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THE ACTORS OF A WIND POWER CLUSTER: A CASE OF A WIND POWER CAPITAL

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Abstract: Raahe is a medium-sized Finnish town on the western coast of Northern Finland. It has declared itself to become the *wind power capital* of Finland. The aim of this paper is to find out what being a wind power capital can mean in practice and how it can advance the local industrial business. First, the theoretical framework of this systematic review study was formed by searching theoretical information about the forms of industrial clusters, and it was then examined what kinds of actors take part in these types of clusters. Finally, the actors of the case area were studied. The core companies of wind power clusters are the wind turbine manufacturers, component manufacturers, developers of the wind farms, wind power operators, and service and maintenance organizations. Understanding of the wind power cluster structure may help decision makers to develop the best possible conditions for the emergence of clusters.

Keywords: Cluster, wind power cluster, cluster model, actors of cluster

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INTRODUCTION

The aim of this study was to clarify what kinds of actors take part in wind power clusters and what kinds of possibilities the case area has for the emergence of a wind power cluster. Because there is no specific definition for the concept of wind power cluster, it is first defined on the basis of existing knowledge and combining it using different sources. The actors of a cluster and the possibilities of the case area are then studied.

The case area is the city of Raahe and its sub-region. Raahe is a medium-sized Finnish town on the western coast of Northern Finland (64°41'N, 24°28'E). The location of the case region is shown in **Fig. 1**. A significant amount, approximately 20 per cent, of Finland's wind power capacity is produced in Raahe and its sub-region. In addition, around twenty new wind farms have been planned for this region (Sarja & Halonen, 2012). Wind farms consist of many wind turbines set in areas favorable for wind power production (e.g. Hossain *et al.*, 2007).

The local media (e.g. Keskinen, 2011; Nousiainen, 2010; Tuikkala, 2010; Veräjänkorva, 2010) has reported about the goal of the city of Raahe to become the *wind power capital of Finland*. No concrete plans or actions have been commenced yet. The objective of this study is to investigate what being a wind power capital can mean in practice and how it can advance the local industrial business. The wind power capital approach is studied in the framework of cluster theories.

In general, the approach concerns a regional business and know-how center, i.e. a polis or cluster. The polis concepts have been utilized more or less successfully in Northern Finland (e.g. Jauhiainen, 2006). A loose definition of a polis is a know-how center focused on a certain sector of high technology (Multipolis, 2009). A cluster means a business center in which the networked companies strive for competitive advantages with the help of cooperation and common supply chain management (Silen, 2001). From a wider point of view, there are also other actors in clusters in addition to the core companies, namely the suppliers, support businesses, and the public sector including education and research organizations (Porter, 1998).

The wind power cluster seems a promising regional undertaking. There is already heavy industry and its supporting business know-how in the case area, as well as required infrastructure. It can also be said that the case area already has wind power tradition. The wind power capacity of the case area is remarkable in the domestic scale. Besides the conventional energy sources, renewable energy sources including wind power play a vital role in satisfying the energy demand (Hossain *et al.*, 2009).

Fig. 1 Location of the case region.

Moreover, the use of renewable energy sources is constantly growing, and thus wind power construction is on the increase and there are numerous wind power projects taking place in Finland. Finnish wind power construction is governed by the climate change and energy strategy, which is based on the climate and energy packet initiated by the European Commission in 2008 (Ministry of Employment and the Economy, 2008; European Commission, 2007).

Research and Methods

The research method in this study is systematic review. Systematic review means identifying, evaluating, and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest (Kitchenham, 2004).

The theoretical material in this study consists of scientific and professional literature on clustering theories. The empirical materials include professional literature, various reports, articles of local media and web sources of the local public sector, open interviews, and for example higher education-level research exercises and theses.

In this review, we have first familiarized with the cluster development theory using especially the diamond model by Porter (1998) and then reviewed the actors of the wind power clusters. Finally, we have analyzed the possibilities of the case area for wind power cluster emergence; what elements and factors already exist and for which elements should the best possible conditions be developed. This model should also clarify the concept of the wind power capital (of Finland).

LITERATURE REVIEW

Regional groups of enterprises have been researched as a clustering phenomenon already for a long time. Early researchers, such as Von Thünen (1826), Launhardt (1885), and Weber (1909), explain the benefits of regional networks with savings in transportation costs.

