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The Regional Financial Cluster and its importance for the Offshore Wind Cluster

Report IRIS - 2010/111

Project number:	7252248
Project title:	The Regional Financial Cluster and its importance for the Offshore Wind Cluster
Client(s):	Sparebank 1 SR-Bank
Research program:	
ISBN:	978-82-490-0697-7
Distribution restriction:	Open from: 15. 07. 2010

Stavanger 08 July 2010

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Preface

The purpose of the project is to document the financial cluster in Rogaland and its importance for developing the emerging offshore wind cluster in the region.

The project is proposed by Sparebank 1 SR-bank, and is a part of the work of the Finance Cluster group in the IFP project (Innovative Foresight Planning for business development). The IFP project is in turn a part of the EU's InterregIVB North Sea region programme.

A preliminary report was presented to delegates to a WP A meeting in Stavanger, June 15 2010.

Thanks to contributors.

We are grateful for the insights and support from the following reference group: Birger Haraldseid, Greater Stavanger, Ragnar Tveteraas, UiS, Nina Otelie Høyland, Sandnes Kommune, Erik Sevild and Stig H. Eriksen, SR-Bank, Bjørn Bugge, BI and Karl B. Skogen, Innovation Norway.

This report has greatly benefited from interviews and conversations with Kjartan Melberg, Per Arne Jensen, Anders Schanche Rettedal, Marianne Tonning Kinnari, Lars Raunholdt, Harald Straume, Tor Dahle, Arne Aamodt and Rune Hersvik.

Thanks to Birger Haraldseid for sharing his knowledge, for invitations to relevant workshops and exchange of informative documents.

Stavanger, 08 July 2010

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Summary

The regional offshore wind industry is an emerging cluster both at the regional level (Rogaland) and at the national level. Financial services related to this industry are also emerging. Financial resources are available from banks, venture and equity companies. So far, however, both competence and a broader range of financial solutions are lacking. The banks are waiting for their customers to move into this emerging industry, and they are taking initial steps in order to get prepared.

The regional offshore wind cluster is fragmented, and the value chain is still in its forming stage. This implies that the emerging cluster has several opportunities and many strategic positions to take. Undoubtedly, internationally the market is large. The home market is very limited, and test sites have been lacking. Regional firms and suppliers have difficulties in demonstrating, testing and verifying their technology, which in turn represent a handicap for achieving funding of the new technologies.

The region has been very successful in developing a comprehensive oil and gas cluster. There is a strong belief in this cluster as well as in public institutions that oil and gas technology and knowledge easily lends itself to an offshore wind transfer. Technologies and knowledge related to fixed and floating foundations, installations at sea, cabling and substations are all areas where a transformation is feasible. The region also commands world class experience in operations and maintenance, project management and education which may be tuned in to the offshore wind industry. In the positive scenario, these technologies and knowledge will successfully be transferred to the offshore wind sector. In other words, the region may emerge as a competitive offshore energy cluster, comprising, oil and gas, wind and maritime services.

On the other hand, some of the actors are more sceptical. They point to the fact that the offshore wind industry is a totally different ballgame with lower margins and requirements of standards, cost efficiency and economies of scale. In the negative scenario, what have been competitive advantages in the oil and gas industry, turn out to be core rigidities in the emerging offshore wind industry. Continued high level of investments in the oil and gas industry accompanied by high profits, will delay attention and adaptation to the new opportunities. Meanwhile competitors in countries like Denmark, Germany and the UK will move ahead and eventually define and command the viable positions in the value chain.

1 Introduction

This report builds on documents, former reports, interviews and two workshops, in Stavanger and Aberdeen, respectively. The one in Stavanger held on April 29th focused on "What can the offshore wind industry learn from the offshore oil and gas industry?"

First the status and the development of the financial cluster is documented. The cluster has grown considerably over the past 15-20 years and is presently ranked as the second largest in Norway. The Oslo region commands the number one position with a clear margin. The regional cluster is broad, including financial groups, credit institutions, venture capital funds, equity groups, mutual funds, and fund managers.

The updated status of the regional financial cluster serves as a vantage point for a swot-analysis within the following context: what are the strengths and weaknesses of the regional financial cluster in relation to financing the offshore wind industry? What are the ambitions and plans for taking an active role in financing the offshore wind cluster? What kind of competence does the regional financial cluster possess in order to take a constructive role in this emerging sector? Does the cluster have national and international ambitions, and in that case: what is their competitive advantage?

In parallel the project sketches the demand side; the need for financial support the actors in the offshore wind industry will require. What instruments are most relevant? The needs depend on the actors' position in the value chain, their size and where in the innovation process the firm is located. The data collection has been guided by a semi structured interview guide. We are also aware of the document "Guidelines for collecting cluster data and conducting swot analysis"[1]. These guidelines recommend that a cluster analysis is not constrained to pure documentation, but rather include a discussion of its importance and effects, how it collaborates, its dynamism and innovation capability.

The potential of the offshore wind cluster is elaborated through foresight studies. Relevant information has been collected from interviews with key informants in the financial cluster and the emerging offshore wind industry. Two short scenarios have been developed based on the most central drivers. The identification of drivers has been elaborated in a dialogue with industrial actors and representatives from the relevant finance sector.

1 Developed for the IFP project and discussed at the Viborg seminar in March 2009

2 Theory[2]

This study is based on theories on regional clusters and regional systems or ecologies of innovation. Economists have long noted that firms engaged in the same or related activities tend to cluster together. These observations are not new. Early in the 19th century David Ricardo developed the notion that national and regional specialization may offer comparative advantage. He argued that differences in endowments such as geographic location, presence of raw materials and cheaper labor generate regional economies that enable one place to produce more effectively than another, based on specialization. A century later Alfred Marshall elaborated reasons for greater firm productivity when several firms in the same industry are located in the proximity to one another, notably labor market pooling, knowledge spillovers and supplier specialization (Marshall 1920). In recent years Michael Porter has become a standard reference. His definition of a cluster includes regional institutions: *"Clusters are geographically close groups of interconnected companies and associated institutions in a particular field, linked by common technologies and skills. They normally exist in a geographic area where ease of communication, logistics and personal interaction is possible. Clusters are normally concentrated in regions and sometimes in a single town"* (Porter 2003).

The definition of clusters is somewhat blurred by the lack of a clear spatial dimension. The concept may be applied to analysis at the national level on industry group linkages in the whole economy (macro), a branch or industry level, or a firm level focusing on inter-firm linkages (micro). Sometimes a region is defined as part of a nation, sometimes it encompasses an area larger than a nation.

The concept of clusters has attracted widespread political interest, and numerous regional political and industrial initiatives are based on regional interpretations and beliefs in clusters. These beliefs are related to the potential benefits of clusters: higher productivity, wages and employment. A region's attractiveness for business and human talent has also developed into goals for regional political initiatives. According to Porter *"regions compete in providing the most productive environment. It is not the industry that matters but the way the firm competes, its use of the advantages that the local environment brings"*. Research into the sources of productivity and innovation in clusters has focused on the circulation of people and knowledge, the generation and diffusion of new ideas and the consequent development of new products and services. Recent evolutionary theories recognize that the generation, adoption and diffusion of new technologies is a complex process and therefore endogenous to growth models (Romer 1990). The circulation of knowledge and technologies in the form of regional systems or ecologies is therefore one of the key potential benefits of clustering.

