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Regional impacts of economic transition: From manufacturing to service and knowledge based development: Long term trends and recent Danish experiences in the Wind Energy industry

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First draft, please do not quote!

51th Congress of the European Regional Science Association

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Regional impacts of economic transition: From manufacturing to service and knowledge based development: Long term trends and recent Danish experiences in the Wind Energy industry.

Abstract:

Most mature industrial economies faced the challenge of severe structural changes in the last decades. Traditional manufacturing moved from the metropolitan and central regions to the periphery. Later the value chain in most industries changed toward knowledge intensive and service activities. This tendency has been reinforced by the trend toward globalization and recently by the impacts of the financial crisis.

The aim of the paper is to sketch the long term trends of regional and industrial development in Denmark; and to identify the drivers of economic and geographical change in the production system Denmark belongs to. The starting hypothesis is that the long term transition is driven by a combination of domestic and international factors. The first part provides an overview of the Danish economy in an international perspective focusing on structural change (i.e. the relative size of primary, secondary and tertiary activities) and the impacts of the internationalization. The second section provides an analysis of the regional structural change in Denmark with special attention on the impacts of globalization and the changes in the international production system. The main focus is on the fact that the global financial crisis seemingly has been a catalyst of a process of change, with probably irreversible impacts on the geography of economic activities in Denmark.

The third part digs deeper into the processes of regional and functional transformation based on a case study of the Danish wind power industry facing fierce global competition and the challenges of international relocation, with heavy regional consequences for employment. Regional impacts in particular in Western Denmark have been significant both with regards to employment and value-added. The functional and competence profile of the industry in Denmark has transformed, reducing the content of physical production.

Currently two tendencies are identified; the move from a production to a skill and knowledge based industry integrated in a global value chain, and an increasing importance of construction and service provision for production capacities in offshore locations.

Keywords: International interdependence – regional and structural change – a new functional division of production – toward a service based economy

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1. Introduction

Most mature industrial economies have faced the challenge of severe structural changes in the last decades. First traditional manufacturing moved from the metropolitan and central regions to the periphery. Later the value chain in most industries changed toward knowledge intensive and service activities. This tendency has been reinforced by the trend toward globalization and recently by the impacts of the financial crisis.

The aim of the paper is to sketch the long term trends of regional and industrial development in Denmark; and to identify the drivers of economic and geographical change in the production system Denmark belongs to.

The starting hypothesis of the project is that the long term transition is driven by a combination of domestic and international factors. The regional pattern and timing of the process differs according to industrial structure and economic cycles.

The first part of the paper provides an overview of the Danish economy in an international regional perspective focusing on income and structural change (i.e. the relative size of primary, secondary and tertiary activities) and the impacts of the internationalization. The second section provides an analysis of the regional structural change in Denmark with special attention on the impacts of globalization and the changes in the international production system, with point of departure in the wind energy sector. The main focus is on the fact that the global financial crisis seemingly has been a catalyst of a process of change, with probably irreversible impacts on the geography of economic activities in Denmark.

The third part of the paper aims to dig deeper into the processes of regional and functional transformation based on a case study of the Danish wind power industry facing fierce global competition and the challenges of international relocation, with heavy regional consequences for employment. Danish companies are among the pioneers in the wind energy business, and still some of largest global players of the industry are based in Denmark i.e. Vestas and the wind turbine division of the German Siemens company. Regional impacts in particular in Western Denmark have been significant both with regards to employment and value-added. In recent years the global picture has changed, the location of the industry and the value chain has become more global, moving toward new productions sites and markets. The functional and competence profile of the industry in Denmark has transformed, reducing the content of physical production.

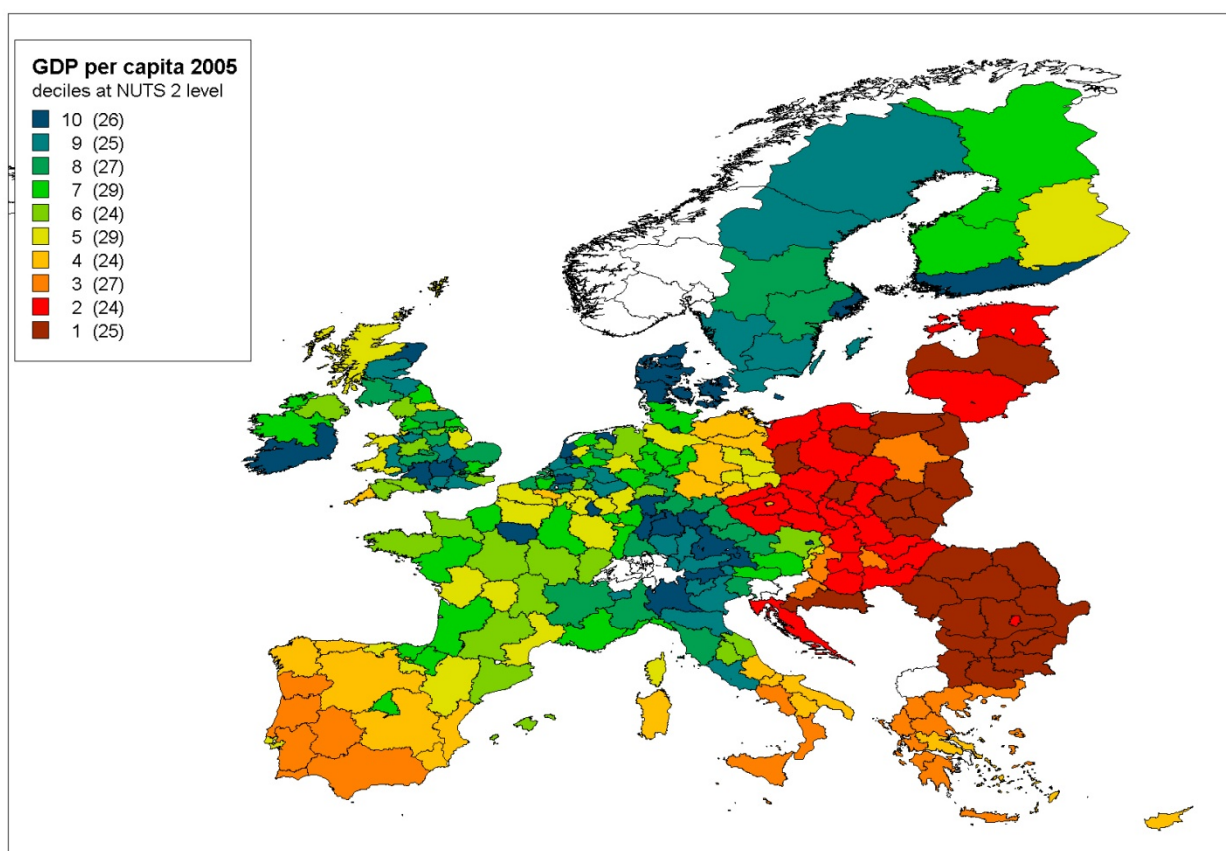
Currently two tendencies are identified; the move from a production to a skill and knowledge based industry integrated in a global value chain, and an increasing importance of construction and service provision for production capacities in offshore locations. The case study¹ provides a first assessment of the regional economic implications of this tendency.

