INVESTIGATING SME PARTICIPATION IN THE UK OFFSHORE WIND SUPPLY CHAIN

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Abstract
Purpose: The UK is the world's offshore wind (OW) market leader in terms of installed capacity. OW is one of the main renewable energy technologies contributing to the UK's greenhouse gas emission reduction targets, and given its shallow seabed and vast amount of the wind resources around its coasts, the UK in general (and the Humber region in particular) offers a great advantage to further develop this technology and bring economic value to its domestic market in the third round of OW farm development. However, discussions around these opportunities raise questions as to how businesses may take advantage of them and what is expected of them. This paper presents the results of a research project investigating participation of small and medium-size enterprises (SMEs) in the UK OW supply chain.

Research Approach: Exploratory techniques were used to collect data from different perspectives to provide a comprehensive review of the industry and its supply chain structures and identify the main requirements that are expected of suppliers interested to be part of this industry through a literature review and interviews.

Findings and originality: The study found that the UK OW sector's supply chain structure varies according to one of four project execution strategies employed by the project owner, e.g. EPIC/EPC, DIY, multi-contracting and alliancing. The study also found that OW farm development and construction involves a lot of different industries each requiring specific qualifications and certifications. However, there are three common requirements, of which ISO 9001 is a prerequisite that SMEs should ideally already have or are working towards obtaining.

Research Impact: The study adds to a sparse literature on how SMEs can effectively develop appropriate supply chain strategies, particularly in the OW sector by providing the findings on different supply chain strategies affecting their structures.

Practical Impact: The study found that the OW sector does represent a good opportunity for SMEs in light of the upcoming Round 3 OW development in the UK. The study identifies the key requirements and expectations SMEs need to adhere to in order to enter the OW market.

Keywords: Offshore wind sector, supply chain management, SMEs, UK

Introduction

This paper presents the results of a Higher Education Innovation Fund (HEIF) funded research project investigating how small and medium-sized enterprises (SMEs) might be enabled to participate in the UK offshore wind (OW) supply chain. HEIF funding is provided to English higher education institutions by the Higher Education Funding Council of England (HEFCE) to enable them to work with external businesses and organisations for the benefit of the economy and wider society.

The UK is the world's OW market leader in terms of installed capacity. OW is one of the main renewable energy technologies contributing to the UK's greenhouse gas emission reduction targets, and given its shallow seabed and vast amount of the wind resources around its coasts, the UK in general (and the Humber region in particular) offers a great advantage to further develop this technology and bring economic value to its domestic market in the third round of OW farm development, also known as Round 3. However, discussions around these opportunities raise questions as to how businesses may take advantage of them and what is expected of them.

This paper reports on this project's research that investigated the participation of small and medium-size enterprises (SMEs) in the UK OW supply chain. The paper focuses on the in-depth case studies undertaken as a first step and is structured as follows. First, the theoretical background and context for the study are presented. Then, the methodology used for the study is described followed by findings from the six case studies. Lastly, conclusions are set out given this analysis.

Literature Review

The literature in industry reports and academic papers have emphasised that there is a growing need for countries to make their commitments in reduction of GHG emissions in order to tackle the global scale problem of the climate change. Growing population together with the economy around the world are the two main issues contributing to the rise of the GHG emissions affecting our climate. Decarbonisation of power generation is considered to be the most effective way in dealing with GHG emissions, therefore developed countries around the world are bound to provide some share of energy from renewable sources, as set out in the United Nations Framework Convention on Climate Change – the Kyoto protocol.

To ensure the European Union (EU) contributes to climate change and energy sustainability, EU leaders have produced a set of binding renewable energy targets known as 20/20/20 targets. These comprise achieving a 20% reduction in EU greenhouse gas emissions from 1990 levels, raising the share of renewable energy to 20% of total gross energy consumption, and achieving a 20% improvement in the EU's energy efficiency (Seanergy 2020, 2012). These targets were further divided into each member state's national renewable energy action plans (NREAPs), specifying differentiated renewable energy national targets to achieve the overall 20%. These targets vary from 10% in Malta to 49% in Sweden based on the country's existing renewable energy sources and gross domestic product. According to its NREAP, the UK has to achieve 15% of its energy consumption from renewable sources by 2020, whereas in 2005 the target was only 1.5%. These ambitious targets highlight the EU's strong commitment and responsibility to increase their proportion of energy use from renewable sources. This effectively encourages the development of various renewable energy technologies around the globe. Various literature have confirmed that wind power including both on and offshore is the world's fastest growing renewable energy source to date and the largest contributor to reach EU renewable energy targets. The literature in industry reports and academic papers have emphasised that there is a growing need for countries to make their commitments in reduction of GHG emissions in order to tackle the global scale problem of the climate change. Growing population together with the economy around the world are

