CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

Vestas Wind Systems A/S: Exploiting Global R&D Synergies

Pedersen, Torben

Document Version
Final published version

Publication date:
2009

License
CC BY-NC-ND

Citation for published version (APA):
Pedersen, T. (2009). *Vestas Wind Systems A/S: Exploiting Global R&D Synergies*. Center for Strategic Management and Globalization. SMG Working Paper No. 5/2009

Link to publication in CBS Research Portal

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
If you believe that this document breaches copyright please contact us (research.lib@cbs.dk) providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 07. Sep. 2026

Vestas Wind Systems A/S: Exploiting Global R&D Synergies

Torben Pedersen

SMG WP 5/2009

July 14, 2009

SMG Working Paper No. 5/2009
July 14, 2009
ISBN: 978-87-91815-46-1

Center for Strategic Management and Globalization
Copenhagen Business School
Porcelænshaven 24
2000 Frederiksberg
Denmark
www.cbs.dk/smg

Vestas Wind Systems A/S: Exploiting Global R&D Synergies

Much had happened since the CEO of Vestas Wind Systems A/S, Ditlev Engel, broadcast the company's new corporate strategy – *The Will to Win 2005-2008* – from headquarters in Randers, Denmark to all Vestas employees worldwide in 2005. Vestas, the market-leading producer of high-tech wind turbines, had since a merger the year before with a Danish turbine producer experienced financial difficulties, and management was therefore replaced with fresh leadership that could bring the Danish company to new heights. With the new management came a radical reorganization and the announcement of several new strategic initiatives. As Engel stated, "These initiatives are aimed at increasing effectiveness in all areas of Vestas's business. We will professionalize our dialogue with the customers, we will improve the quality of our products and we will be much more effective in all that we do." [1] The charismatic CEO also argued that "by the implementation of *The Will to Win*, we create a new global Vestas. This work will, no doubt, be exciting and very hard. At the same time, it will require the will to change in all of us and I am confident that we at Vestas can meet this challenge."[2]

Among the initiatives was the establishment of the Vestas Technology R&D business unit, headed by Finn Strøm Madsen. Inexperienced in the field of wind energy, Madsen was determined to achieve global leadership in all core technology areas and, consequently, strengthen a core competence for the company. By 2008, Madsen had succeeded in setting up a global R&D network with R&D centers in Denmark, the UK, Singapore, and India, and in early 2009, a center was opened in the US. Vestas Technology R&D accounted for EUR 228 million in expenditures (3.7 percent of the consolidated revenue) in 2008, which was 79.5 percent higher than in 2007. That same year, Vestas announced a new corporate strategy known as the *No. 1 in Modern Energy* strategy. With this strategy, the company – as market leader – committed itself to promoting the wind industry as a whole and to putting wind energy on par with oil and gas. In addition, the strategy highlighted Vestas as a high-tech company and put a greater emphasis on its technological innovations.

Despite impressive growth in recent years – the amount of energy delivered by Vestas increased by 75 percent since 2005 and its revenue had grown by 68 percent – Finn Strøm Madsen faced a dilemma. The number of employees in Technology R&D was at a record high, the R&D network already encompassed five development facilities around the world,

[1] Vestas press release, "*Strategic Plan 2005-2008*", 05/26/2005.
[2] Vestas press release, "*Strategic Plan 2005-2008*", 05/26/2005.

and further expansion was planned. On top of that, the network had extensive links to external research centers and universities. The task of coordinating and, consequently, capitalizing on the R&D network was growing more complex and complicated as the network expanded. Identifying novel, profitable competences and innovations around the world, managing the interfaces between different research units and resources, and exploiting synergies were challenges Finn Strøm Madsen faced. Even though Vestas had shown positive growth, competition from different types of companies was growing considerably due to the attractiveness of the wind energy industry.