Marshall (1890) can be regarded as the first real cluster researcher and he is often quoted as the first researcher who brought together business productivity, location, and proximity to other companies in the field (Vom Hofe and Chen, 2006). Marshall found other long-term advantages in clustering, such as the spread of information between enterprises, (skilled) labor market development, and cost benefits by achieving non-commercial sharing inputs (e.g. research and training). Vom Hofe and Chen (2006) have made a comprehensive summary of the past and present state of cluster study. According to them, the starting point of the current cluster research can be considered to be the first edition of Porter's *The Competitive Advantage of Nations* in 1990, in which he investigated 883 clusters in 49 different countries.

In the last couple of decades, a lot of research has been done on the emergence of clusters. The emergence of cluster research is likely to have been affected by findings of a specialized industry and regional competitiveness increase. The most well-known cluster is probably Silicon Valley located in the San Francisco Bay area. In previous studies (Cooke 1998, 2003), it has been found that there is something systematic in the concentration of industry in the same line of business. According to Nummi and Lahenius (2003), a local innovation system consists of (manufacturer) companies, component suppliers, service providers, customers, research and educational institutions, commercial associations, and the public sector actors.

Cluster Navigators Ltd. (2001) divides clusters into three types; national clusters, regional clusters and commercial clusters. National clusters resolve national matters, such as policy or infrastructure and the scale of them (e.g. industry-specific IT-clusters). The regional clusters focus on developing a business environment for the member companies and their support businesses as well as public sector organizations including educational and research institutions. Commercial clusters are multiple consortia. The wind power cluster planned for the case area is clearly a regional cluster.

The concept of cluster can easily be confused with that of network. A network, however, is built around a single company, and it describes the company and its interest groups regardless of the network members' locations. A cluster means a group of enterprises in a same line of business and their relationship to (regional) networks (Silén, 2001).

Cluster Analysis

The "diamond model" (**Fig. 2**) by Porter (1998) is the most well-known cluster model, and many other models are based on it (Haverinen, 2011). It can be used in cluster analysis to understand the operating environment

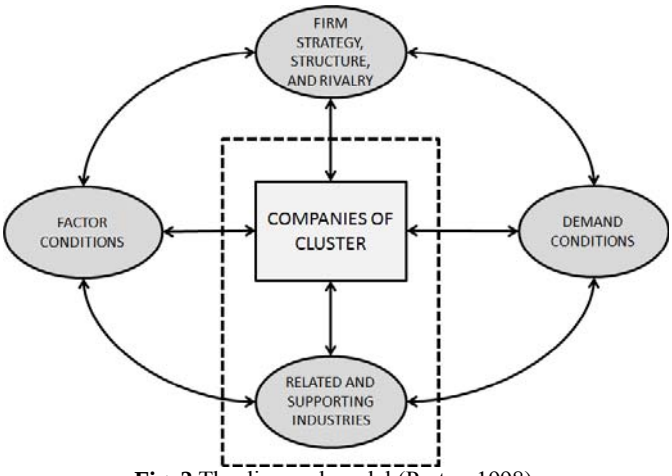

Fig. 2 The diamond model (Porter, 1998).

of regional companies and organizations and the formation of competitiveness in a particular industry sector. This model describes the context in which companies are born and compete. The context is based on four background factors, which are factor conditions of production; strategy, structure and rivalry; demand conditions; and the related and supporting industries. In this model, the success of enterprises correlates with the favorability of the background factors.

This study focuses on the key product or the core companies of the cluster as well as their supporting businesses and organizations. This focus area is limited by the dotted line in **Fig. 2**. The formation of the enclosed area is a prerequisite for the emergence of a cluster. Cluster Navigators Ltd. (2001) has developed a model for the creation of a cluster based on Porter's model with the focus limitation described above.

Cluster Navigators' (2001) model describes the leading member companies, their support businesses and the types of infrastructure (**Fig. 3**).

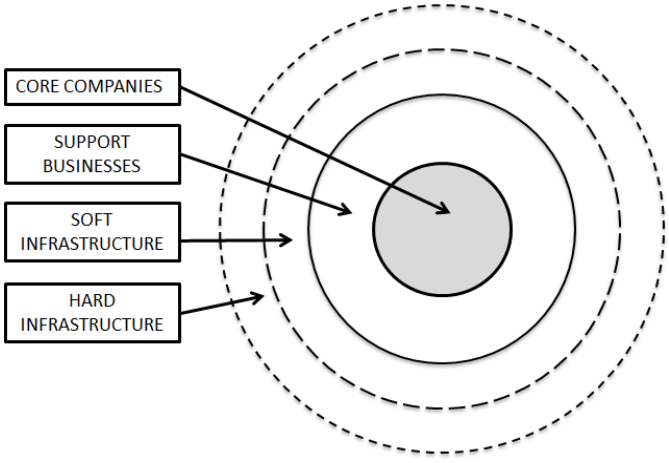

Fig. 3 The cluster (Cluster Navigators Ltd., 2001).