Diffusion and spillovers are believed to be the major mechanisms that link R&D with growth, not simply the levels of R&D investments. In other words, if research results and novel solutions fail to be diffused and absorbed in the economy, the public support

2 This chapter draws on the OECD review "Competitive Regional clusters", 2007

to research becomes significantly less productive. R&D institutions need to develop strategies on what roles they intend to take in the regional innovation ecology (Westnes, Hatakenaka et al. 2009). Diffusion of knowledge is most effective if organized in interactive ecologies of people and institutions. Cluster initiatives may facilitate such interaction.

Cluster policies come with risks. One is the degree of specialization or to what extent a region depends on one cluster. In that case a risk of vulnerability will arise in regions heavily dependent on oil and gas production. Many policy-makers equate cluster support with competitiveness of firms. This link is nuanced and complicated as documented in a recent study of innovation processes in firms in Rogaland. This study indicates that the most innovative firms have more *international* relations than others, and do not rely as much on a *regional* cluster (Fitjar 2010). Firms in a regional cluster may become too inward looking or rigid, resulting in what is termed lock-in effects. Major investments to support specific sectors or clusters may make it difficult to adjust strategies to new circumstances because a tight regionally concentrated cluster is less open to adaptation and let opportunities pass (Andersson, Schwaag-Serger et al. 2004). This point is open to debate as other perspectives identify clusters as a way to generate greater rivalry and complementarities which spur innovation, not complacency. These issues will be discussed in this report as we focus on the potential of transforming oil and gas technologies and knowledge to the emerging offshore wind sector.

3 The regional financial cluster

The region has a comprehensive and growing financial cluster. The recent global financial crisis has not inflicted serious wounds to the regional cluster, which also testifies to the fact that the Norwegian economy faired well through the financial turmoil. An overview of the industry is first offered, we then go on to discuss the impact of the regional financial sector on the emerging offshore wind industry.

3.1 An overview of the regional financial cluster

This overview is mainly based on public statistics, proprietary websites and interviews. The interviews are related to the strategies and ambitions of banks and venture funds. The most recent figures (2008/09) are compared with similar studies in 2004/04 and 2006[3].

Table 1: Employment in financial cluster Rogaland

Employment in Rogaland	2003/04	2006	2009	Change 06-09
Capital suppliers – banks	1400	1550	1539	-11
Capital suppliers – credit unions			348	348
Brokers		40	42	2
Financial management of own and others assets	126	170	112	-58
Venture and equity companies	24	30	50	20
Venture companies, own investments	18	20	97	77
Investment sales and consultancy	40	100	217	117
Pension funds			6	6
Insurance companies			101	101
Sum	**1590**	**1900**	**2512**	**622**

The employment in the financial cluster has grown during the past decade. The number of employees has grown by 622, but approximately 200 are related to the inclusion of the whole county. Adjusting for that, the real growth is stipulated to 422 or 22%. In evaluating these figures one should bear in mind that the finance industry was in deep trouble in 2008-09. The table indicates growth in all parts of the cluster, both regular capital suppliers like banks and credit unions, and venture and equity companies. These categories are relevant to the offshore wind sector.

3 This report defines the region as the county of Rogaland. The two former reports were based on the Stavanger region. When relevant the impact of this difference is commented. In general, the Stavanger region represents 2/3 of number of jobs and inhabitants in the Rogaland County.

The next table offers more detail of number of units, employees and examples of firms included. Sparebank1 SR-Bank and GE Money Bank are the two largest employers with 946 and 309 employees, respectively. The former has a strong local presence throughout the county and has expanded into the neighbouring counties both north and south. In the same manner, Sparebanken Vest, headquartered in Bergen, has expanded into Rogaland.

Table 2: Employment and type of financial institution

Type of institution	No units	Employees 2009	Examples
Capital suppliers – banks	13	1609	Sparebank1 SR-Bank, Haugesund Sparebank, DnB Nor
Capital suppliers – credit unions	5	348	GE Moneybank, Spb1 Boligkreditt
Brokers	3	42	Pareto, First
Financial management of own and others assets	21	134	Statoil Capital Mgmt., Skagen Funds
Venture and equity companies	30	50	Hitec Vision, Energy Ventures, Progressus
Venture companies, own investments	66	97	Statoil Venture, IKM Invest
Investment sales and consultancy	19	295	Acta, Pareto
Pension funds	11	6	Statoil, Conoco Phillips
Insurance companies/brokers	92	101	Statoil Insurance, Waco
Sum		**2512**	

Table 3: Assets under management (NOK billion)

Type of institutions	2003/04	2006	2008	Change 06-08
Capital suppliers – banks	-	79,2	115,4	36,2
Capital suppliers – credit unions	-	32,4	93,7	61,3
Sum capital suppliers	**-**	**111,6**	**209,1**	**97,5**
Financial management of own and others assets	51,0	89,4	108,5	19,1
Venture and equity companies	1,0	4,4	12,3	7,9
Venture companies, own investments	0	3,0	7,5	4,5
Investment sales and consultancy	-	78,0	85,2	7,2
Sum AUM	**52,0**	**286,4**	**422,5**	**136,1**
Investment sales and consultancy	9,8	10,4	33,4	23,1
Pension funds	-	-	41,1	41,1
Insurance companies/brokers	-	-	18,9	18,9
Sum incl. investment companies	**61,8**	**296,7**	**515,8**	**219,1**