¹ The case study is based on a study provided within the framework of and project supported by the Growth Forum for the Region of South Denmark and the EU, for details see Energi på havet (2011).

2. Danish Economic Cluster Structure in an European Perspective¹

The Danish economy has experienced an evolution similar to many other of the European economies during the past decades. This implies that the regions in Denmark with high incomes are specialized in services, financial services etc., whereas the regions with lower income are specialized in primary and secondary production. The former are mainly located in the urban regions in the metropolitan areas of Copenhagen and the Eastern Jutland growth belt (Cornett & Sørensen 2007), whereas the latter predominately are located in the rural regions.

Figure 1 Distribution of GDP per Capita in € 2004 by Deciles



Note: Statistics for Norway, Slovenia, Switzerland and most Balkan countries has not been available.

Source: Own calculations based on Eurostat (2007).

However, in a European perspective Denmark is a high income country with fewer if any regional problems; see Cornett & Sørensen (2009b).

¹ This section is based on Cornett & Sørensen (2009a). Due to data problems a detailed analysis of the regional and industrial transition is delayed and will first be available at the conference.

The remaining part of this section aims at to shed some light on this issue in an European perspective. To examine the topic a data set of GDP per capita by regions was divided into deciles. The evidence is shown in Figure 1, where it is observed that all Danish regions belong to highest income decile (10th decile). In general, the wealthiest European regions are found among the original EU-members, the UK and the Nordic countries. The accumulation of wealth is due to an early industrial development and the fact that these countries also are the frontrunners in industrial change toward a service and knowledge based society. The growth drivers behind the wealthiest regions of Europe can to some extent be identified in statistics from the European Innovation Scoreboard (EIS), (Innometrics 2006). The EIS provides a comparative analysis of innovation, and is originally developed as an instrument to assess, evaluate and compare the innovation performance of the European Union. The EIS is based on statistics from five main categories and at the regional level. The scoreboard is built up on seven regional indicators, based on concepts inspired from new economic growth theory. The regional innovation scoreboard indicators are summarized in Table 1 below. At the regional level innovation performance statistics is available for 202 regions are reported for 2006 at the NUTS 2 level.