Madsen knew he had the full support of Ditlev Engel, who had stated: "Investments in research and development demand some financial resources, but we truly believe that the right framework also gives many rich opportunities"[3]. However, Madsen also knew that he would eventually have to present some tangible results arising from the extensive R&D efforts that were launched under his leadership. He therefore had mixed feelings as he prepared himself for the weekly Vestas Government meeting where Vestas's management shared and discussed business information and progress.

Introducing Vestas Wind Systems A/S

Vestas Wind Systems A/S was a global, market-leading producer of high technology wind power solutions. Its headquarters was located on the east coast of Jutland – the Danish mainland. By the end of 2008, the company had delivered 5,580 MW of electricity through its wind turbines, which were installed around the world. It held 23 percent of the wind energy market and employed approximately 21,000 workers all around the world. In 2008, the company had EUR 6,035 million in revenues and gross profits of EUR 1,179 million (see Exhibits 1 and 2).[4]

The company was founded in 1945 as Vestjysk Staal Teknik A/S (abbreviated to Vestas) by Peder Hansen, the son of a successful blacksmith in western Jutland. During its first 30 years, the company's activities focused on a broad line of household appliances and agricultural products. However, in 1979, during the turmoil of the second oil crisis, Vestas manufactured and delivered its first wind turbines to customers who were increasingly demanding sustainable energy.[5] Vestas has since grown to become a globally successful wind energy company, with its core businesses centered on the development, manufacturing, sale,

[3] Børsen, "*Vestas satser markant på teknologicenter i Århus*", 01/22/2008
[4] Vestas Annual Report, 2008.
[5] www.vestas.com/en/about-vestas/history/1898-1969.aspx.

marketing and maintenance of wind power systems that use wind to produce electricity.[6] The name of the company was changed to Vestas Wind Systems A/S in 1986, a change that marked the company's exclusive focus on wind power solutions.

In 2005, Ditlev Engel, then the newly appointed CEO and President of Vestas, announced the launch of a new corporate strategy – *The Will to Win 2005-2008* – which would eventually transform the company from a mere Danish producer of wind power turbines into a global energy and technology corporation. Mr. Engel described his view of the strategy, stating: "The initiatives presented today aim to ensure that Vestas will still be the world's leading manufacturer of wind power systems in three years time – both in terms of technology and the market…. We must be prepared for the fact that the future customers for our wind power systems are international energy companies. They have high demands for us and for our products. Many people still regard wind power, and thereby Vestas, as a 'romantic flirt' with alternative energy sources. It is not. Vestas and wind power are real, very competitive alternatives to oil and gas."[7] Even though Vestas was already the world's largest player on the wind energy market, the new strategy explicated the company's global aspirations and professionalized the organization in accordance with a global mindset. The alteration in management and strategy came one year after the company merged with another Danish wind turbine maker, NEG Micon. The merger made Vestas the global leader in the wind energy market, but the marriage also entailed some financial troubles, which eventually prompted the changes.

In conjunction with the new strategy, the company presented a new vision of "Wind, oil and gas" and revised its mission to "Failure is not an option". The former was formulated to underpin wind as a source of power at least as important as fossil fuels. The latter emphasized the company's commitment to continually optimize working processes, safety procedures and products. In addition, Vestas was proud to possess an extensive portfolio of wind turbines based on more than 25 years of experience, insight and knowledge of wind, ranging from the V52 turbine with a capacity of 850 kW to the V90 with a capacity of 3 MW (see Exhibits 3 and 4).[8][9] On average, Vestas installed a new wind turbine every three hours. Since 1979, the company had delivered approximately 38,000 turbines.[10]

[6] www.vestas.com/en/about-vestas/history.aspx.
[7] Vestas press release, "*Strategic plan of action 2005-2008*", 05/26/2005.
[8] www.vestas.com/en/wind-power-solutions/wind-turbines.aspx.
[9] The numbers used in Vestas's turbine names indicate the diameter of the rotor in question
[10] Vestas Annual Report 2008.