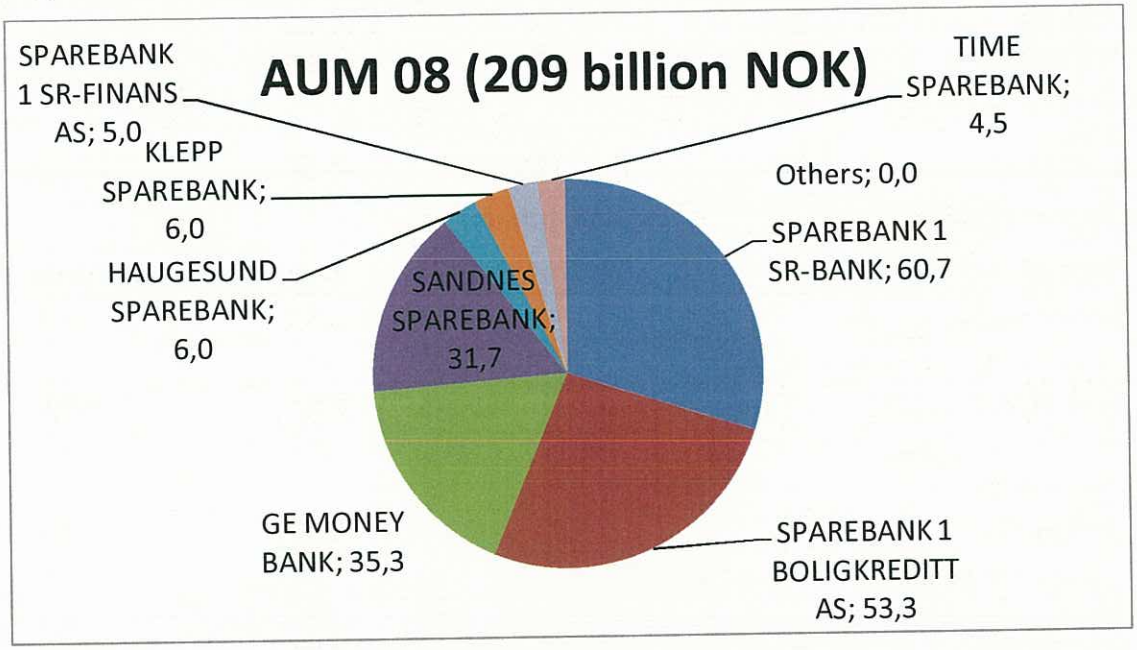
Assets under management in banks and credit unions have risen considerably from 2006 to 2008. Unfortunately, the study in 2003/04 did not include these institutions. Approximately NOK 10 billion of the growth accrues to the inclusion of the whole county, so the real growth amounts to NOK 87,5 bill. or close to 80%. These figures reflect the extremely high level of economic and industrial activity in this period, especially related to the all time high investments in the oil and gas cluster and related demand.

The figures below paint a more detailed picture of the various actors headquartered in Rogaland. We start with the banks

3.2 The banks

Sparebank1 SR-Bank has transferred its home mortgage business to its credit union, so a large share of the capital under management in the bank proper should be available for business. GE Money Bank is mainly targeting the consumer market. The savings banks typically have s strong regional focus, and serve both the consumer market and businesses. They tend to have s strong presence with SME's. Figure 1 displays the assets under management in banks and credit unions.

Figure 1: Assets under management in banks and credit unions



Funds allocated to the offshore wind industry are presently marginal[4]. The reason is simple. As a bank manager exclaimed: "There is no market for offshore wind". This

[4] Sparebank1 SR-Bank has transferred its home mortgage business to its credit union, so a large share of the capital under management in the bank proper should be available for business. GE Money Bank is mainly targeting the consumer market. The savings banks typically have s strong regional focus, and serve both the consumer market and businesses. They tend to have s strong presence with SME's.

statement is an acknowledgement that the business customers of the bank have decided not to enter the emergent offshore wind market. The policy of the bank is to "follow our customers", not to take a proactive role in developing a new regional cluster. Unleashing the banks' potential is derived from their customers' priorities.

There are tokens of change, however. The dominant regional bank renames its "petro/maritime" department to "energy/maritime", suggesting that energy is more than oil and gas. There are additional reasons why that department only has a part time position dedicated to the offshore wind segment. Generally, banks are prudent and cautious after the decade's lending spree and financial crisis. Banks are themselves striving to get funding. Furthermore, there is a belief that the mature oil and gas sector is less risky than an emerging industry with a rather fuzzy value chain. Risk management is more feasible in the oil and gas sector with 40 years experience to build on. An emerging cluster is associated with a high degree of uncertainties. Following Frank Knight, risks can be calculated as the probabilities of different events are known, in contrast to true uncertainties (Knight 1921). The lack of a trustworthy, long-term political and legal framework represents an uncertainty. Acknowledging the attitude in the banks, some of the suppliers intending to enter the offshore wind segment, consciously market solutions based on technology proven in the oil and gas industry. This strategy will broaden the doors to the banks, they believe.

Fourthly, banks need to acquire more competence related to the mechanisms of the offshore wind cluster. A better understanding of the market, its firms and institutions, is needed. They would also like to possess more knowledge about the market drivers and the political and legal framework, and how that may differ from country to country.

In the Norwegian context, some of our interviewees report that DnBNOR has specialized in financing the wind sector. They have concentrated their expertise at the headquarter in Oslo, not in their offices in Stavanger.

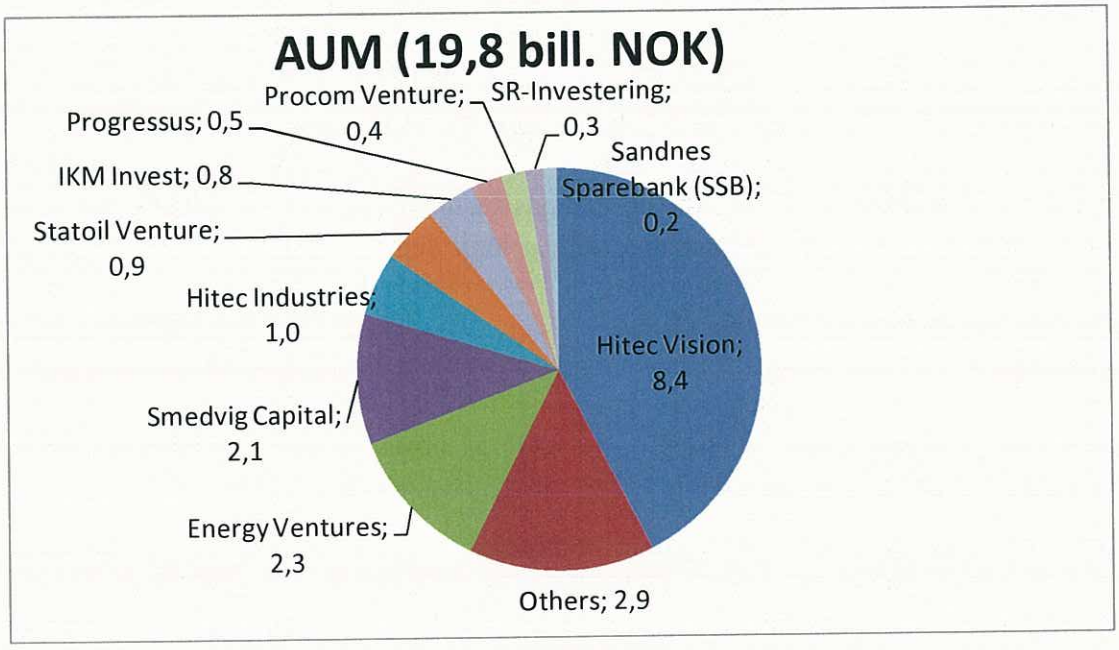
According to Douglas-Westwood, the energy business analyst, the investment case for offshore wind is tough. Banks and investors are being cautious as the rate of return on projects is currently low and risk is high.

The offshore wind market is characterised by projects which are significantly larger and more risky than most onshore projects, and it appears likely that different organisations will develop and construct these projects. Special vessels and techniques for erecting turbines have been developed, and the means of access to offshore turbines has emerged as a major issue influencing cost, availability and safety. The turbine technology too is different for offshore projects: there are strong reasons why individual turbine size is significantly larger, and turbines of 5 MW and more are being aimed at this market. More subtle differences in technology are also emerging, due to the different environment and increased requirements for reliability. There is perhaps greater probability of truly innovative designs emerging for the offshore market than for the onshore market, possibly with new players.