Table 1 Regional Scoreboard Variables

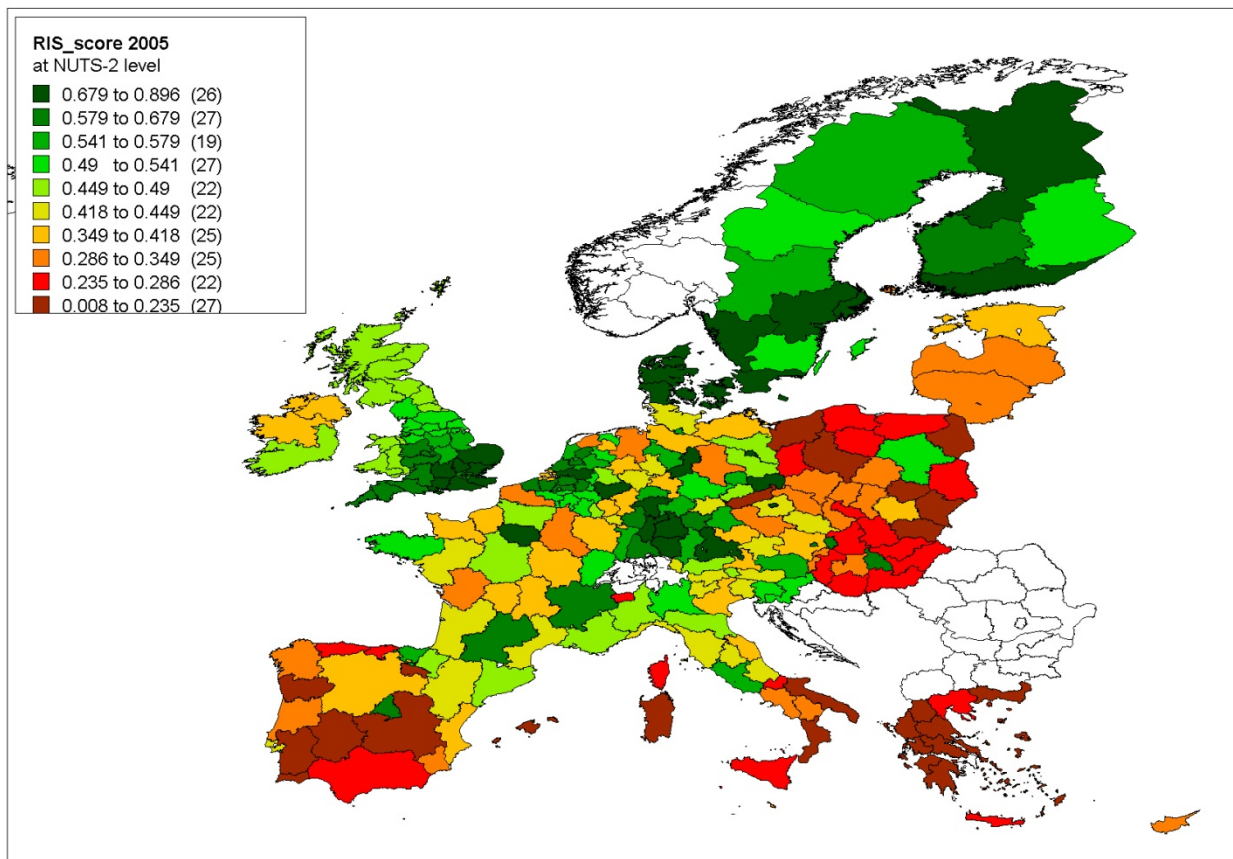
<i>Variable:</i>	<i>Measurement:</i>
Knowledge workers	Science and technology – core per cent of population
Life-long learning	Participation in life-long learning per 100 population aged 25–64
Medicine and high-tech manufacturing	Employment out of total workforce
High-tech services	Employment in high-tech sectors in per cent of total workforce
Public research and development	Public R&D in per cent of GDP
Business research and development	Private R&D in per cent of GDP
Patents	EPO patents per million population

Source: Innometrics (2006) page 28.

Figure 2 provides an overview of the scoreboard-performance by region in Europe. The similarities to the result presented in Figure 1 are astonishing. First, regions with high incomes have also high values on the scoreboard. This is especially true as regards the Nordic EU-members, the UK,

Belgium and the Netherlands. Second, countries such as France, Spain and Italy are quite diversified. The high German score in the scoreboard (see Innometrics 2009 & 10) disguises high regional differences, due to in particular high regional performance in the South and some metropolitan areas throughout the country, i.e. Hamburg, one of the richest European regions. These observations are in line with the concept of entrepreneurship capital developed by Audretsch and Keibach (2005). Regions with high GDP per capita are positively correlated with entrepreneurship and innovation.

Figure 2 Innovation Scoreboard Indicator by European Regions 2005



Source: Innometrics (2006).

The German example in mind indicates the need to analyze the growth drivers not only in a national but also in an economic performance context. Therefore this paper investigate the relation between the level of income and the innovation performance by decile, we can combine the information of the two maps. This is done in Table 2. Here, the elements of the scoreboard by region are related to

our dataset of the logarithm of GDP per capita sorted by deciles from Table 1. In this way the coefficients of our variables will indicate a positive, negative or non-significant contribution to economic growth. Note that we initially have to sort out regions where no innovation statistics are available. Unfortunately, this is especially true in the first and second decile. We have then pooled the data in these two groups. The result of the regressions by deciles can be found in Table 2.

In general, the performances of the regressions are poor. This is due to the relative small number of observations and consequently a low number of degrees of freedom. Due to this problem we have also pooled decile 6 and 7; and decile 8 and 9.

Table 2 Influence of Scoreboard Classification on GDP by decile

	<i>CON</i>	<i>KW</i>	<i>LLL</i>	<i>MHTM</i>	<i>HTS</i>	<i>PR&D</i>	<i>BR&D</i>	<i>PAT</i>	R^2	<i>Standard Error</i>	<i>Obs.</i>
	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7			
Total	8.44***	5.42*	2.23	2.38	3.41	1.28	-0.74	12.35***	0.40	0.58	202
1+2. decile	7.79***	26.2***	12.7***	3.82*	-5.06	6.11	-1.16	5.54	0.69	0.16	30
3. decile	9.10***	-1.68	10.46***	8.01***	7.91***	-3.97	-1.95	5.61	0.69	0.21	23
4. decile	9.23***	1.49	-3.97	4.01	7.16***	0.20	-2.59	10.71***	0.59	0.16	24
5. decile	9.51***	-1.25	-0.21	1.53	-0.40	0.10	-2.33	6.95**	0.21	0.20	33
6+7. decile	9.75***	4.89***	3.57***	2.82**	1.94	0.51	0.76	8.41***	0.54	0.15	49
8+9. decile	9.84***	2.93	2.84**	1.40	-2.37	-0.62	-0.72	2.63***	0.49	0.14	42
10. decile	10.54***	2.28	6.75*	-2.95	1.10	-1.24	-1.05	4.13**	0.36	0.24	25

Note: * Indicates weak significance (10 % level); ** Indicates significance (5 % level); *** Indicates strong significance (1 % level). The variables are described in Table 3. CON = constant term; KW = knowledge workers; LLL = Life-long learning; MHTM = Medicine and High-Tech Manufacturing; HTS = High-Tech Services; PR&D = Public Research and development; BR&D = Business Research and Development; PAT = Patents.