No. 1 in Modern Energy

Following significant success with the *Will to Win* strategy, Vestas commenced on a new corporate strategy, namely the *No. 1 in Modern Energy* strategy, in 2008. While the focus of the *Will to Win* strategy was internal improvements, the new strategy emphasized external positioning and Vestas's commitment as market leader to promoting the industry as a whole and to putting wind energy on par with oil and gas. Vestas aimed to create the world's strongest energy brand. To achieve that goal, the company focused on consolidating its market leadership position in the high-growth wind energy industry, which was becoming increasingly competitive. "Vestas will be one of the world's top five energy brands," Marketing Director Tina Ebler argued with regard to the new strategy, "and wind will not be characterized as alternative energy anymore. Politicians and decision makers should understand that wind works."[11] Also integral to the new strategy were the financial goals set for 2009, which reflected the company's ambition to be profitable while remaining *No. 1 in Modern Energy*. The goals included an EBIT margin of 11-13 percent, net working capital of a maximum of 10 percent of annual revenue, and revenue of EUR 7,200 million.[12]

Vestas' structure consisted of the Executive Management and 14 separate business units focused on sales, production or development. While the former consisted of Ditlev Engel and Henrik Nørremark, Executive Vice President and CFO, each of the latter were represented by a separate unit president. Corporate Functions was also a unit in the company structure, and dealt with aspects such as contracts, forecasts, planning, IT, finance and operations (see Exhibit 5). The company introduced a core concept coined "Vestas Government", under which Executive Management and the presidents of the 14 business units – the "Ministries" – met on a weekly basis to share and discuss key business information and to monitor the implementation of the company's strategy. Accordingly, a Vestas Constitution was formulated with the purpose of converting visionary thoughts into concrete action. "*Constitution* is a very basic term. It is something people understand," Ditlev Engel explained. "In the same way [as with a national constitution], it makes it clear that all of our business methods and systems, all of the laws that surround us on a daily basis, derive from some very fundamental attitudes."[13]

Markets and competitors

[11] Børsen, "*Vestas investerer vildt i markedsføring*", 04/16/2008.
[12] www.vestas.com/en/about-vestas/strategy/goals.aspx.
[13] Berlingske Nyhedsmagasin, "*Først Vestas – så verden*", 03/30/2007.

Vestas's most important markets were in Europe, which constituted 60 percent of revenue in 2008, followed by the Americas and Asia/Pacific, accounting for 26 percent and 14 percent, respectively.[14] However, despite the significance of the European markets, the company was well aware of industry analysts' forecasts that although Europe remained the absolute leading market for wind energy – representing 61 percent, or 57,000 MW, of accumulated installed capacity in 2007 – the American and Asian markets (particularly the US, China and India) were growing rapidly. Analysts expected these markets to replace Europe as the most important markets in just a few years.[15] It was therefore no surprise when Vestas announced the establishment of R&D centers close to these markets (Singapore, Chennai and Houston).

Much of the industry's growth potential was facilitated by the exceedingly supportive political and social climate. Not only had the anti-nuclear power campaign sparked a general interest in the industry, but favorable political resolutions and targets had also contributed to the remarkably optimistic forecasts. Among the latter was the EU resolution that 20 percent of all energy consumption must come from renewable sources by 2020. Also, China set its renewable energy target at 15 percent, while the newly elected US President publicly announced his intentions of creating a green economy.[16]

A result of these developments was that Vestas found itself facing growing competition. Vestas was the largest producer of wind energy at the end of 2007 in terms of market share, but the large conglomerates of Siemens and GE Wind were using their strong financial bases to invest heavily in wind energy to capture future market shares and were therefore considered to be serious challengers. In addition, a number of listed companies (Suzlon, Gamesa, Nordex and Repower) and family-owned businesses (Enercon Gmbh) represented strong rivalry for Vestas (see Exhibit 6). Lastly, there were an increasing number of low-cost, Chinese providers entering the wind energy scene, which were seen as posing a considerable threat to Vestas' market-leading position. In fact, Per Krogsgaard, the Director of BTM Consult, a Danish consultancy company specialized in renewable energy, stated that "the Chinese market is booming at the moment, and you should not be surprised if Chinese producers like Goldwind become the world's largest in a short period due to the large sales on the Chinese market."[17] Peter Kruse, Vestas's Director for Communication and Investor Relations, was, however, not overly concerned: "We are in a far more mature market today,