3.3 Equity and venture capital

For our purposes in this study, the venture and equity companies are potentially relevant. The figure below lists the major companies headquartered in Rogaland.

Figure 2: Venture companies, assets under management



The upstream oil and gas industry is the primary market for the funds managed by the two major venture companies based in Stavanger. The fund managers, partners and advisors have long oil and gas backgrounds, giving thorough understanding of the industry and its technology needs. Hence they also have close relations and networks which help in identifying new opportunities. Their investment team has extensive operational experience from the oil and gas industry and investments. Both firms have been very successful and have also succeeded in attracting capital from internationally well reputed investors.

HitecVision provides capital and competence to growth companies in the energy sector in Europe and North America, and was in 2009 managing three private equity funds with total assets of NOK 7 billion. The company also invests directly in the three funds. Hitec vision is one of Norway's largest private equity investors and a leading European investor within oil and gas. The portfolio companies supply advanced solutions and services to the oil and gas sector, independent oil companies, and traditional oil service businesses The company is based in Stavanger with offices in Oslo and Houston.

Energy Ventures is dedicated to new upstream oil and gas technologies. With a total committed capital of NOK 2.33 billion ($400 million USD), the company currently manage and advise four venture funds. Investments range from $5-20 million per company, with typical holding of 10 to 40 percent of equity. Headquartered in Stavanger, with offices in Houston and Aberdeen, Energy Ventures is located in some of the world's strongest oil and gas clusters.

Progressus is also based in Stavanger, but has a smaller asset base than the two companies mentioned above (NOK 472 mill.). Contrary to the two dominating venture firms in the region, the company has a wider investment universe, and include both wind and sun segments. Their fund takes major position, also in smaller firms. Progressus is presently evaluating one company in the offshore wind sector, again contrary to HitecVision and Energy Ventures.

Procom Venture is a Stavanger based early stage venture capital company focusing on companies in the Petroleum-, Clean Energy- and Industrial Biotechnology sectors. The company was established in 2002. In May 2009 Procom Venture AS took over as manager of SåkorninVest AS. The majority of their investments are related to the oil and gas sector. One investment is clearly devoted to the offshore wind market (gear boxes), and another investment (monitoring cables) may be relevant. SåkorninVest AS was established in Stavanger in 1998 and manages two funds with a total capital base of NOK 429 mill. The company is owned by regional and national industrial and financial investors.

Contrary to oil and gas, the value chain and the structure of the offshore wind industry is still fuzzy. This adds to the uncertainties for the venture companies, as potential asset plays are hard to decipher which in turn makes it harder to make investment decisions. Many venture companies start their screening and selection process by studying the value chain, in offshore wind that's impossible to do. Lack of a well defined position in the value chain may constitute a deal breaker. Not knowing the real positions of the contenders and the power they command, constitutes a challenge. Which firms are really defining the rules of the game and how is the real power distributed? With a fuzzy structure and ill defined positions, trust in management is even more important than usual for equity firms. Leadership with strong capabilities in strategic management and execution capacity will be searched for. On the other hand, in this type of market, first mover advantages may be obtained and standard setting is possible. Companies capable of defining the industry's standard for product categories will obtain economies of scale, strong market positions and above average profitability.

For the offshore wind industry, there is no Norwegian home market. Consequently, the North Sea is defined as the home market. In many ways this is a natural consequence. Many companies are accustomed to compete and deliver to this market from the oil and gas sector. Also Norwegian companies should be able to transfer a good reputation from oil and gas to other sectors, like offshore wind. However, Norwegian firms will have difficulties in obtaining project finance and funding abroad as they often lack access to the proper networks and an understanding of the institutional setup. This is an argument for developing a regional financial cluster where these companies typically have a reputation both as persons, managers and companies.

The equity and venture funds in Rogaland feel more comfortable with the traditional oil and gas sector. They know the risks, the firms and their managers. The offshore wind sector is still an alien bird because contracts and risk factors are different; there are uncertainties as to the political and legal framework and varying competition with alternative energy forms. Equity investors and venture capitalists will search for firms with access to large projects because economies of scale is needed to reduce costs. Their

understanding and appreciation of the market would be improved by more visible demand, from projects, licenses and public funding

These are issues the entire industry has to learn and handle, not only banks, equity firms and venture capitalists. These firms are able to offer not only funding, but access to relevant networks, negotiations, positions, management and strategic capabilities.

In conclusion, Stavanger is host to a good number of venture and equity companies. The two major companies are dedicated to oil and gas and neither one have invested in the offshore wind sector. Some of the smaller - and younger – equity and venture companies have invested in, or are evaluating investing in, offshore wind related technology firms. Looking for expansion and growth companies, not in the early phase, but established firms with a positive revenue stream, takes major positions. The regional equity and venture companies have no deliberate and offensive strategy to enter the emerging offshore wind market. On the other hand, public seed money is available from Innovation Norway and Enova.

The Rogaland office of Innovation Norway[5] reports of substantial interest for wind projects, both from established firms and start-ups. Some of them originate from the oil and gas sector. In addition to funding, Innovation Norway offers free consultancy (up to 15 hours) where the client is sought connected to other potential funding sources like the Norwegian Research Council and Enova. Since this is a new industry, the office finds it very challenging to evaluate the proposed technologies and business models. When it comes to verifying technology, research institutions are used, including the regionally based International Research Institute of Stavanger (IRIS) and the University of Stavanger (UiS).

Innovation Norway offers funding to SME's for Industrial Research Development contracts (IFUs in Norwegian). This mechanism is supposed to stimulate collaboration between a demanding customer and one or several SME's. The benefits for the SME are improved competence, access to a broader market or network, and a solid reference customer. For the customer firm potential benefits are access to new expertise and technology.

The efforts of Innovation Norway and other public agencies compensate for lacking risk willingness in banks and venture companies. This gap has become wider following in the wake of the financial crisis in 2008. As part of the stimulus package from the Norwegian Government, Innovation Norway was allotted expanded budgets to mitigate the lack of funding for innovative projects and technology. This package is not specific for the Rogaland county, but the implementation and actual performance is always regionally influenced.

5 Innovation Norway promotes nationwide industrial development profitable to both the business economy and Norways national economy, and helps release the potential of different districts and regions by contributing towards innovation, internationalisation and promotion.

4 The regional offshore wind cluster

Two different forms of clusters are discussed in this section; organically growing, market-driven clusters, and deliberately planned cluster initiatives. The section also includes sketches of a swot analysis of the regional offshore wind cluster. In particular we underline the potential of technology and knowledge transfer from the successful oil and gas cluster, as well as underlining the absence of demanding and influential customer groups.