Source: Sørensen & Cornett (2009a) based on statistics from Eurostat (2007) and Innometrics (2006).

In general, we observe that all significant coefficients take the correct signs. For all regions taken together, only the presence of knowledge workers and patents has a positive influence on GDP. In general, it is also observed that neither public nor private research nor development is significant. For the 10th decile where the regions of Denmark are located the presence of patents and life-long learning is of most importance. This all mean that new developments in combination with high

productivity in traditional industries like for example metals are of significance. This is exactly the case with the Danish windmill cluster located in rural western Denmark.

In addition, it is likely that the wealthy deciles are better equipped with the capital needed in order to develop and implement new the technology embodied in patents. The presence of patents also restricts other producers or regions to adapt the new methods. What happens then? For example, a patent of a given process of production is outsourced to a poorer region with a well-equipped and wage competitive labor force for example in Eastern Europe. Then the localization of the outsourced plant will raise the level of GDP per capita in the considered region.

A tentative conclusion of this section is that the regions with the highest GDP per capita also are the regions with the best performing R & D, production development and related services.

The next section next section analyzes this issue in a specific industrial and regional context based on the Danish Wind turbine industry in Western Denmark¹.

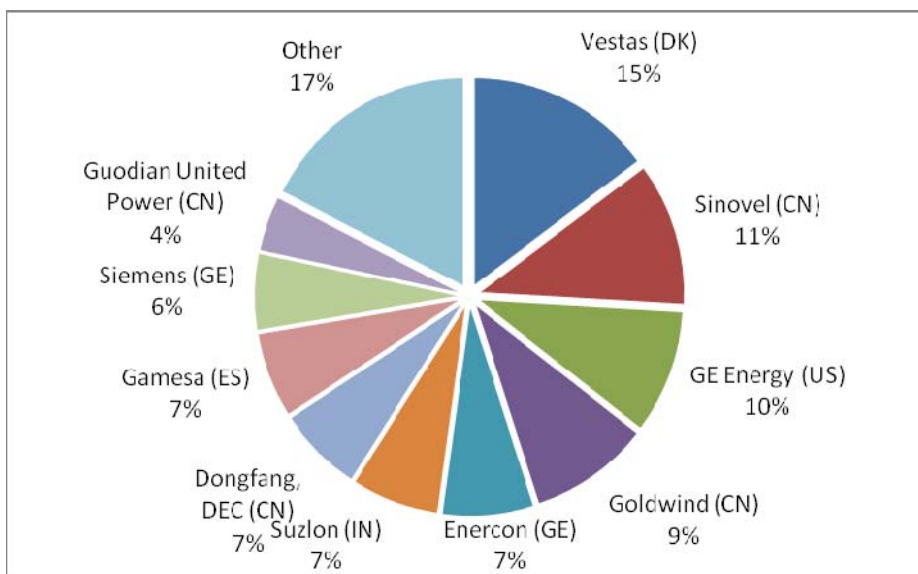
¹ The regional and service related aspects are closely related to the region south of the border, undergoing a similar development, also facing the challenge of outsourcing and relocation. Repower Systems one of the leading German producers, now owned by Indian Suzlon (see figure3 in the next section) with production sites in Husum has recently decided to add additional production facilities of Repower wind turbines in India rather to expand the existing facilities in Northern Germany due to cost pressure. More serious are the implication for R&D in the region (Nordschleswiger, 8-6-2011). In the long run this also will challenge the location as one of the most important locations for wind power related fairs in the world, questioning the growth potential in the non production related activities in the future.

3. Wind energy industry in Denmark – from production to system provider

3.1 The industry in an economic and regional context

Traditional the location of the Danish Wind energy sector was in Western Denmark with strongholds in Western and central part of Jutland, with an geographical wide spread regional system of subcontractors. The profile of the Danish windmill cluster has changed in recent years, the industry is consolidated with the two companies Vestas and the German Siemens Windpower as the major Danish anchors, and with a strong position in the global markets for wind turbines and providers of turnkey solutions. Nevertheless the past dominating position does not exist any longer, due to the partly due to the absolute increase of the volumes produces, and most important due to new competitors, see figure below:

Figure 3 Installed Wind Turbine Market Shares 2010



Note: According to BTMConsult installed capacity 2010: 39.4GW, http://www.btm.dk/public/Navigant_WMU2010_ReportRelease.pdf, <http://borsen.dk/>

Source: Here quoted from Ekopolitan (2011).

For the moment Danish based producers still maintains a significant position in the wind turbine segment. According to the latest figures Vestas still has the lead as the largest producer (14.8%) with production facilities in many regions. Siemens is currently ranked no.9 with a marked share of 5.9 % (see figure 3) (Windpower Monthly, May 2011). On the European off shore market the Danish based producers maintain their leading position regardless the fact that the importance of the

Danish home market becomes more and more insignificant. Vestas (63 %) and Siemens (32%) were almost sharing the EU offshore market between them in 2010, maintaining the lead since the first off shore wind turbines were connected to the grid in early 1990's (GWEC 2011, p.38)¹.