The earnings of the core come mainly from outside the cluster. The operations of the support companies support the businesses of the member companies directly or indirectly. The infrastructure can be divided into two parts; the knowledge-based organizations supporting the core, such as educational and research institutions, and the material infrastructure, such as transport and telecommunication links (Haverinen, 2011).

MODEL OF THE ACTORS IN A WIND POWER CLUSTER

This section presents a model of the actors of a regional wind power cluster. In the literature, wind power clusters are mentioned occasionally but no universal definition or model exists. The model proposed here was created by examining the related literature. After this, businesses established in the case area that could be regarded as actors of the cluster were mapped. Finally, the need of new actors in the region was analyzed in order for there to exist a vital cluster, a wind power capital.

Bolon *et al.* (2007, p. 19) and Boeckle *et al.* (2010, pp. 8–9) identify wind turbine manufacturers and wind farm developers as the core players of a wind energy cluster. Villafafila *et al.* (2007) define wind turbine manufacturers, part suppliers and research and educational institutions as the members of a wind power cluster. Besides the mentioned actors, Cornett and Sörensen (2011, p. 4) add business developers and the public sector to the cluster members. Boeckle *et al.* (2010, pp. 8–9) extend the concept of wind energy cluster by including the supply chain; according to this definition, raw material manufacturers, electricity grid suppliers, and wind power operators also belong to the cluster. In several independent open interviews, wind power plant maintenance organizations were seen as essential actors. **Fig. 4** shows the model of the actors of a wind power cluster. The model is based on the general cluster analyses and source materials.

The rough grouping in **Fig. 4** illustrates the core members of a wind power cluster (*section 1*), supporting businesses (*section 2*), soft infrastructure (*section 3*), and hard infrastructure (*section 4*).

The core companies of a wind power cluster are directly involved in the wind energy business; they operate in manufacturing or operating of wind power. The operations of the support businesses support the core companies directly or indirectly, for example by providing earthwork or lifting services. The soft infrastructure consists of educational and research arrangements which support the wind power business. The hard infrastructure enables the functioning of the business environment by providing for example transportation, telecommunication links, and electricity grids. In the model, the public sector serves the material environment together with private companies as well as the knowledge environment.