The theoretical perspectives on clusters were presented in chapter 2. The widely used definition of Michael Porter considers clusters as geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions in particular fields that compete as well as collaborate (Porter 1998). Furthermore, Porter has introduced his "diamond" model to analyze four inter-related cluster advantages (Porter 1990):

- Specialized factor inputs (human resources, capital resources, physical infrastructure, universities and research institutes)
- Related and supporting industries
- Demanding an sophisticated customers (that press firms to improve and provide knowledge on future market needs, often associated with innovation pressure)
- A favorable investment climate and vigorous local rivalry

A cluster success is often attributed to superior innovation performance. Innovation requires entrepreneurs, either in established firms or as start-ups and spin-offs, which in turn creates a need for competent risk capital. Thus clusters need to provide appropriate conditions for successful new business development, such as en entrepreneurial culture, access to customers, suppliers and capital, and access to exploitable knowledge in existing firms and research institutions.

Clusters may be market driven as the firms and institutions naturally and organically develop a cluster based on the perceived and real advantages explained above. Gradually more firms are attracted to the emerging cluster, a well functioning and skilled and specialized labor market develops, and schools and universities see the need to educate more talents within the merging industry etc. These clusters are market driven without a deliberate and superimposed plan. The benefits can be achieved simply through co-location and normal business transactions.

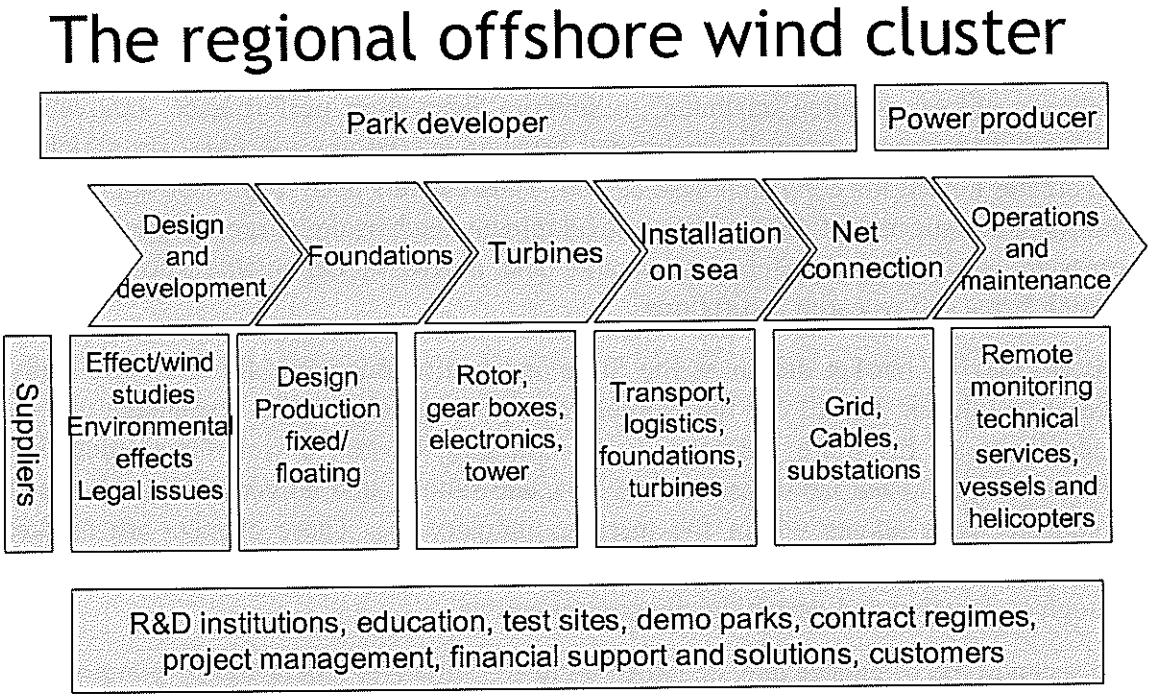
The second type of cluster may be called a cluster initiative, a deliberately planned and often publicly supported network of firms and institutions. Typically these clusters have members or partners, who pay a fee to fund common resources available to the members. This approach assumes that co-location is not sufficient to reap or advance the benefits of clustering. The infancy of cluster growth may be speeded up by interventions such as incentives for joint industry projects, commercialization of public research, creation of spin-off companies, development of science and innovation parks,

and upgrading of suppliers to assist them in gaining contracts with larger, dominating firms (Potter and Miranda 2009). A frequent mistake made by policy makers and analysts is to think that clusters are synonymous with deliberate policies or deliberate collaboration in formal networks. Consequently, a warning: One of the most important lessons from cluster experience is that policy should not seek to build clusters in places where necessary critical mass and conditions do not exist. This type of "wishful thinking" has been found where policy driven cluster attempts not only lack critical mass, but also an identifiable source of advantage that might promote organic development (Enright 2003). Thus the role of interventionist policy should be carefully assessed and implemented.

4.1 The value chain and regional cluster

Below we present a general model of the first type of cluster, an organic, market driven offshore wind cluster. The model depicts the value chain in the offshore wind industry embedded in en ecology of related services and institutions. The model is inspired by a report from SINTEF (Tomasgard 2009) and interviews with managers in the offshore wind industry.

Figure 3: The offshore wind cluster



According to the European Wind Energy Association (EWEA) the offshore wind energy sector has emerged as "a distinct sector" of the wind industry. However, the offshore wind energy sector is at a much earlier stage of development, this is also true for Norway and Rogaland. The implication is that a mature and visible value chain and cluster has not surfaced. To the financial service industry this situation seems to imply a

barrier to their engagement and involvement. On the other hand, an emerging, incomplete value chain offers abundant opportunities for those willing to take the risk and act as entrepreneurs. From the perspective of the firm, positions and roles are there to take and define. In other words, the set of strategic opportunities is greater than in well established clusters, and developing sustainable corporate strategies will be more important.

In the model we have differentiated between a "park developer" and a "power producer". In onshore projects some firms specialize in developing the wind parks and sell them as turn-key products to producers. In that case, the park developer demands project financing; which may be substantial. The power producer may be a utility company, in the case of Rogaland the regionally, publicly owned Lyse AS may serve as an example. The role may also be taken by turbine producers or oil and gas companies with ambitions to go "beyond petroleum" and define themselves as diversified energy companies. Engineering companies like Wood Group, GdF Suez may also develop and deliver turn-key projects.

The Rogaland county hosts utilities, oil and gas companies, and specialized park developers (onshore) that may take a corresponding role in an emerging offshore wind cluster. The regional oil and gas industry is well acquainted with socalled EPCI[6] contracts, a competence easily transferred to the offshore wind sector.

Firms may also take on both the role as park developer and producer of the power.

Producers of turbines play a major role in the value chain. Six turbine manufacturers are presently supplying the offshore market: Siemens, Vestas, REpower, BARD, Multibrid and Nordex (EWEA 2009). Most current offshore turbines are adaptations of onshore designs. None of these companies are located in Rogaland. With such a small number of companies, oligopolistic competition is expected. New players may enter the race, and from a Rogaland perspective, Statoil's innovative concepts Hywind and Sway may give the region an entrance to this promising market. Hywind is now being tested and is constructed for very deep water (120-700 m), but is very expensive at this stage. These developments highlights the importance of strategy, one focusing on producing continuous, incremental improvements in the current basic concepts, another one based on breakthrough with new and simple concepts. EWEA argues that in order to harness the offshore wind potential of deeper waters off the Norwegian coast and the Atlantic Ocean, floating designs are required. In this context both Hywind and Sway are potential concepts. Sway collaborates with the German wind turbine producer Multibrid.