The significance of off-shore windmills or turbines has increased relative to the land-based wind turbines in North Western Europe. This is especially due to the negative externalities and noise nuisances that make it difficult to find new suitable areas on land. With a long coastal line relative to her size, and no deep sea areas, Denmark is an ideal country for off-shore windmill parks. Further, the distance to harbor facilities is in general short.

3.2 Paths of development

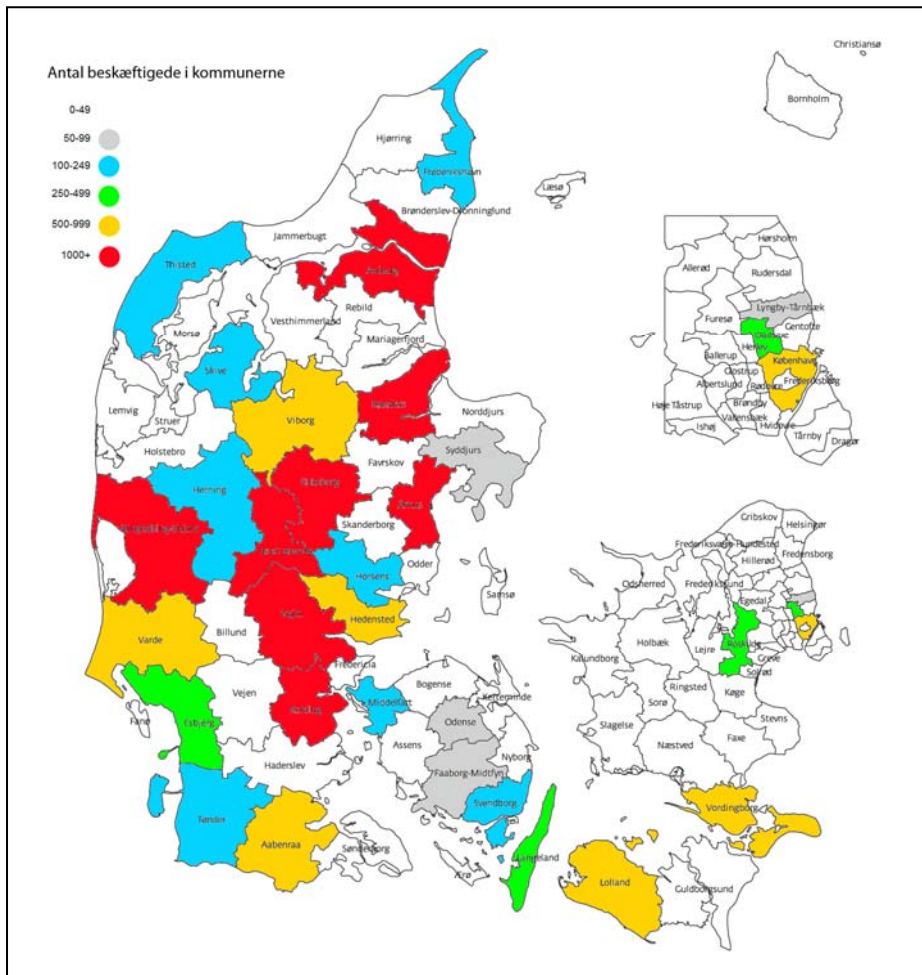
The Danish Wind energy industry can be characterized as a national cluster according to the cluster classification developed by M. Porter. Originally the cluster was mainly based on production of windmills, but now extended to service, research and development and the provision of turnkey projects. According to Porter (2003, p.562), a cluster is defined:

“...as a geographically proximate group of interconnected companies, suppliers, service providers and associated institutions in a particular field, linked by externalities of various types. ...Clusters are important because of the externalities that connect the constituent industries, such as common technologies, skills, knowledge and purchased inputs”.

Originally the industry developed in a decentralized pattern often with starting point in small local enterprises serving local customers. The development was supported by generous support scheme for customers investing in wind power through the pricing scheme used for power supplied into the grid. Today wind energy related activities are geographical spread throughout the country, with in particular production related stronghold outside the metropolitan area of Copenhagen and Århus. Research and development, marketing and managerial functions have to some extent moved to these areas, see figure 4 below displaying the location of the Danish wind energy industries employment.

¹¹ For more information see Cornett& Sørensen 2011, section 2.2.

Figure 4 Geographical distribution of employment in the Danish wind power industry (Number of employed in municipality 2009)



Source: Vindmølleindustrien (2011).

It is important to note that Porter explicitly stressed that an industry can become a part of several clusters¹, which can cause problems in the empirical assessment of cluster performance (i.e. with regard to employment). From a conceptual point of view the issue is solved by a distinction between narrow and broad cluster definition. The former is based on the strongest geographical and location ties of a particular industry. Broad clusters include all industries in the cluster (Porter 2003,

¹ The Danish wind energy industry is a good example. According to a survey from the Federation of Danish wind turbine producers 1/3 of the members have less than 25 % of their turnover in the sector, 1/3 more than 75% and 1/3 between 25 and 74 %. (Vindmølleindustrien 2008).

p.563), see also Porter (1998, p.199ff.) for a general elaboration of the concept of clusters. In this sense, the cluster shares many features with the more general concepts of production systems (or from a firm-level, value chains). This narrow concept shares many features with main stream industrial district literature, focusing very much on the inter-firm networks in a specific sector or area.