[14] Vestas Annual Report 2008.
[15] BTM Consult press release, "*International Wind Energy Development – World Market Update 2007*", 03/27/2008.
[16] Vestas Annual Report 2008.
[17] Børsen, "*Kinesere haler ind på Vestas' forspring*", 03/31/2008.

and the large customers in the energy sector always consider how long the different producers have been in the market – they want to be fully reassured that the producer is safe before they place large orders".[18]

A Global R&D Network

"For us, research and development is a global activity," Finn Strøm Madsen, President of Vestas Technology R&D, explained.[19] "It is through technology that we need to differentiate ourselves. Our goal is to have a borderless, global setup with hubs in Europe, Asia and North America. Via this network, we are aiming for an ongoing flow of ideas and technology for developing the best products and services."[20]

Vestas Technology R&D was established in 2005 in conjunction with the reorganization of the company under the vision "Global leadership in all core technology areas"[21], and had roughly 1,300 employees of 18 different nationalities scattered around the world in 2008. The formation of the business unit was a manifestation of the company's focus on technology, as well as a means of accessing technological hot-spots around the world and fostering a global search for talent. With the new establishment came the unification, professionalization and globalization of Vestas's R&D, which had previously been implicitly and tacitly carried out to a large extent. This change was evident in such aspects as R&D responsibility, which was now centralized in Technology R&D, and the introduction of technical risk management as a central concept. Prior to the *Will to Win* strategy Vestas's research and development were characterized by decentralized R&D responsibility, the mixed use of new products and unproven technologies, and limited risk management (see Exhibit 7). In addition, until the network was centrally organized, each R&D activity was undertaken by individual engineering branches, such as Mechanical, Blades, Electrical and Plant IT. As time passed, it became apparent that this silo-structure was exceedingly time consuming, as the process of creating compatible components required intense dialogue with the other branches. Such a process was, consequently, highly resource-demanding.[22]

In 2008, Vestas used EUR 228 million on research and development, compared to EUR 127 million in 2007.[23] Technology R&D consisted of three sub-units: Global Research ("Develop breakthrough innovation"), Engineering and Products ("Deliver products to

[18] Børsen, "*Kinesere haler ind på Vestas' forspring*", 03/31/2008.
[19] Finn Strøm Madsen interview, January 2009.
[20] Vestas Magazine Win(d), February 2008.
[21] Vestas Chennai slides, 02/04/2009.
[22] Christian R. F. Iversen, Master Thesis.
[23] Vestas Annual Report 2008.

production"), and Operations ("Enhance service business") (see Exhibit 8). The objectives of the business unit were accordingly three-fold: to secure effective product development in Engineering and Products, to strengthen Global Research project execution and innovation, and to leverage synergies in the supply chain. Four cornerstones of supporting the R&D activities were identified: the creation of a global network (considered the most significant), research programs with internal and external partners and top universities around the world, a strategic focus on intellectual property rights, and new ventures and acquisitions. "Global Research must contribute to driving down the cost of energy by maturing new technologies to create breakthroughs that can be deployed into products", Jan Kristiansen, Senior Vice President of Global Research, commented. "We must be a network-based organization, both because of our own globalization but also because a global presence is essential to gaining access to key competences."[24] Vestas Technology R&D consisted of many pieces of knowledge and could not, therefore, rely solely on one location. Instead, it had to tap into knowledge from a global network of R&D centers.

