a marine engineering and dredging company	Zwijndrecht, Belgium		Orbis,company site

Workfox	4	26	Installation and service	activities in oil & gas as well.	71,097/4,181	n.a.	n.a.	n.a.	n.a.	61	n.a.	n.a.	n.a.	n.a.	2005	Currently owned by Seafox consolidated limited (since 2008), which is an English shipping company.	HOOFDDORP, Netherlands		Orbis,company site
Stemat	16	no data	Service and cable laying	hoisting and pile driving, pipe and cable pulling,anchor handling, survey work, transportation	n.a.	n.a.	n.a.	n.a.	n.a.	45	45	45	45	n.a.	n.a.	Owned by Stemat Holding BV (engineering consulting services) since 2010. Operates within Royal Volker Wessels Stevin	Rotterdam,Netherlands	Company	Orbis,company site

																group which has a diverse portfolio of activities in the energy, infrastructure and building industries.			
Master Marine	1	[2 years]()	Service (accomodation)	oil & gas industry as well	681,567,689 /-100,971,055	318,445,312/-577,795,917	65,322,414/-692,335,048	20,486,597/220,739,338	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Currently controlled by Crystal Violet BV (81%), which is an investment company investing in the maritime industry	Oslo, Norway	Company	Orbis,company site

Eiden Marine Services	11	26	Installation and service	oil & gas industry as well	35,793,213					n/a					n.a.	Owned by Eide Marine Services Holding AS (not founders) , a shipping company	Hoylandsbygd, Norway	Individual	Orbis,company site
Windcat workboats	30	5	Service	Not indicated	107,204,060/2,587,959	n.a./ -7,277,451	n.a.	n.a.	n.a.	9	9	9	5	2	2008	Owned by Windcat workboat holding , which is a UK business services investment company	IJMUIDEN, Netherlands	Company	Orbis,company site
Dalby Offshore	6	1	Cable laying and service, acommodation	oil & gas industry as well	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2007	Owned by private shareshoIders since 2011.	Bridlington, UK	Individual, jointly owned	Orbis,company site

Offshore wind services BV	10	no data	Service	oil & gas industry as well	27,964,465	n.a.	n.a.	n.a.	n.a.	15	n.a.	n.a.	n.a.	n.a.	2011	Owned by KONINKLIJKE DOEKSEN B.V.(shipping company) and WORKSHIPS GROUP B.V., which is a shipbuilding company.	ROTTERDAM, Netherlands	Company	Orbis,company site
C Bed	3	37	Service (accomodation)	Not indicated	n.a.	n.a.	n.a.	n.a.	n.a.	32	31	31	31	35	n.a.	Founded by ENDEAVOUR INVEST APS and JJ HOLDING & INVEST APS, owned	Schiphol The Netherlands	Company	Orbis,company site

																by MONJASA HOLDING A/S, which is a financial investment company, since 2011			
Turbine Transfers	26	3	Service	Not indicated	146,776/ 29,921	89,701/ 12,187	38,884/ 8,031	1,501/- 1,036	n.a.	100	n.a.	n.a.	n.a.	n.a.	2009	Owned by Holyhead Towing company (100%)	, Holyhead , Anglesey , UK	Company	Orbis,company site
Dansk Offshore Transport	6	no data	Service	Not indicated	n.a./1,173,000	n.a./1,969,000	n.a./374,000	n.a./1,112,000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2009	Owned by DOT Holding (100%), which is a financial holding company	Ega, Denmark	Individual	Orbis,company site
Windcrew workboats	3	no data	Service	Not indicated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2011	Jointly owned by David Armstrong and	Blyth, UK	Individual, jointly owned	Orbis,company site

															Christopher Church, which are also CEOs			
SeaZip Offshore	3	1	Service	Not indicated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2009	Established and owned by Seazip holding BV, which is a financial holding	HARLINGEN, Netherlands	Company	Orbis,company site
Maritime Craft Services	16	4	Service	Not indicated	131,011/ 35,133	83,247/ 17,818	78,005/ 2,793	79,591/ 24,650	n.a./ 31,713	78	62	68	50	42	n.a.	Owned by private shareholders	Ayrshire, UK	No data	Orbis,company site
East Coast Charters	7	5	Service	survey and diving, oil & gas industry as well	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2010	Owned by private shareholders, controlled by Michael Latham, the CEO	Suffolk, UK	Individual	Orbis,company site

Wildcat Marine	5	no data	Service	diving, survey	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2008	Owned jointly by the two CEOs	Barrow-in-Furness, UK	Individual, jointly owned	Orbis,company site
Wind wave	3	4	Service	Not indicated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2008	Owned jointly by the two CEOs	PENZANCE, UK	Individual, jointly owned	Orbis,company site
Sealion shipping	28	10	Service	platform supply, towing, heavy lifting, air diving	n.a.	678,682/2,301	367,507/571	46,952/1,311	n.a.	n.a.	69	67	65	n.a.	2010	Owned by Toisa Ltd, which is a financial holding company	Farnham, UK	No data	Orbis,company site
SureWind Marine	4	no data	Service	mooring, guard work	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2009	Owned by Sure Wind Holdings lts since 2012, the founder is still a CEO of the company	Corbridge, UK	Individual	Orbis,company site