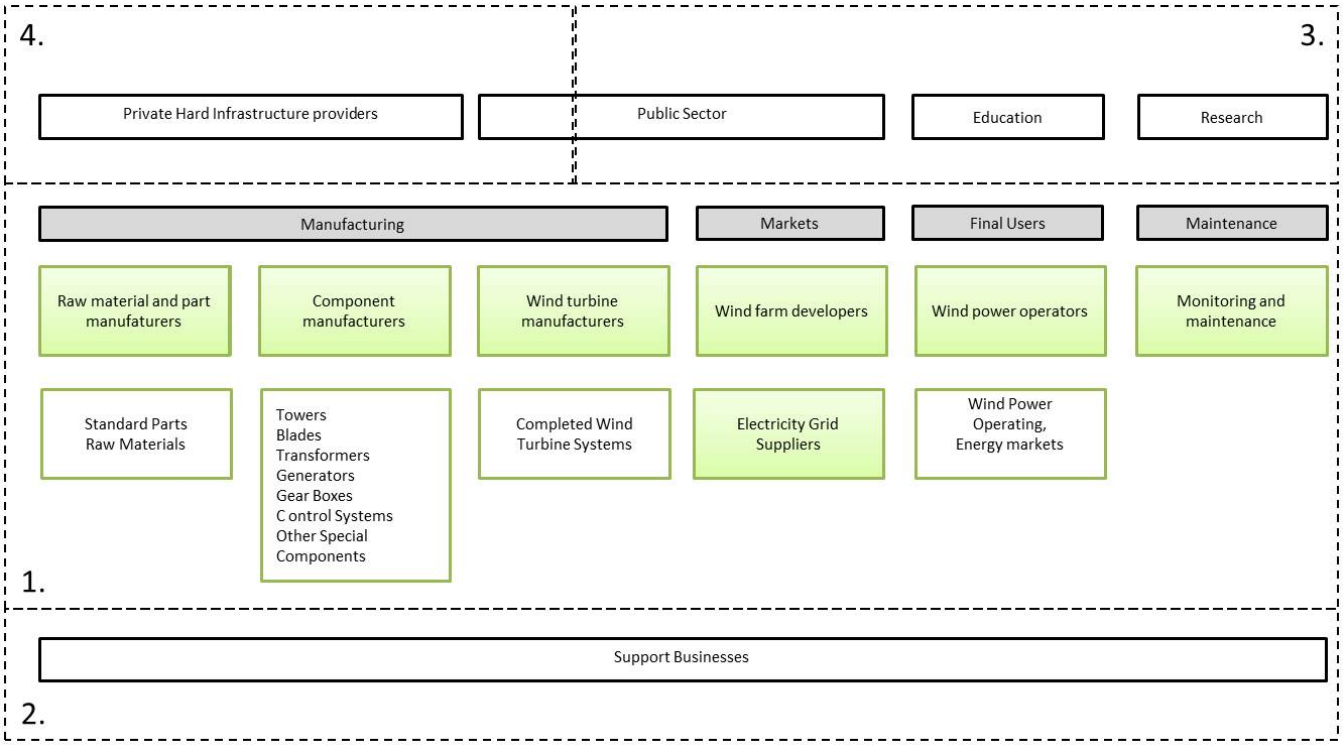

Fig. 4 The model of the actors of a wind power cluster.

The Case of Raahe and its Sub-Region

This section presents the capabilities of the target areas of growing into a wind power capital with the help of the wind power cluster model presented above.

The core companies of the wind power cluster operate in the wind energy business and are involved in manufacturing or operating sectors. The wind power cluster of the case area is in an early stage and thus there exist only a limited number of core companies and they are generally known. The same applies to the infrastructure elements.

The supporting businesses were analyzed using Statistics Finland's standard industrial classification. The standard industrial classification TOL 2008 is based on the NACE (*Nomenclature générale des Activités économiques dans les Communautés Européennes*) standard industrial classification. NACE derives from the standard industrial classification ISIC (International Standard Classification of All Economic Activities) of the United Nations. TOL 2008 is used as a framework for economic statistics (Statistics Finland, 2012).

Figure 5 illustrates the present state of the wind power cluster in the case area. The current actors of the case area have been added to the wind power cluster model.

Raahe and its sub-region constitute with their 35 000 inhabitants an excellent material environment due to their comprehensive range of public and commercial services and transport links. In the area, there are a great number of support businesses, some wind power sector companies and a large quantity of new wind power initiatives.

The Core

According to the wind power cluster model, the core companies operate in manufacturing or operating of wind power. They are wind turbine manufacturers, component manufacturers, developers of wind farms, wind power operators, and service and maintenance organizations.

Raahe is known for its steel industry. The local steelworks supply both the primary raw material and completed towers for wind turbines. There are presently two wind power operators, and they operate three wind farms in the case area. In addition, there exist wind farm developing and project management businesses. In total, 19 new wind power initiatives have been planned for the case area; 16 onshore and 3 offshore. There are total 10 companies behind these projects. The new wind power projects are listed in **Table 1**. A nationally important wind power company has also established a maintenance organization in the case area.

Support Businesses

The operations of the support companies support the businesses of the member companies directly or indirectly. The supporting businesses were analyzed using Statistics Finland's TOL 2008 standard industrial classification. Industries and supporting businesses that have shared interests with the wind power industry were chosen from the standard industrial classification. The focuses of branches were selected according to the same principle. The supporting businesses were counted by selecting companies of the related branches listed in the business directory maintained by a local business service organization (http://rsyp.owla.fi). Companies that clearly offer consumer products were excluded. This listing is for illustrative purposes only, and the companies listed may somewhat overlap with the core companies of the cluster. The supporting businesses are illustrated in **Table 2**.