Development Facilities

Inaugurated in 2008, Vestas Technology R&D's head office in Aarhus, Denmark was the industry's largest, most modern R&D center. As stated in Vestas' Annual Report, "the centre unites a number of test and development facilities in a unique innovation environment, which produces optimum conditions for integrated product development and cross-disciplinary collaboration with customers and suppliers. Following an extension of the facilities, the centre will house more than 900 people in 2010."[25] With a large, symbolic wing crossing through the triangular infrastructure, the flagship center carried out research and development across the entire value chain, and possessed excellence status in most of the functional competences for research. "That a Danish company has, in relatively few years, taken a global role as the world's undefeated market leader is, in itself, an achievement", Ditlev Engel said in relation to the new development facility in Aarhus. "…but we cannot allow ourselves to rest on our laurels – the competition is extremely tough. Therefore, it is essential for us to remember that our leading position is not all about the number of wind turbines we sell and install. It is equally about the technological development".[26]

[24] Vestas Win(d), nr. 11, 2008.
[25] Vestas Annual Report 2008.
[26] Børsen, "*Vestas satser på teknologicenter i Århus*", 01/22/2008.

In contrast, the R&D center on Isle of Wight in the UK – a sailing Mecca and marine center – was originally a production site for Vestas blades. A separate, highly specialized R&D center was not established at this location until the autumn of 2008. The Isle of Wight location housed a world-class expertise centered on design materials and aerodynamics, and it was therefore an obvious place for Vestas to pursue competences.[27] More specifically, the Isle of Wight R&D facility was considered to be a Center of Excellence with respect to aeromechanical composites, and it was seen as a competence center for aeromechanical structural design and analysis. It employed approximately 60 mechanical engineers in 2008.

In Singapore, three key aspects justified Vestas's presence. First, the country was intensely focused on its energy supply, which, when combined with its strong economy, created a particularly conducive environment for Vestas's research and development profile. Second, the number of highly qualified engineers in Singapore was favorable. Third, the R&D presence in Singapore created a gateway into the increasingly important Chinese market. As the intellectual property rights regulations in China were still too ambiguous and risky for conducting research and development, Vestas relied on Singapore as a regional hub for this task. However, Finn Strøm Madsen recognized the longer-term need to establish an R&D center in China in order to gain access to one of the fastest-growing markets in the world.

The office in Chennai, India was established in 2008 as an R&D back office due to the high local concentration of mechanical and IT engineers. Since its establishment, the competences and talents identified in India proved strong, and the office proved its global worthiness. Higher levels of responsibility were therefore transferred from the global headquarters in Denmark to Chennai (see Exhibit 9). For instance, product support R&D for the V82 wind turbine, which was produced only in India, was assigned exclusively to Chennai. Moreover, while aeromechanical structural design and analysis were among the major competences identified, the center was also expected to demonstrate competences in composites, advanced loads modeling, and gear and drive trains, as well as in power electronics and power control. Accordingly, the number of employees in India, which was 125 in 2008, was expected to reach 600 in 2012.

The latest addition to the network was the R&D center in Houston, Texas, established in early 2009. Regarded as the energy capitol of the world and seen as the center of a massive amount of energy knowledge, Houston was pivotal to Vestas's establishment of a regional platform in the area. The company also expected the Houston R&D center to create closeness

[27] Finn Strøm Madsen interview, January 2009.

to one of the most prominent markets in the world.[28] "Houston provides access to a highly qualified workforce in an international and extremely energy-focused research and development environment," said Finn Strøm Madsen. "In addition, Houston will allow Vestas to establish and strengthen relations within the North American and global energy industry. Tapping into and contributing to the tremendous pool of knowledge and know-how offered by Houston's energy environment is invaluable in our quest to develop wind turbines that also in the future can meet the technological and cost-efficiency demands of our customers."[29] The company intended the US center to provide aeromechanical, electrical and power plant competences.