Turbine manufacturers are also "demanding customers" for suppliers of turbine components, an interesting market for many Rogaland based companies. Ideally, the region should host one or more turbine manufacturers. They may dominate the value chain through barriers to entrance and by integrating suppliers of components in their

6 EPCI contracts are used when the contractor performs Engineering, Procurement, Construction and Installation, in other words a turn-key product. The acronym EPCIM includes maintenance.

own value chain. From the perspective of building a regional offshore wind cluster, the "wholes" of turbine manufacturers, park developers and power producers should be filled as decisions regarding the rest of the value chain rest mainly here.

The region hosts consultants that may carry out the critically important effect and wind studies. Environmental effects and consequences have been an integral part of Norwegian offshore oil and gas projects. Again based on technologies from the offshore oil and gas cluster, design and manufacture of fixed and floating foundations could be carried out in the region. With this region's legacy from oil and gas, concrete foundations are very likely. The company ViciVentures has enjoyed an "enormous response"[7] to their mono structure which builds up to 100 m. Scale production may reduce costs to 1/3. Rogaland offers unique conditions for their concept as everything may be constructed and built in the fjords of Vats or Åmøy, implying testing close to the shore. He advocates a demo park in Norway, as they need to demonstrate a network of suppliers and develop a more encompassing concept.

As illustrated above, component suppliers to the turbine manufacturers are located in Rogaland, the big issue is whether or not they gain access to the major foreign turbine producers. Anglewind may serve as an example. They develop gearboxes and drive-trains for a new generation of wind turbines. They partner with the regional utility company Lyse AS and "a world leading wind turbine supplier".[8]

The present combination of the offshore oil and gas cluster and the marine sector constitutes an excellent vantage point for offering vessels and services to installations at sea. Norwegian yards are capable of constructing feeders, similar to FPSOs.[9] The Stavanger based aims at a strong presence as an integrated EPCIM contractor for the global offshore wind market. Their strategy is to offer vessels and services for complete installation of wind farms, including foundations, turbines, met masts, substations and cables. The company has a global perspective, but regards UK as the key market with their ambitious growth plans. Their potential customers are utility and energy companies, offshore wind turbine suppliers and larger engineering companies.

BergenRosenbergGroup (BRG) is developing strategies for several segments of the offshore wind value chain: maintenance, fixed and floating foundations, substations, cabling, floating. Locally, BRG has access to superior facilities at Buøy, and the yard facilitates fabrication of a growing market for substations. These constructions build directly on oil and gas technology and competence. A substation is a transformation station collecting cables from the turbines in 60-80 wind mills, and transfers the electricity onshore. Doggerbank alone (with 2000 wind mills) represents a market of

7 From a company presentation Nov. 3, 2009, by Øystein Huglen

8 From a company presentation dated Nov. 3, 2009

9 A **floating production, storage and offloading (FPSO)** unit is a floating vessel used by the offshore industry for the processing and storage of oil and gas. A FPSO vessel is designed to receive oil or gas produced from nearby platforms or subsea template, process it, and store it until oil or gas can be offloaded onto a tanker or transported through a pipeline.

more than 200 substations. Some of the production may be set out to low cost regions, but that's another issue.

The strategies of the regional and innovative utility company Lyse is still ambiguous. Presently offshore wind is expensive with unfavorable frame conditions. Lyse has taken equity positions in several wind technology companies, which they regard as learning arenas. Lyse has taken an initiative to establish a test site for offshore wind product development with Statoil and GE as partners. Lyse will take the role as field developer of the demo site. The utiliy has a limited financial capability and cannot invest billions in offshore wind. However, regionally, they may play an important role as a facilitator and network hub.

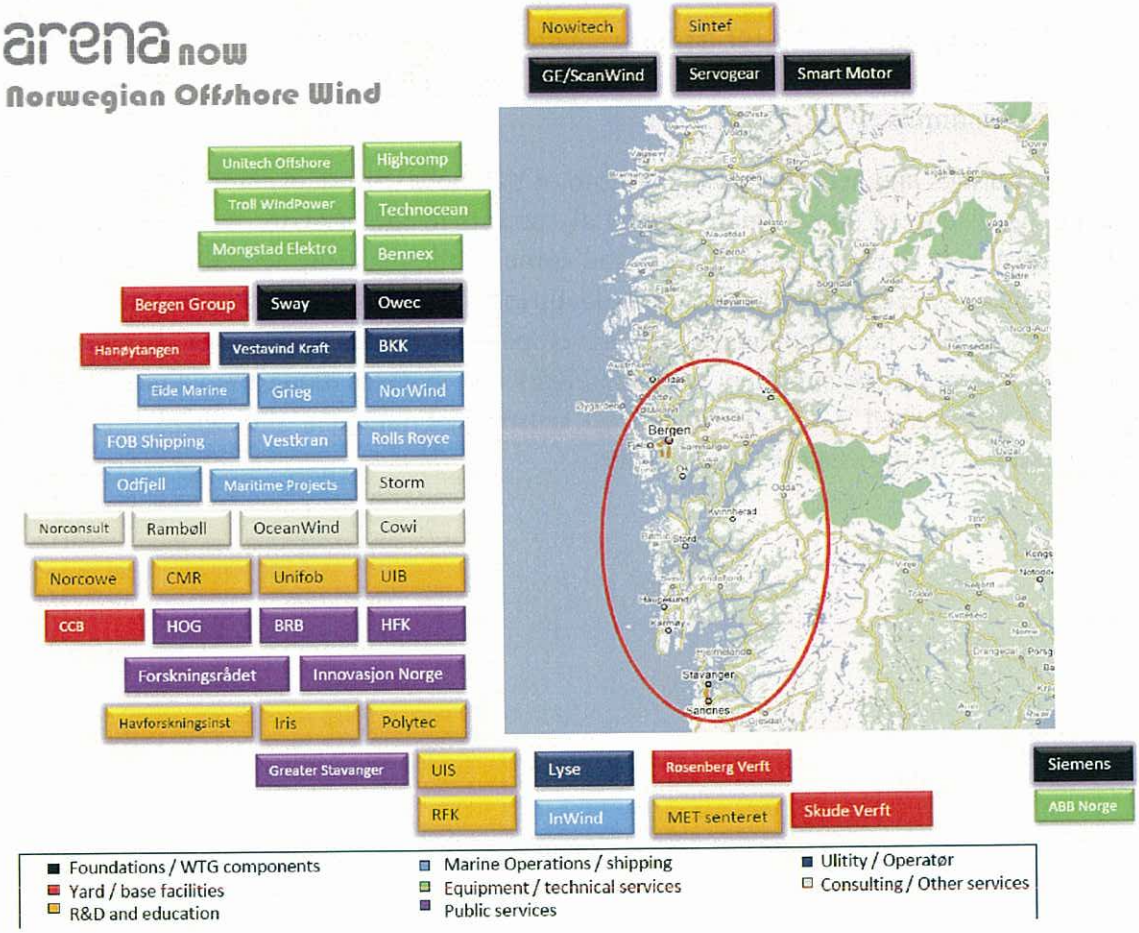
The regional oil and gas sector has also much to offer to the market for operations and maintenance. The concept of integrated operations lends itself to remote monitoring of offshore windmills.