The development of the wind energy sector has become an important instrument in regional economic development policy sometimes by chance like the initial growth in Western Jutland, but with significant impacts on employment in periods of structural change. The growth usually took place in the production and benefited from an existing pool of skilled labor. In the last decade more conscious strategies were launched to facilitate the growth and improvement of the value chain. After a successful period of regional spread of activity the current trends toward globalization and outsourcing has created new economic downturns in peripheral regions that temporary benefitted, like the Nakskov area on Lolland where an old shipbuilding area partly were revitalized.

The crucial problem is to avoid creating new industrial mono structures based on a temporary boom. In a wind power perspective this risk seems to be obvious the global trend of the industry taking into account. That the development of off shore wind parks can have large potential can be illuminated by the case of Bremerhaven (European Wind Energy Association 2009, p.60), and traditional port and fishery city located on the mouth of the Weser river in Northwest Germany. Until 2009 700 new jobs were created in the city, covering traditional production of towers and blades, of shore foundation structures etc. The development of the sector was supported by tradition measures of industrial policy, R&D and other knowledge institutions (i.e The Fraunhofer Institute) which operates a rotor blade test facility, and the university of applied science, (Fachhochschule Bremerhaven), representing a classical triple helix setup¹.

A crucial condition for a successful and lasting structural policy is to create a sustainable basis which can adapt to alterations in the economic environment. In our case this implies not to rely solely on production of equipment, but to become a center of high end value-added functions and or to develop service linked to the operation of installed capacity.

¹ See Cornett & Ingstrup 2010, pp. 56-58.

4. Regional service clusters

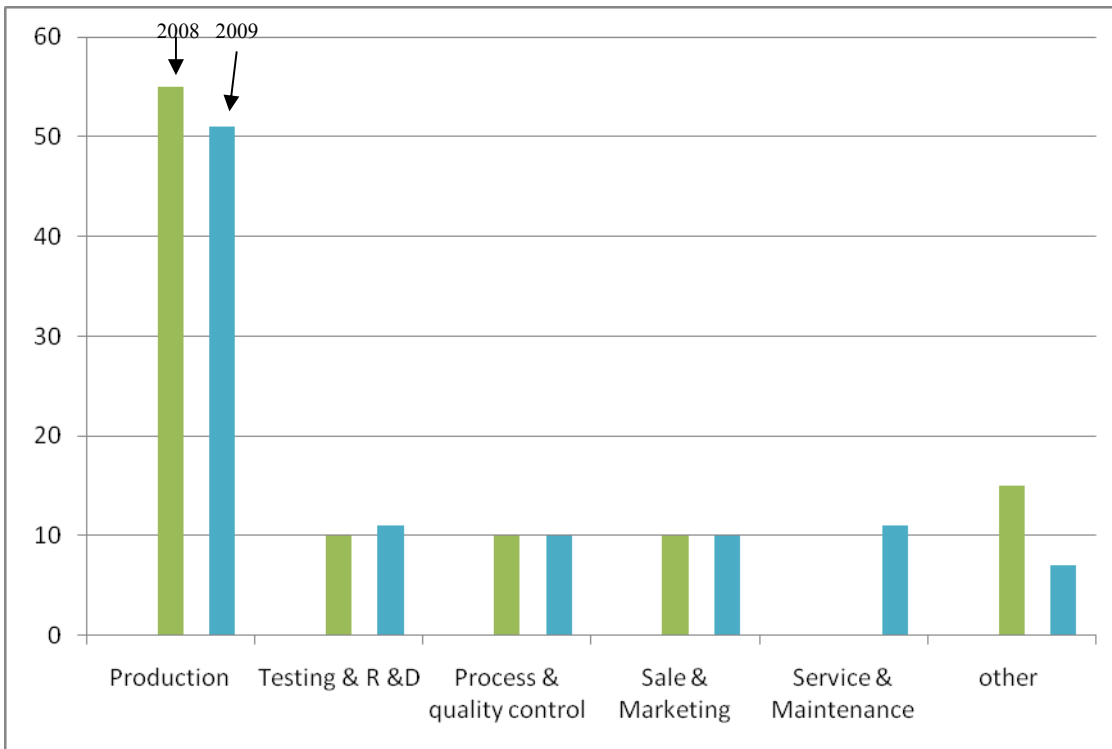
The above sketched narrow concept of a cluster shares features with main stream industrial district literature, focusing on the inter-firm networks in a specific sector or area, covering both production and service activities. The Danish wind energy industry is a good example of the ongoing functional shifts taking place within an industry, often hard to identify in official statistics. Companies maintain their statistical classification regardless the fact that the nature of activities shifts.

The wind turbine industry has developed in a specific economic and institutional setting. The final output, electricity is sold on a highly competitive market under institutional/regulatory and infrastructure constraints. In particular the latter is of growing significance when the overall share of wind energy is increasing, national as well as in a trans-European perspective. Therefore the grid infrastructure (see European Wind Energy Association 2009, pp. 25ff) and production cost are crucial parameters for the industry, affecting regional development opportunities for the sector. Recent global trends in the industry are pointing toward production close to main customers, implying that the market share of electricity production in the location Denmark will erode over time, weakening the local manufacturing base of the industry. In this perspective location advantages will deteriorate from a production point of view, but persist and according to recent forecast (European Wind Energy Association 2009) increase in a service and maintenance perspective.