Managing the Organizational Dynamics

The idea behind the global R&D network was to create a network-driven set of complementary competences, each identified at a different technological hot-spot, which would fit into one integrated product. In this respect, a Global Operation Model was designed as a stage-gate model in which 14 competences were categorized into four groups – aeromechanical, electrical, control and system architect, and power plant. They were then plotted in a matrix together with the to the capabilities of the five R&D centers (see Exhibit 10). This meant that, for instance, Vestas's R&D center in Singapore did not design wind turbines only for Singapore, but for the whole world. The set of competences identified in Singapore were therefore compared with the competences identified in the other R&D centers in the Global Operation Model, which ensured optimal collaboration. This was also evident in relation to the business unit's separate, disaggregated R&D value chain, which covered seven activities from the initial ideas in the "Blue Sky" to the final stages of development of the "Product" and "Product support", with the respective R&D centers simultaneously engaged in multiple activities (see Exhibit 11).

Another essential facet of the Global Operation Model was the emphasis on the respective centers' constant development of competences. As the business unit aimed to develop the best products and services, internal learning and development were vital. The Global Operation Model divided the respective centers into "competence centers" and "Centers of Excellence" according to the level of research undertaken in each competence. Vestas naturally aimed to elevate as many research areas into Centers of Excellence as

[28] Finn Strøm Madsen interview, January 2009.
[29] Windfair, "*Vestas establishes research centre in Houston, Texas*", 06/02/2008 (www.windfair.net/press/4708.html - last accessed 03/11/2009).

possible. This process could, for instance, be seen in the Chennai center, where it was originally expected that the lower ends of the R&D value chain (e.g. mechanical and IT-related R&D) would become a stronghold. As the center gradually contributed more and more to the overall learning process in Technology R&D, it gained responsibility and earned a higher status. Therefore, the original intention of accessing talent for an R&D back-office grew into a vision of an R&D Center of Excellence where the responsibilities increasingly covered the higher ends of the value chain. According to Finn Strøm Madsen, having a dynamic, developing environment within the network was also essential to securing the critical mass required for developing the business unit. "We're devoted to acquiring the best employees – and the best employees are in a constant search for a professional environment", Madsen argued. "We need to ensure that we give them this environment, that they have constant challenges, and that they draw on each others' competences – simply put, that we have critical mass."[30]

Optimizing the interfaces between the R&D centers in the network was another central focus for the Technology R&D unit. Vestas devoted many of its resources to establishing tools, procedures, training and education to achieve this goal. When, for instance, Technology R&D ran a project across the network, the individual processes were determined in advance so that each site was comfortable with what to do and what to deliver. Furthermore, as each site completed its part of the project, the product or service could be gathered centrally. Vestas had also invested in a video conference system that allowed employees from different regional hubs to have real-time, face-to-face meetings and conferences. "It is actually a virtual meeting room where you have six chairs on one side and three large screens on the other side with two chairs each", Michael Høgedahl, Operating Manager of the Chennai Technology R&D center explained. "When you are calling a similar office, it looks like you are attending a physical meeting with faces and sounds from the right places".[31] In addition, Vestas's focus on one particular product, in contrast to competitors such as General Electric or Siemens, gave the company the possibility of coordinating the wide-spread set of R&D centers and competences.

Collaborations with external research institutions and universities, i.e. open innovation, were also seen as important for Vestas Technology R&D's strategy, as it was too costly and complex for Vestas to pursue leadership in all areas on its own (see Exhibit 12). In 2008, Vestas initiated a Global University Program through which a large number of

[30] Finn Strøm Madsen interview, January 2009.
[31] Michael Høgedahl interview, December 2008.

professors, PhD students, and master's students from leading universities received sponsorships.[32] The partners were generally selected from a geographical perspective in relation to Vestas's R&D centers around the world. For instance, in Chennai collaborations with Centre for Wind Energy Technology (C-WET) and the Indian Institute of Technology in Madras (IIT-Madras) were established. According to Finn Strøm Madsen, "…increased cooperation with universities is a natural consequence of our growth. We are highly interested in working closely with leading researchers worldwide in order to ensure that we maintain our position as the leading supplier of wind energy solutions and to reinforce the recruitment of the brightest students from these universities."[33] Accelerating Vestas's innovative wind power research through collaborations and partnerships provided the company with access to the most recent knowledge and the most qualified human resources, which would serve as a competitive advantage in a highly attractive market in which the rivalry for market share and profit was growing increasingly fierce. What was perhaps regarded as a network of five R&D centers was, in fact, a complex, extensive arrangement of Vestas's own R&D facilities and external research centers and universities.