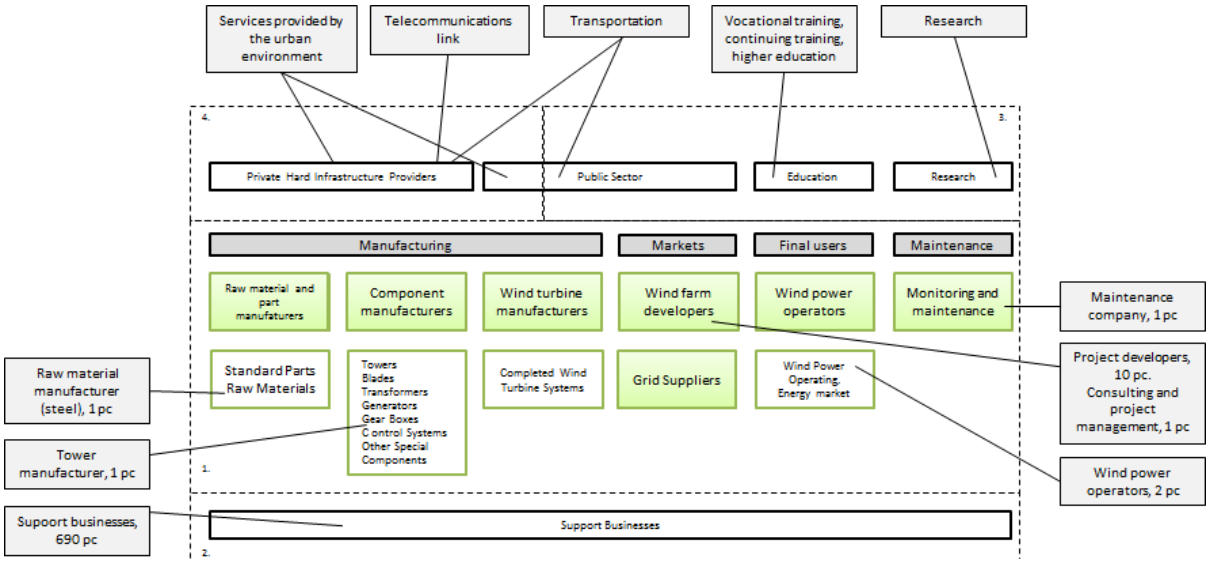

Fig. 5 The basis of the case area's wind power cluster.

Table 1. The wind power initiatives in the case area

ONSHORE PROJEETS		
Municipality	Project	Operator
Siikajoki	Varessäikkä+Kuusiniemi	Intercon-Energy Oy
Siikajoki	Toppila	Intercon-Energy Oy
Siikajoki	Papinkangas+Vartinoja	Oxford Intercon Finland Oy
Raahe	Pöllänperä	Suomen Hyötytuuli Oy
Raahe	Hummastinvaara	Suomen Hyötytuuli Oy
Raahe	Somerokangas	Innopower Oy/Metsähall.
Raahe	Satama I + Satama II	Evergreen Investment Oy
Raahe	Yhteinenkangas	Suomen Hyötytuuli Oy
Raahe+Siikajoki	Mastokangas	Eneolica Suomi Oy
Raahe	Annankangas	Metsähallitus
Raahe	Kopsa	Puhuri Oy
Raahe	Ketunperä	Puhuri Oy
Raahe	Ylipää ja Jokela	Innopower Oy/Metsähall.
Raahe	Piehingin Ylipää	Puhuri Oy
Raahe	Haapajoki	Tuuliwatti Oy
Pyhäjoki	Mäkikangas	WPD Finland Oy
OFFSHORE PROJECTS		
Raahe	Ulkonahkiainen	Suomen Hyötytuuli Oy
Raahe	Pertunmatala	Suomen Hyötytuuli Oy
Raahe	Maanahkiainen	Rajakiiri Oy

Table 2. The supporting businesses in the case area

Field of Business	Focus of branch	Number of companies	Total
B Mining and quarrying	07 - Mining of metal ores	1	1
C Manufacturing	23 - Manufacture of other non-metallic mineral products	6	
	24 - Manufacture of basic metals	8	
	25 - Manufacture of fabricated metal products, except machinery and equipment	43	
	26 - Manufacture of computer, electronic and optical products	3	
	28 -Manufacture of machinery and equipment n.e.c.	13	
	33 - Repair and installation of machinery and equipment	16	89
F Construction	42 - Civil engineering	12	
	43 - Specialized construction activities	120	132
H Transportation and storage	49 - Land transport and transport via pipelines	107	107
	52 - Warehousing and support activities for transportation	11	118
J Information and communication	61 - Telecommunications	1	
	62 - Computer programming, consultancy and related activities	21	
	63 - Information service activities	6	28
L Real estate activities	68 - Real estate activities	27	27
M Professional, scientific and technical activities	69 - Legal and accounting activities	25	
	70 - Activities of head offices; management consultancy activities	11	
	71 - Architectural and engineering activities; technical testing and analysis	51	
	72 - Scientific research and development	2	
	73 - Advertising and market research	16	
	74 - Other professional, scientific and technical activities	24	129
N Administrative and support service activities	77 - Rental and leasing activities	7	
	78 - Employment activities	6	
	80 - Security and investigation activities	3	
	81 - Services to buildings and landscape activities	38	
	82 - Office administrative, office support and other business support activities	5	59

On the basis of the standard industrial classification, the branches of the selected supporting businesses of the wind power cluster were mining and quarrying (B), manufacturing (C), construction (F), transportation and storage (H), information and communication (J), real estate activities (L), professional, scientific and technical activities (M), and administrative and support service activities (N).