For the above mentioned reason the shift toward service is hard to identify in official statistics, but information from the industry illuminates the tendency. According to the annual reports from the Danish Windmill industry (Vindmølleindustrien 2009 & 2010) a weak trend away from traditional production seems to be visible¹, see figure 5 below.

¹ The relative measures are affected by the decline of total employment from 2008 to 2009, and reductions in employment usually is much faster in the blue color sector due to the Danish labor market regulations, and this may to some extent explain the structural shift.

Figure 5 Job functions in the Danish Windturbine industry ultmo 2008 and 2009 (pct. of employment)



Note: 2009 other includes ‘Service & Maintenance’

Source: Vindmølleindustrien (2009 & 2010)

The development of service related activities is easier to follow in a local location and business development perspective. The remaining part of this section aims at illuminating this aspect based on the current development in the southern part of the Danish west coast.

Due to few tide independent harbors on the eastern rim of the North Sea the development of an off shore wind energy service and maintenance cluster building on the experiences from the oil and gas off shore cluster seems to be promising, also in a cross-border perspective taking the planned German off shore wind turbine parks into consideration¹. The starting point is different and obviously targeted at a lower level of ambitions than the above mentioned example from Bremerhaven in Germany.

The idea to establish a regional service cluster for off shore the wind energy sector is partly a spin off from the successful off shore oil service sector developed in the Esbjerg area since the beginning

¹ Dena (2011) & Der Nordschleswiger (18.6.2011).

of the oil production in the Danish North Sea in the late 1960's and early 1970's, partly a consequence of the fact that wind energy production in the last decade has moved from land to off shore locations. From a principal point of view at least three types of activities are at stake:

- Transport of large scale construction unit's to foreign customers or to off shore wind parks.
- Service related to the establishment of off shore wind energy facilities
- Service and maintenance of existing off shore units.

Furthermore the overall restructuring of the electric power supply system toward renewable energy requires alterations and extensions of the national and international energy network, in particular the high voltage power grid, creating additional demand in the construction and service maintenance industry.

Denmark has in an international perspective, a long tradition for off-shore windmill parks. From the establishment of the first park in 1991, a total of 13 parks have been established. Figure 6 provides an overview of the location of the established off-shore windmill parks and the possible positions for future parks around the coast of Denmark.

Together, all windmills – land based as well as off-shore turbines amounts in a normal wind year, for approximately 20 percent of the Danish electricity demand. About 1 percent of the wind power production is exported. The main problem with wind turbines is that the production costs per unit energy are higher than for conventional fossil based electricity. This is especially true for off-shore windmills. This is due to high costs of establishment and transportation of the power, and the costs of service and maintenance required during the life time of the wind parks on the sea. These functions are currently conducted in association to existing off shore facilitation companies, but new actors are entering the scene.

The harbor of Havneby is located at the southeastern tip of the island of Rømø (see insert in figure 6) with relative good access to deep water. The post was established in the early 1960's as a state owned harbor, now owned by the municipality of Tønder in the southwestern corner of Denmark adjacent to the German Border. The traditional economic base of the port was fishery and a ferry line to the German island of Sylt, housing some of the most popular summer and beach resort in Germany. The off shore wind service aims partly to replace the shrinking activities in the two