the two main issues contributing to the rise of the GHG emissions affecting our climate. Decarbonisation of power generation is considered to be the most effective way in dealing with GHG emissions, therefore countries around the world are bound to provide some share of energy from renewable sources. This effectively encourages the development of various renewable energy technologies around the globe. Various literature have confirmed that wind power including both on and offshore is the world's fastest growing renewable energy source to date.

The majority of the existing OW farms that is more than 90% of the global OW installed capacity are located within the coasts of Northern European countries in the North, Baltic and Irish Seas, and the English Channel (GWEC, 2014). By the end of 2015, the total of 11,027.3MW of installed capacity was reached in EU. With nearly 50% (5,060.5MW) share of the EU's total OW installed capacity, the UK maintains its leading position in the OW market, followed by Germany 30% (3,294.6MW), Denmark 12% (1,271.3MW), Belgium 6% (712.2MW), and the Netherlands 4% (426.5MW). This makes Europe the largest OW market globally however an interest in OW technology is rapidly growing in other parts of the world. China is currently the world's leader in onshore wind installed capacity and is potentially the second largest OW market after the EU due to China's rapid OW technology development and its plans to install 30GW by 2020 (Hong *et al*., 2012). The USA, currently the second largest onshore wind market, is also on its way to deploying its first 468MW OW project – Cape Wind off the coast of Cape Cod in Massachusetts. Despite the US being slow to adopt OW technology due to regulatory issues, it has more than 4000GW of OW potential, as identified by National Renewable Energy Laboratory (NREL, 2010).

Despite the development of the OW in different parts of the world, the UK is expected to maintain its leading position in OW market globally with its upcoming Round 3 OW development programme containing seven OW farms with expected overall capacity of 22GW and with the potential to produce 32GW, which would be almost three times bigger than the 8GW capacity of all Round 1, 2 and their extension projects together. In addition to significant carbon reduction contribution, the Round 3 OW development programme not only promises to increase energy security but also the growth of the UK-based supply chain, which will give UK based companies an opportunity to enter the OW market. To ensure UK businesses benefit from the future OW developments, the UK government requires wind farm developers to produce a supply chain plan before they can apply for subsidy mechanism known as Contracts for Difference (CfD). This will in turn provide an opportunity for the UK SMEs to take part in the future OW projects.

However, new subsidy mechanisms such as CfD in the UK affects the confidence of many OW farm developers due to the lack of clarity they pose regarding energy prices, which raises a concern as to whether some of the planned projects will go ahead. But the biggest concern surrounding the future of the OW development in the UK and across the world is the cost of this technology. During 2012 OW turbine installation capacity reached the highest of 1.6GW, which required up to $10bn of financial investment. Considering ambitious targets of EU countries alone, some of the future projects will require double the amount of financial support, which considered by some as too much to be financed (Freshfields Bruckhaus Deringer, 2013). Nevertheless, both the industry and associated governments are keen to work on cost reduction of the OW. Cost of OW projects in the UK have already fallen faster than anticipated from £136/MWh in 2010/11 to £121/MWh in 2012-2014, which provides confidence for investors in the UK market (UKTI, 2015).