The institutions and activities at the bottom of the model are relevant to the entire value chain. As discussed above, many potential entrants to the offshore wind industry miss Norwegian test sites and demo parks, and some of the most influential and demanding customers - especially the turbine manufacturers - are located elsewhere. On the other hand, the region hosts potential park developers, operators and power producers, in addition to innovative suppliers of components and systems along the value chain. We have also described a regional financial cluster not taking a pro-active role in the development of the offshore wind cluster.

4.2 A regional cluster initiative

These conclusions bring us to the other type of cluster, the deliberately planned cluster initiative called Arena NOW (Norwegian Offshore Wind). An overview is presented below:

Figure 4: The offshore wind initiative: Arena NOW cluster



The figure displays the member firms and institutions and the colors relate to their position in the value chain.

The cluster initiative Arena NOW has about 40 members from the Norwegian west coast (counties Rogaland and Hordaland) with experience from the oil and gas sector. They join forces to secure contracts in the development of offshore wind parks. Their goal is to strengthen cluster development and product development through initiating joint projects. Education and R&D adjusted to the needs of the cluster are other ambitions. The cluster wants to increase the mobility of labor and expertise, and develop a common strategic platform for the cluster. A project facilitator has been employed.

The Arena-program is owned by the Norwegian Research Council, Innovation Norway and SIVA; and offers financial and professional/technical support for innovation and regional industrial clusters. According to the owners, the logic behind the ARENA program is as follows:

The competitive strength within the industry is to a large and increasing degree dependent on the ability for constant innovation, which in turn is based on the ability to actively cooperate with other companies, R & D institutions and other partners. Companies might benefit from belonging to a well developed local/regional business environment, where there exists a cluster of competitors and/or competing companies, demanding customers, specialized suppliers, and relevant R&D and educational institutions. A situation like this does not in itself provoke a definite and useful collaboration. There has to be genuine common bonds between the participants, and it is necessary to develop a culture and infrastructure in order to stimulate such collaboration.

A business cluster or business environment can contribute to:

- *Increased productivity and efficiency, since:*
    - *Companies have more straightforward access to important input factors*
    - *New knowledge can be distributed faster*
    - *There are better opportunities for establishing cooperation based on complementary roles*
- *Increased innovation activity, since:*
    - *Closeness to competitors, customers and cooperative partners provides better access to new ideas*
    - *It is easier to find partners for implementing innovation activities*
- *Increased commercialization and more new businesses, since:*
    - *The core business provides the basis for new suppliers*
    - *The core skills provide the basis for spin-offs*
    - *The attractiveness of the community appeals to new business*

These are possibilities that stand a better chance of being realized if initiative is taken to bring the participants together, to systematically explore possibilities for cooperation, and to stimulate measures for actual cooperation.

These arguments are closely aligned with the accepted theory of clusters described in chapter 2. In this case the Arena NOW may be regarded as complementary to the organic, market driven offshore wind cluster with the aim of both strengthen market driven processes and close gaps/fill "holes" where the market itself does not function.

5 Foresight: the two scenarios

The market for offshore wind is indisputable. According to the European Wind Energy Association (EWEA) "Europe's offshore wind potential is enormous and able to power Europe seven times over". EWEA has a target of 40 GW of offshore wind in the EU by 2020, implying an average annual market growth of 28% over the coming 10 years. This translates to about 10.000 wind mills. Is this more than wishful thinking? The EWEA links these projections to the development of onshore wind: *"In the 12 year period from 1992 – 2004 the market for onshore wind capacity in the EU grew by an average 32% annually; from 215 MW to 5749 MW. There is nothing to suggest that this historic onshore wind development cannot be repeated at sea."* (EWEA 2009). Offshore wind is recognized as an integral part of EU's energy policies: "Offshore wind power provides the answer to Europe's energy and climate dilemma – exploiting an abundant energy resource which does not emit greenhouse gases, reduces dependence on increasingly costly fuel imports, creates thousand of jobs and provides large quantities of indigenous affordable electricity".

According to the Norwegian government Norway should aim at having a capacity of 40 TWh renewable power in 2020-25, half of which from offshore wind (5000 – 8000 MW). This implies investments in the range of NOK 100 – 220 billion.

In other words, the market is undoubtedly there. Will we see a regional offshore wind cluster as vibrant as the corresponding, existing oil and gas cluster? The growth of that cluster is reported before (Hatakenaka, Westnes et al. 2006). The answer is explored in two different scenarios. In the positive scenario, technologies from the present oil and gas cluster is upgraded, transformed and transferred to offshore wind. The negative scenario – just as realistic – describes a future with disincentives, failing firm strategies and lack of resources; and the wind blowing past the region.

The future of the regional offshore industry will depend on external developments as well as regional. By external developments we mean drivers beyond the control of the region and its firms. These external drivers are common for the two scenarios. The implication is that prices of offshore wind energy, alternative energy sources, grid connections, institutional framework and formal incentives are identical in the two scenarios. We do that to single out those drivers that have regional origins and hence those that the region, its firms and institutions may influence. This technique provides a clear regional focus, in particular for the industry itself, regional politicians and agencies.

Our ambition is not to delineate two detailed scenarios, but rather offer an example of how the foresight method can be used to carve out how different drivers may result in very dissimilar evolutions of clusters.

5.1 Scenario 1: Realizing the ocean of opportunities

In 2020 the region has developed a strong cluster related to oil offshore wind. This outcome is based on three main drivers. First the great potential for technology and knowledge transfer from oil and gas was exploited fully. Secondly, the region's general innovative capabilities proved to be applicable also in offshore wind, and thirdly, the region succeeded in attracting some of the highly demanding and influential international customers.

The region's experience from the oil and gas industry served us well in exploiting both the excellent wind resources off the coast and the huge international markets. Our ports and logistics proved to be superior for facilitating equipment and marine operations. Vessels were developed for complete installation, including foundations, turbines, substations and cables; and for maintenance of the offshore wind farms. Karmøy Industrial Park with its access to deepwater quays has become a center for product development and testing of offshore wind technology. Following extensive testing the floating concepts Hywind and Sway have both become international successes. Bergen Group Rosenberg is highly competitive with their substations. Their topside design and layout is based on a modularized flexible solution, where client requirements are fully accommodated. Together with their experience with EPCI contracts, BGR has become a big player in the offshore wind market. Systems for remote monitoring and control of installed turbines have been copied from the oil and gas industry, and have contributed to substantial leaps in productivity. The investments in "integrated operations" in the oil and gas industry really pay off – in the offshore wind segment. Efficient processes for cabling have also been imitated from the oil and gas industry.