In the case area, companies of each of the selected branches can be found. There is a particularly large number of companies in the manufacturing, construction, transportation and storage, and professional, scientific and technical activities branches.

Soft Infrastructure

In this study, the soft infrastructure comprises mainly the educational and research providers of the case area. The soft infrastructure is relatively broad compared to the population. The education available includes education from the basic level to higher education.

Besides the upper secondary school, there exist four vocational schools in the case area. Two of them offer technical programs appropriate for the needs of the cluster. Continuous training is also offered. Higher education is offered by the University of Applied Sciences and the Open University.

The higher educational organizations, the branch office of the University of Oulu, and the national research centre provide research activities.

Hard Infrastructure

In this review, the hard infrastructure comprises mainly transportation and telecommunications links. The transportation connections in the case area are excellent in terms of freight traffic, and at least acceptable in terms of passenger traffic. The blind track serving heavy freight comes to the heart of the case area, and it is connected to the main railway network of the country. The nearest railway station for passenger traffic is located on the edge of the case area. The eighth busiest year-round harbor in Finland with more than 700 ships a year is located in the case area. The nearest international airport (Oulu Airport) is located 70 kilometers away from the case area. One of the main highways of the country (Highway 8) cuts through the case area. The telecommunications links are excellent in the entire country (e.g. Grimes, 2003).

In addition, it can be concluded that the city of Raahe with its 23 000 inhabitants and the entire case area including the sub-region with its 35 000 inhabitants with comprehensive commercial and public services compose a functional hard infrastructure for an industrial cluster.

CONCLUSIONS

The city of Raahe has announced its plan to become the wind power capital of Finland. The target is logical because the case area is already a significant wind power producer in the national scale, there exist a lot of heavy industrial know-how and networks in the area, and many new wind power initiatives have been planned. New pillars of business life are being actively sought in the traditionally industrial town, and the city can offer a strong operational environment for the new industries.

The study started from the premise that the wind power capital means that the city grows into a strong wind power cluster. It can be said that there is already a small-scale wind power cluster in the case area with a few wind energy business companies. However, the existing companies operate as relatively independent actors, and the cluster includes no very noteworthy supply chains.

Because there is no universal definition or model of a wind power cluster in the literature, we have proposed a model of the actors of a wind power cluster by examining the related literature. We propose that the actors of a wind power cluster are wind turbine manufacturers, raw material and component manufacturers, wind farm developers, wind power operators, grid suppliers, service organizations, research and educational institutions, public sector actors, support businesses, and (both private and public) infrastructure providers.

We compared the core companies, support businesses, infrastructure, and public services of the case area with the wind power cluster model. We found out that there are a few wind power-related companies in the case area, and they provide a good basis for the emergence of a cluster. After sifting, almost 700 support businesses were found in the case area. There is education available from the basic level to higher education, and research support exists, so it can be concluded that soft infrastructure is acceptable regarding the size of the case area. It can be said that the hard infrastructure in the case area is excellent because of existing heavy industry and working freight traffic solutions including shipping, rail traffic, and road transport.

Therefore, the conditions for the emergence of a nationally significant wind power cluster are good. We think the next step would be to market the area and develop the best possible conditions for the core companies of the wind energy business outside the case area. The missing core companies are especially wind turbine (see **Fig. 5**) and part manufacturers, but a larger number of other core companies would also profit the area. In addition, it should be ensured that the education and research available are able to serve the needs of this kind of cluster also in future.

The practical relevance of this study is to help the decision makers of the case area to piece together the present state of the *wind power capital* and to see what kinds of actors should be drawn in. This study may also offer new aspects for the wider local energy cluster strategy, which is a part of the business strategy of the case area. The theoretical contribution of this study is the definition of a universal model of a wind power cluster in a general level. It can be used in other studies in the field and focused and updated by taking into account local circumstances.

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