A description of the problem or challenge

The UK OW industry is faced with supply chain capacity constraints or in other words there is a limited amount of businesses capable to supply their products or services to OW industry. According to PwC

(2011), this constraint is likely to increase with the future Round 3 development in the UK and other major renewable projects in Europe. Some of the UK's Round 3 OW project developments will significantly exceed 500MW capacity, for example the Dogger Bank wind farm off the east coast of Yorkshire has an agreed capacity of 9000MW, with the potential to produce 12,900MW. Such a rapid increase in size of the future OW projects will put a great pressure on the existing supply chain, including original equipment manufacturers, cable suppliers, turbine installation industry, and the various suppliers to these firms at tier 2 or higher. Therefore, there is a need to increase the UK supply chain capacity that will not only contribute to the economic value of the country but also to cost reduction of the OW overall, as confirmed by the UK government (HM Government, 2013).

However, despite some government initiatives to support the growth of the UK supply chain, businesses still find a lot of challenges with regard to entering the OW industry. The most challenging task faced by SMEs is to connect with the right company to supply products or services to, in addition to identifying relevant information about the industry's requirements. This paper thus reports the results of a research project investigating SMEs participation in the UK OW supply chain.

The research work

The methodology for this study comprised three main activities: firstly, the literature review, conducted based on industry reports and academic papers to provide an overview of the OW industry globally, in the EU and in the UK, discussed above, and to explore the supply chain structures of the UK OW industry that were drawn based on secondary sources from 4C Offshore (www.4coffshore.com) that provides information of companies involved in the OW farms, supported by the information drawn from attendance at various conferences and events covering OW industry issues. Secondly, six case studies and thirdly a survey of 100 firms. Due there only being ten respondents to the survey we conducted follow-up interviews with six survey participants. However, due to the lack of deep information obtained from the survey and follow-up interviews, we are only reporting here on the six case studies.

The six case studies were selected using a purposive sampling technique in order to find out the main requirements that the OW industry expects of the smaller businesses that want to be part of this industry, (Yin, 2003). The case study organisations all possess vast experience in the OW industry. Yin suggests that a case study research strategy is suitable for contemporary phenomenon investigation in a real life context and allowing more research flexibility and was thus selected as the main research strategy for this study to inform the survey.

The cases were selected from diverse industry backgrounds in order to identify industry requirements from different points of view. Data was collected using semi-structured interviews performed either face-to-face or via telephone, due to time and location limitations. Interviews were recorded and transcribed for further data analysis. Interview data analysis of each case was followed by a cross-case analysis to identify similarities and differences. Common themes emerged as a result of cross-case analyses and are discussed below. Question themes included the supplier audit process of each case company, the evaluation criteria or factors that were considered important or not important to the particular case company in its supplier selection process, the technical requirements or accreditations expected from suppliers, the contract types used by cases, and the means of communications they use with suppliers. In order to understand current supply chain needs, issues and capabilities, the interviewee in each case company was also asked to evaluate the UK supply chain strengths and weaknesses.

UK OW Supply Chain Structures

The structure of the UK OW supply chain depends on the strategy of project delivery that the owner, i.e. the customer of the wind farm, chooses to pursue. The choice of project delivery strategies that have prevailed in the UK OW sector so far include EPIC (Engineer, Procure, Install, Commission), DIY (Do-it-Yourself) and Multi-contracting. The main differences between the three options are determined by two core issues, namely cost and risk. The former is a sector-wide challenge that puts OW future development in question. Therefore, the main task for the sector is to reduce costs related to OW. This focus on cost suggests that the three current project delivery strategies should be reconsidered. For this reason, the OW Cost Reduction Task Force (CRTF, 2012) has recommended that a new project delivery option known as Alliancing be used. It is a new concept that is yet to be tested. Alliancing is an arrangement that includes a structure to share risk and reward among multiple contractors and the owner, thus the financial success of each of the parties are linked to the overall success of the project (Anvuur and Kumaraswamy, 2007).

Findings

UK businesses have a great opportunity to benefit from future Round 3 OW developments, but in order to secure contracts there is often a range of industry requirements that businesses have to meet. The following section discusses the findings from face-to-face and telephone interviews with six case companies. Details of the case companies are provided in Table 1.