Over the past forty years, the region has developed a strong innovation capability. As told by one of our interviewees: *"The region hosts an infrastructure which can draw any invention in detail. And what can be drawn, can also be made"*[10] Entrepreneurs are encouraged to repeatedly come up with ideas as they don't have to invest in factories in order to have prototypes made. The need for risk money is thus substantially reduced. This entrepreneurial system was instrumental and thrived in the offshore wind sector. Start-ups and SME's have proven to be innovative and have launched numerous highly valued components to the wind turbine manufacturers.

Having been convinced of the potential of the offshore wind market in 2010, the regional financial cluster took a proactive role and became an integral part of the emerging cluster. The internationally well reputed oil and gas oriented venture companies got more and more involved in offshore wind companies. Offshore wind parks on the Norwegian continental shelf were funded internationally, coordinated by the regional banks and their customers (park developers). Regional business angels entered the scene with equity for breakthrough technologies originated from academia and creative engineers wanting an alternative to the oil and gas industry.

10 Håkon Skretting, INTSOK

The success of start-ups and SME's all along the value chain was facilitated by the fact that some of the international wind turbine producers were attracted to the region. Access to major customers was thus greatly improved and comprehensive collaboration between innovative SME's and turbine producers became the rule. In addition, suppliers took advantage of the Hywind and Sway successes.

5.2 Scenario 2: The wind blows away

The natural resources are never enough to develop a viable industry. Companies in Rogaland has access to an excellent wind resource base, but a report in 2020 concludes that the most competitive offshore wind clusters have emerged in the UK and around Bremerhaven in Germany. In hindsight, the signs were there to see back in 2010. At the offshore wind workshop in Aberdeen May 18 2010, the business and research communities around the North Sea met to flesh out strategies for the next decade. Everybody was enthusiastic about the great opportunities in offshore wind, how could the performance become so vastly different? One observation proved eye-opening and sparked the suspicion that the Norwegians never would make it. The British representatives continuously stressed: "We need the jobs" and "We need the power". With an unemployment rate of 3% and ample access to clean hydro power, the situation in Norway was completely different. In other words, the incentives to prioritize offshore wind were of another order in the UK, Germany and Denmark. These observations were manifested in the fact that predictable and competitive regulations continuously lagged behind from the Norwegian government. Many interviewees to a report written in 2010 had asked the relevant question: "Do we want this development strongly enough, and do we have the motivation?"

The consequence was that large projects were located to other countries; the Norwegian continental shelf was not developed into a test bed of new offshore wind technology, like it successfully had been for oil and gas product development. This lack of a real laboratory made the Rogaland wind cluster less attractive for R&D investments. The Arena NOW initiative could not mitigate this development. When the supply of public funding discontinued, the infant cluster did not survive its adolescence.

Rogaland enjoys a reputation as an innovative region with entrepreneurial managers and employees. The firms could have seized upon the vast opportunities offered by the offshore wind market. They did not. All firms have scarce resources. All ideas cannot be developed and turned into products. From the pool of new ideas and concepts, some of them are selected for further development, testing, prototyping and marketing. These selection mechanisms are usually linked to beliefs about revenues and profitability. Ideas with higher profitability and best expected returns are ranked above those with lower or more risky returns. For firms embedded in the oil and gas industry, a high price of oil makes investments in oil and gas related innovations less risky with prospects of higher revenues. In other words, the potential of technology transfer from oil and gas will not materialize. With the prospects of a steadily high oil price and very comfortable revenues, the knowledge and technology transfer will be delayed and the Rogaland offshore wind cluster will lose the race to first mover advantages and standard setting.

These indications sounded overly pessimistic when introduced in 2010, but in 2020 (and before) it turned out that the theories on innovation proved true. Managers tend to repeat old successes. They want to do better what they already do and implement "best practise". However: "The time to search out and develop a new core resource is when the current core is working well"(Itami 1987). And managers do not realize until it is too late that core capabilities may turn to core rigidities in new circumstances (Leonard-Burton 1992). Capabilities are not easy to change because they include a pervasive dimension of values and beliefs. History may have an inhibiting effect.

The region put too much trust in the traditional oil and gas companies to take a leading role in offshore wind. Statoil's Hywind looked promising. As we approached 2020 it became evident that this innovative floating windmill was a stand alone effort. Neither Statoil nor the global oil companies were able to create business models that could deliver cost efficient products and systems to the much lower margin offshore wind market. These companies never appreciated fully that the latter constitutes a very different context from oil and gas, a context that they could not define themselves.

Greenfield companies tried to fill this gap, but in vain. With competent venture capital scarce in supply, they were not capable of seizing and utilizing the opportunities.

This case demonstrated that it was incorrect to assume that the information itself (of the formidable wind market) did not cause managers to seize the opportunities. Consciously or unconsciously, the offshore wind was not given the necessary dedication and priority. Those companies that made efforts to enter the market, was not successful. They were used to high margins and tailor made solutions for their customers in the oil and gas industry. Developing standard products and developing production processes suited for realizing economies of scale required a new set of capabilities. Furthermore, mass production was not the play former oil and gas engineers wanted to play. Developing standard products rendered low professional prestige and could not attract the most talented engineers and entrepreneurs.

The inadequate development of the regional offshore wind cluster was observed by the banks and the rest of the regional financial community. When their customers moved slowly and cautiously, they followed suit. The financial industry dedicated to fund the offshore wind cluster, located in the financial capital of Norway, Oslo.

6 Conclusion

The market for offshore wind is indisputable. According to the EWEA "Europe's offshore wind potential is enormous and able to power Europe seven times over". EWEA has a target of 40 GW of offshore wind in the EU by 2020, implying an average annual market growth of 28% over the coming 10 years. This translates to about 10.000 wind mills. Offshore wind is recognized as an integral part of EU's energy policies: "Offshore wind power provides the answer to Europe's energy and climate dilemma – exploiting an abundant energy resource which does not emit greenhouse gases, reduces dependence on increasingly costly fuel imports, creates thousand of jobs and provides large quantities of indigenous affordable electricity".

Regional managers are well aware of the ambitions in EU, and regard them as a major drive for the emerging offshore wind market. There seems to be an unambiguous belief in the long term consistency of these goals and ambitions, and thus a crucial political framework in which to operate.

The region has access to superior wind resources off the coast. In addition, the region can boast an internationally competitive and innovative oil and gas cluster which offers a vast potential for knowledge and technology transfer to offshore wind.

The combined effect of a substantial market, access to an everlasting natural resource, related knowledge and technology and a proven capability for innovation, should lead to a strong regional position within the growing offshore wind. These resources and capabilities should enable the region to become the true "Energy capital of Europe".

That path is not straightforward, however. The lack of political and economic incentives combined with the present and continued success of the oil and gas cluster, may impair the transfer of capabilities, human and technological resources to the offshore wind sector. The scenario "The wind blows away" elaborates how this may happen. This scenario – just as realistic as a more positive one – describes a future with disincentives, failing firm strategies and lack of resources; and the wind blowing past the region. A cautious financial industry not willing to take risks and build the prerequisite competences is included in that pessimistic scenario.

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