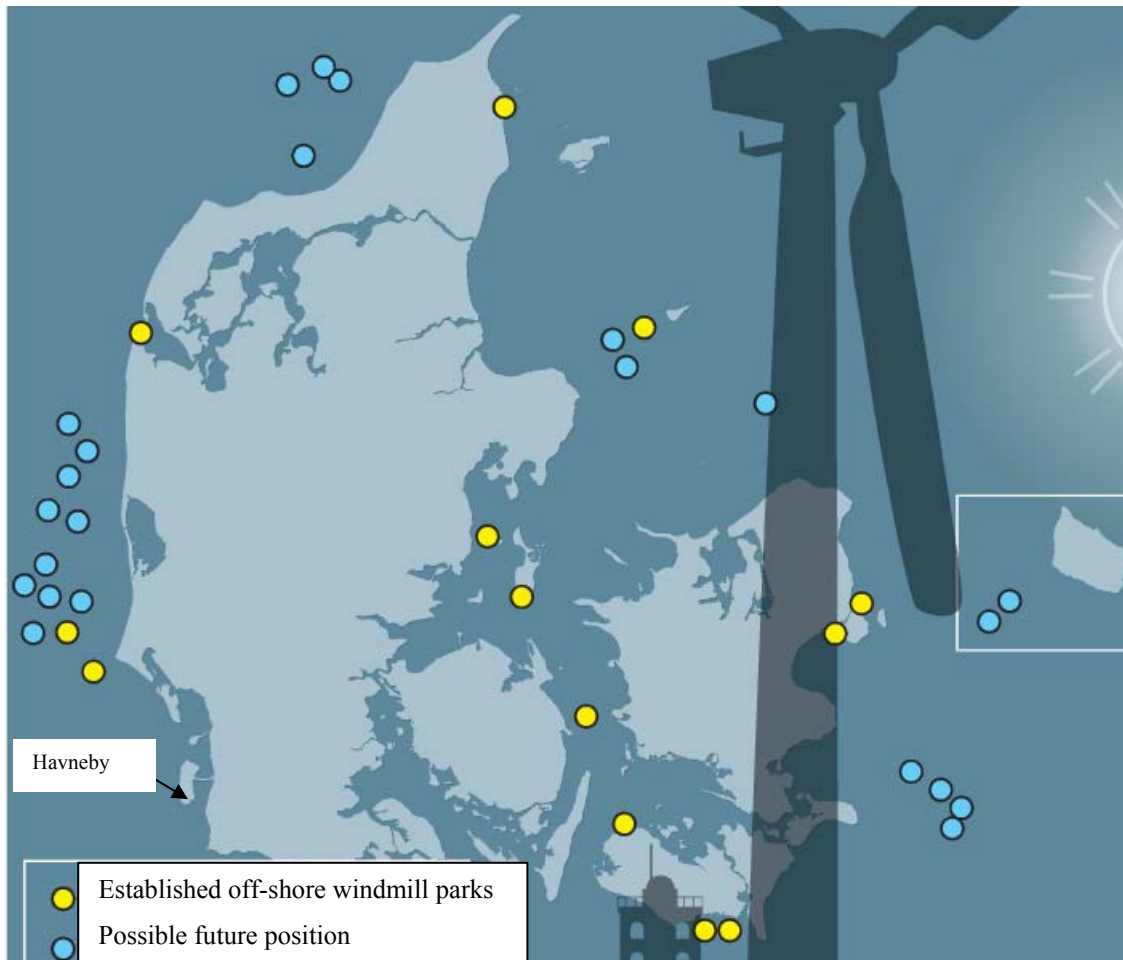
traditional legs, partly constitutes the initiative an attempt diversify the economic base of the port¹. The strategy mainly focuses on the last two of the above mentioned aspects of Windpower related services, related to the establishment of off shore wind energy facilities and service and maintenance of existing off shore units. The port has started an extensions program, to increase the available amount of land for harbor activities and to improve road access to the area. In particular the latter has potential adverse effects on the most important industry on the island, tourism. So far only few new companies have decided to locate in Havneby, and a successful development will to a large extent depend on the realization of the planned off shore wind park at Kriegers Flak located on the sea boarder between Denmark and Germany west of Rømø and Sylt, see figure 6 above. In a general perspective the prospects of the initiative will depend on strategic decisions within the offshore wind power related industry in both countries. In a Danish context the competition with Esbjerg may become decisive, partly due to lack of capacity (in competition with the incumbent oil and gas cluster) and of course for cost reasons. In a German perspective the competition comes mainly from the established wind power location in Husum (with relative poor harbor access during low tide, approx. 50 km south on the) continent and the overall focus on wind energy related economic activities in Schleswig-Holstein² and Northern Germany (Dena 2011, & Nordschleswiger 18.9.2010).

Whether the local initiative will be successful or not is impossible to evaluate yet, but the local examples from Denmark and Germany at least prove that the development of off shore wind energy has the potential to create new economic activities and contribute to a diversification of the service related activities in a region to a large extent depending on tourism and traditional economic activities. In an industry perspective the structural changes within the value chain seems to be affected as well. Service related activities can at least partly create employment for people facing unemployment caused by the relocation of production. Furthermore service and maintenance will become a lasting source of employment when the stipulated blueprints for off shore energy production in Denmark and Germany are carried out.

¹ Most of the information about Havneby is based on an interview with the portmanager Kristen Nedergaard, conducted January 11, 2011.

² The Ministry of economic affair launched a program to support wind energy related activities in 2010, which supported an industry network (Windcomm). One consequence are plans of the German port to cooperate with regard to wind power related activities (Nordschleswiger 18.9.2010).

Figure 6 Actual and Possible Positions of Off-shore Windmill Parks, Denmark 2010



Source: Ministry of Environment, Off-shore Windmill committee, 2010. Here quoted from the newspaper, Politiken, September 10, 2010 (In Danish: Energistyrelsen, Havmølleudvalget)

5. Summary and perspectives

The aim of this paper is to analyze the patterns of and the drivers behind the structural transition of the Danish economy in a regional context with special attention on the service sector. First of all the overall transformation of the mature European industrial economies toward a service based economy has redirected economic growth towards the center regions after a period of high growth performance in the western part of Denmark since the late 1960's (see Illeris 2010).

Overall we have seen a change from production toward service based industries in most mature industrial nations, and only few countries (i.e. Germany and Japan) have kept a strong and relative significant industrial base in their economies. This has obviously strong geographical implications, in Denmark and is in particular visible in the return of the Copenhagen region as an engine of economic growth, driven by R&D related activities, financial service and until 2008 an amazing building boom.

This is not only a general pattern but has also affected specific sectors, i.e. the Danish wind turbine industry, traditional a stronghold in Jutland, but can also be identified in other industries, i.e. textile where an increasing share of value added is taking place outside the core area of the traditional Danish textile cluster.

In the Danish windmill industry a significant increase of employment has taken place in the Copenhagen area and Eastern Jutland (Århus and Randers). The latter is partly a consequence of the merger between the two largest Danish companies a couple of years ago, when the headquarter of Vestas moved to eastern Jutland. In the long run the outsourcing of physical production and the concentration of the upper end service and research and development functions in the center regions are the most important feature of the industry, weakening a stronghold of the nonmetropolitan regions of Denmark.

With regard to service related activities the peripheral (coastal) locations have to focus on maintenance and service function related to the operation of off shore wind energy parks, and of course the construction of new capacity and the extension of the power transportation grid.

In the long run further analysis of the transformation processes, both on the societal level and within specific industries are needed, i.e. a cluster and regional knowledge perspective, if a lasting economic decline and in the long run a depopulation of the periphery should be avoided.

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