* * *

Pondering over how he would approach the Vestas Government, Finn Strøm Madsen knew that, on the one hand, the establishment of Vestas Technology R&D as a separate function gave Vestas a unique opportunity to create sustainable competitive advantages. In that respect, he was comfortable with the stated goals for the business unit under his domain. On the other hand, the increasingly complex, resource-demanding task of coordinating an R&D network encompassing internal and external units – and eventually capitalizing on it – concerned Madsen. Indeed, it was not a secret that Vestas emphasized its R&D efforts to meet the escalating competition on the wind energy market, particularly the competition arising from Siemens and GE Wind. These companies had a completely different point of departure from which to undertake their businesses due to their remarkably strong resources and financial situation. If Technology R&D wanted to pursue its vision of "Global leadership in all core technology areas", it was undeniably forced to chase and tap into knowledge and know-how on a global basis. In the end, Madsen and his business unit had to undertake a

[32] Vestas press release, "*Vestas Technology R&D launches a Global University Programme*", 05/19/2008.
[33] Vestas press release, "*Vestas Technology R&D launches a Global University Programme*", 05/19/2008.

balancing act between the synergies deriving from the global R&D network and the costs associated with it. Therefore, the remaining members of the Vestas Government looked forward to hearing how Finn Strøm Madsen would handle the complex progress and structures of Vestas Technology R&D, and how he would take the business unit forward to deliver tangible outcomes that would benefit Vestas Wind Systems A/S as a whole.

Exhibit 1 – Financial figures[34]

mEUR	2008	2007	2006	2005	2004
HIGHLIGHTS					
Income statement					
Revenue	6,035	4,861	3,854	3,583	2,363
R&D expenditures	228	127	125	97	67
Gross profit	1,179	852	461	84	120
EBITDA	803	579	328	9	64
EBIT	668	443	201	-116	-49
Profit of financial items	46	0	-40	-42	-41
Profit before tax	714	443	161	-158	-89
Profit for the year	511	291	111	-192	-61
Balance Sheet					
Balance sheet total	5,308	4,296	3,654	3,085	2,881
Equity	1,955	1,516	1,262	962	1,162
Provisions	274	305	265	239	181
Average interest-bearing position (net)	395	179	-299	-560	-625
Net working capital	299	-68	122	498	686
Investment in property, plant and equipment	509	265	153	95	89
Cash flow statement					
Cash flow from operating activities	277	701	598	148	-30
Cash flow from investing activities	-680	-317	-144	-137	-201
Cash flow from financing activities	-91	-54	-101	-46	458
Change in cash at bank and in hand less current portion of bank debt	-494	330	353	-35	227
Employees					
Average number of employees	17,924	13,82	11,334	10,3	9,449
Number of employees at the end of the year	20,829	15,305	12,309	10,618	9,594
RATIO					
Financial ratios					
Gross margin (%)	19.5	17.0	12.0	2.4	5.1
EBITDA margin (%)	13.3	11.9	8.5	0.3	5.0
EBIT margin (%)	11.1	9.1	5.2	-3.2	-2.1
ROIC (%)	34.1	30.9	11.9	-13.2	-3.8
Solvency ratio (%)	36.8	35.3	34.5	31.2	40.3
Return on equity (%)	29.4	21.0	10.0	-18.1	-6.9
Gearing (%)	6.3	9.9	13.8	51.2	50.1