	Type of Business	**Industry**	**Size (Nr. of employees in 2014 and recent turnover)**
Case 1	Subsea Control Umbilicals and Subsea Power Cable Manufacturer	Offshore Energy (Any energy that is extracted from offshore resources including wave and tidal, wind and oil & gas	Large (~ 500 emp. worldwide and ~£100 mill turnover in 2013)
Case 2	Developer	Renewable Energy – Offshore wind development	Medium (~117 emp. worldwide)
Case 3	Energy Provider	Offshore wind power and oil and gas exploration and production	Large (~1600 emp. Worldwide)
Case 4	Turbine Manufacturer	Manufacturer of offshore and onshore wind turbines	Large (~3-4000 emp. worldwide and ~€2bill in 2012-2013)
Case 5	Steel Work Fabricator	Defence, Renewable Energy, Offshore Oil & Gas, Construction, Quarrying, Rail and Recycling	Large (~400 emp. and £55mill)
Case 6	Integrated Development, Engineering, Construction and AO&M Services Provider	Renewable Energy (Offshore Wind, Wave and Tidal, Biomass)	Large (~2000 emp. worldwide and £700mill In 2011-2012)

Table 1: Description of case companies

Interview participants were asked to explain their SME supplier assessment procedures, how far down the supply chain they go and the time it takes to qualify potential supplier's products or services. Five cases out of six noted that their supplier assessment procedure happens in-house based on their own pre-qualification check lists or procurement rules, and only one company uses Achilles pre-qualification system, commonly known as UVDB in the UK, suggesting that supplier assessment process is not standardised across the OW sector and varies depending on the product type or services and the industry needs at the time.

In relation to potential suppliers, the most important business factor highlighted by all participants was industry experience or track record as shown in Figure 1. As many other industries, OW industry is also looking for quality of products and services provided by suppliers, and track record is one of the key factors that can demonstrate this, but in addition to that it must be supplemented by the right technical qualifications that suggest that the right technical and safety procedures are followed.

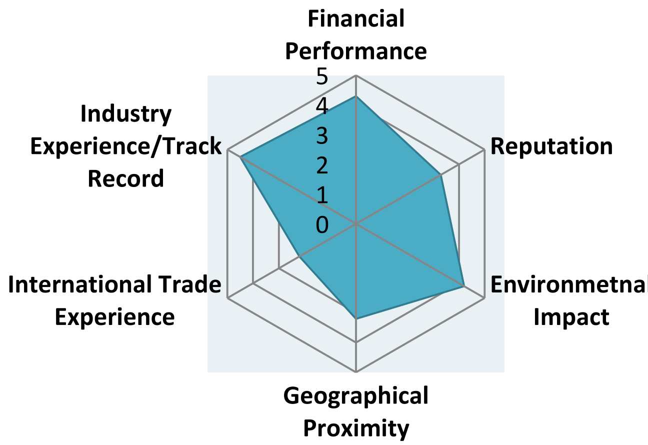

Figure 1: Radar chart of important business factors related to potential suppliers

OW farm development and construction involves a lot of different industries such as surveyors, specialist and professional services for working-at-height and in harsh offshore environments, and various engineering, electrical and manufacturing industries each requiring their own technical specifications and accreditations; thus making it difficult to identify all the necessary OW industry requirements for every sub-industry. However, we identified three common industry requirements that are expected from businesses that have an interest to be part of OW:

- ISO 9001 (Quality Management Standard)
- ISO 14001 (Environmental Management Standard)
- OHSAS 18001 (Occupational Health and Safety Standard)

Both Environmental Management and Health and Safety standards that are ISO 14001 and OHSAS 18001 are accepted as 'work in progress', which means that interested businesses have to work towards obtaining these standards, whereas ISO 9001 Quality Management standard is a prerequisite and as Case 3 pointed out: *"...it is a must nowadays"*. However, these standards might not be relevant for every type of business, for example small services providers, but are very relevant for component manufacturers, engineering businesses etc.

From the interview responses gathered it has become evident that apart from own terms and conditions the OW industry uses contracts adapted from other major construction projects such as oil and gas and coal plants. The most commonly used ones are FIDIC contracts. FIDIC stands for International Federation of Consulting Engineers and is known for its standard contractual conditions for different types of work defined in so called books:

- Gold book – DBOM (Design Build Operate Maintain)
- Silver book – EPC (Engineer, Procure, Commission)/turnkey
- Yellow book – Design and build
- Red book – Construction

Given that FIDIC contracts were not specifically designed for the OW industry they are used as a template and are often modified to suit the specific task of a specific contractor. Each case company confirmed that they often have their own standard terms and conditions, which are then reviewed according to the task. In this case FIDIC contracts are a good starting point to align these standard terms and conditions between the parties, therefore, the majority of suppliers need to comply with FIDIC terms and conditions. It was noted however that FIDIC terms and conditions are more relevant to higher value contracts. Smaller value items are worked on a purchase order.