Excel Marine services	4	5	Service	Not indicated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Owned by private shareholders	Herne bay, UK	Individual	Orbis,company site
Red7 Marine	8	no data	Installation and service	activity in oil& gas, diving, marine civil engineering	332,437/ 15,831	192,34/ 17,137	n.a.	n.a.	n.a.	107	99	n.a.	n.a.	n.a.	2007	Owned by Red7Marine group Ltd since 2011	MANNINGTREE, UK	No data	Orbis,company site
Fastnet Shipping	5	2	Service	towage, dredging, diving	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Owned by the founder .	Waterford, UK	Individual	Orbis,company site
Windpower support	3	4	Service	oil and gas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Owned by founder Mr Kurt Laurits Christensen, who owns a few other shipping companies as well.	Grimsby, UK	Individual	Orbis,company site

Cwind	13	1	Service	project solutions, training	115,950/ 19,708	n.a.	n.a.	n.a.	n.a.	24	n.a.	n.a.	n.a.	n.a.	2010	Controlled by CTRUK group (67%), which is an investing dedicated to supply of people and vessels for the construction of offshore wind farms	Colechester, UK	Individual	Orbis,company site
Hyperbaric Consult	3	7	Service	Navy Diving Unit, Offshore Oil and Gas, Tunnelling	n.a./5.834	n.a./12.369	n.a./10.170	n.a./4.965	n.a./ 1.528	n.a.	n.a.	7	6	n.a.	2003	Current shareholders - Søgaard Madsen Invest ApS (Financial and insurance company) and	Gilleleje, Denmark	Individual, jointly owned	NN markedsdata, company site, Orbis

																Eilersen invest ApS (mutual pension fund), the company is set up by Eilersen and Madsen.			
Iceni Marine	5	1	Service	Not indicated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2009	Acquired in 2013 by Turner & Co. (Glasgow) Limited, the Engineering Services, Support Services and Asset Rental specialists	Great Yarmouth, UK	Individual	Orbis,company site,http://www.offshorewind.biz/2013/06/26/uk-turner-acquires-iceni-marine-services/

Appendix E: Company founders data

No	Company Name	Year	Founder name	Founder background	Founder still in company?	Location	Source
Installation vessels subsegment							
1	A2Sea	2002	Kurt Hansen	Mechanical engineer	No	Denmark	Orbis, NN, company site, linkedIn
Cable layers subsegment							
1	CT Offshore	2002	Paw Cortes	Marine navigator, electrician	No	Denmark	Orbis, NN, company site, linkedIn
Service vessels subsegment							
1	J.A. Rederiet	2009	Kim Alfastsen	Captain	Yes	Denmark	Orbis, NN, company site, linkedIn
2	Dalby Offshore	2007	Stuart McNiven	Skipper	Yes	UK	Orbis, NN, company site, linkedIn
3	Dansk Offshore Transport	2009	Lars Bo Nielsen	Skipper	Yes	UK	Orbis, NN, company site, linkedIn
4	Windcrew workboats	2011	Christopher Robert Church, David Armstrong	Chartering entrepreneur	Yes	UK	Orbis, NN, company site, linkedIn
5	East Coast Charters	2010	Michael(Mick) Latham	Skipper	Yes	UK	Orbis, NN, company site, linkedIn
6	Wildcat Marine	2008	Robert James Benson and Omar Namor	business, management		UK	Orbis, NN, company site,

							linkedIn
7	Windwave	2008	Frederick Buckingham	no data	Yes	UK	Orbis, NN, company site, linkedIn
8	SureWind Marine	2009	Dominic Abraham	Marine resource management, business	Yes	UK	Orbis, NN, company site, linkedIn
9	Excel Marine services	2005	Adrian Goss	shipping business	Yes	UK	Orbis, NN, company site, linkedIn
10	Fastnet Shipping	n.a.	Trevor O'Hanlon	technical engineer	Yes	Ireland	Orbis, NN, company site, linkedIn
11	Windpower support	n.a.	Kurt Christensen	skipper, fishing industry	Yes	UK	Orbis, NN, company site, linkedIn
12	Cwind	2010	Andy White	naval architect	Yes	UK	Orbis, NN, company site, linkedIn
13	Hyperbaric Consult	2003	CEO is Michael Søgaard Madsen, who is also a CEO of Søgaard Madsen Invest	civil engineer	Yes	Denmark	Orbis, NN, company site, linkedIn
14	Iceni Marine	2009	Richard Thurlow and Guy Gibson, founders	shipping economist	Yes	UK	Orbis, NN, company site, linkedIn

Appendix F Energy statistics

Overview evolution of RES-E support instruments