In light of cost issues that the OW sector is experiencing, all six case companies evaluated product/services quality as the most important factor to be delivered by all suppliers including new ones. Any delays in programme timelines or small faults in goods or services can result in huge amounts of pay-outs. This has also been highlighted as one of the biggest risks for established industry players associated with new suppliers. As it was explained by some interview participants, cheapest does not mean the best and is often perceived as a disadvantage for someone who wants to get into the market.

Interview participants raised the following concerns in discussion of current weaknesses in the UK OW supply chain:

- Market knowledge
- Resources of experienced people
- Lack of investment in facilities
- UK capacity of large component manufacturers
- Capability
- Reliance on overseas companies
- Availability of spare parts from OEMs

In response to skills and manufacturing capacity shortage, industry suggests to go into joint venture partnerships with existing suppliers that want to expand in the UK. It is a good way to get an experience and become an independent supplier to OW industry. It is also the way for the supply chain to demonstrate that there is a capacity, the resources and skills to do the work. Table 2 below provides a summary of the key requirements and expectations of potential suppliers as pointed out by the interview participants.

Despite some areas of concern, the UK clearly has some unique strength in serving future OW projects. Research participants identified the following strengths of the UK plc sector:

- Largest OW market in terms of installed capacity
- Track record

- Material selection
- Access to innovation and technologies through universities and other research bodies
- Shallow seabed
- Infrastructure
- Location
- Relatively low labour cost
- Steel manufacturing
- Desire for UK content
- Technical and engineering expertise
- Highly regarded health and safety policies and procedures
- Growing economy

Summary of the Key Requirements and Expectations of Potential Suppliers
• Quality of products and services
• Ability to deliver products and services on-time/in-full
• Possess relevant technical standards like ISO 9001
• Be familiar with relevant standards and requirements specific to work provided
• Accountability of own fault without additional cost
• Ability to form long term strategic partnerships

Table 2: Summary of the key requirements and expectations from potential suppliers identified

Conclusions

This paper has reported on a research project investigating the OW industry in general and the UK in particular to understand the bases of this industry's future development as well as its current supply chain structures and most importantly the requirements that this industry expects smaller businesses to have in order for them to qualify as the suppliers for the OW.

Europe leads the world in terms of the OW turbine installations off its Northern coasts, with the UK at the forefront of the total installed capacity. It is evident from the national renewable action plans of the European countries and national renewable targets in general that the development of the OW will continue across the European, Asian and American countries despite the concerns over cost of the OW. The UK is expected to maintain its leading position in installed OW capacity given its plans for Round 3 OW developments, although China who is the world's leader in onshore wind might well become the next leader in OW as well due to its ambitious targets in commitment to reduce carbon emissions.

The major plans for OW developments, as well as other renewable energy technologies, suggest that there will be a growing need for the supply of different components and services, putting pressure on the existing supply chains. Current problems in extant supply chains opens up an opportunity for new businesses of different specialism and size as confirmed by the literature review and the information gathered from the interviews with industry experts. Apart from this, the UK government is also interested to create local economic value by imposing a rule for the OW developers to provide a supply chain plan before developers can apply for CfD, meaning that developers of the OW farms are unable to receive government support without any intent for support of the local businesses.

However, it is also clear that the OW industry has a number of requirements it cannot compromise due to the very high cost of any deficiencies in supplier performance. Analysis of the case studies have revealed that there are three main requirements sought after from the suppliers, namely Quality Management standard, Environmental Management standard and Health and Safety standard, although other qualifications also apply depending on the primary activity of the business.

Although there some deficiencies in the UK OW supply chain, including capacity and capability constraints, the UK is still considered to be an attractive market for the future OW developments which gives some confidence to the potential investors and the UK based SMEs that want to enter the OW market.

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