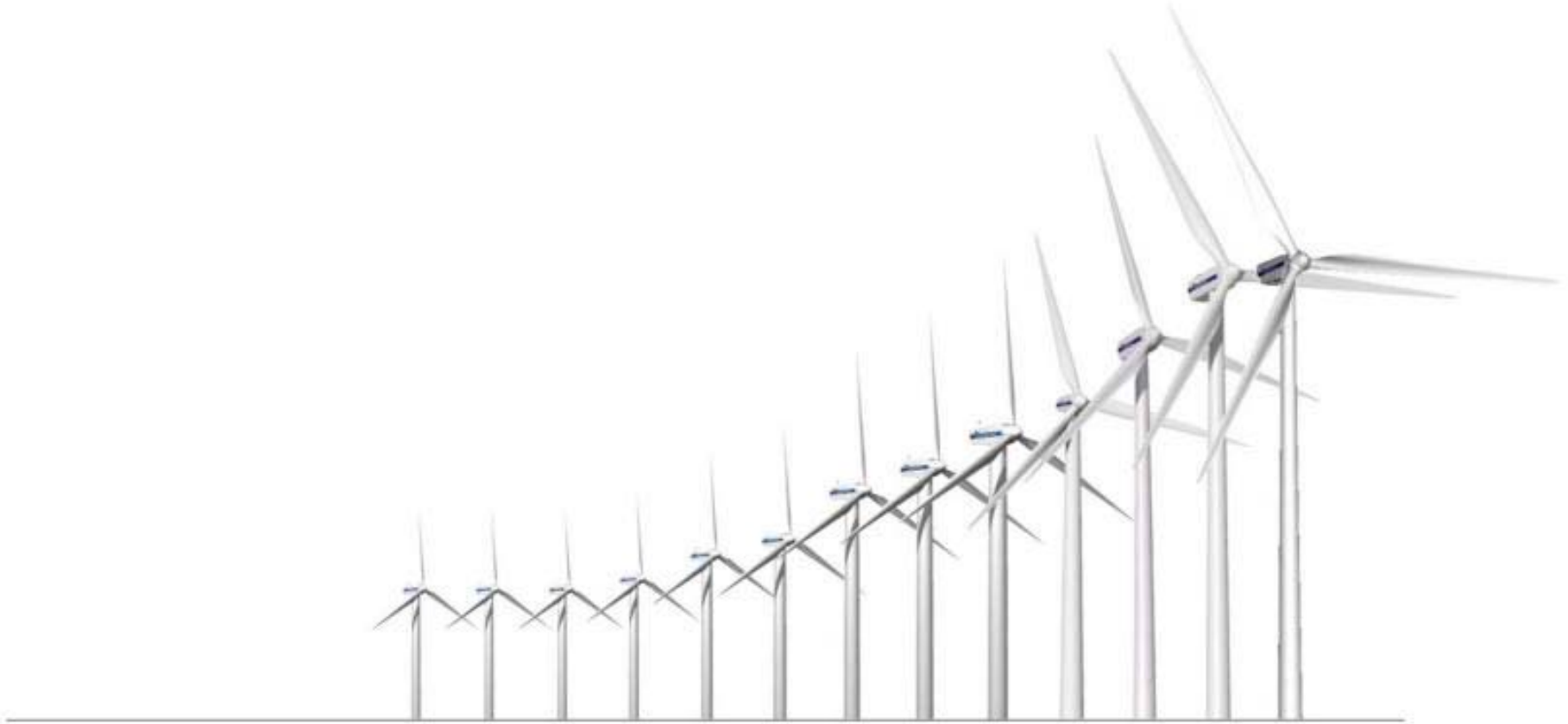
[34] Vestas Annual Report 2008.

Exhibit 2 – Non-financial figures[35]

	2008	2007	2006	2005	2004
KEY FIGURES					
Occupational health & safety					
Industrial injuries (number)	534	534	525	472	319
- of which fatal injuries (number)	0	0	1	0	2
Products					
MW delivered	5,580	4,502	4,239	3,185	2,784
Utilization of resources					
Consumption of metals (tons)	187,478	170,505	164,413	143,170	90,732
Consumption of other raw materials, etc. (tons)	129,207	111,541	93,983	82,592	20,080
Consumption of energy (MWh)	458,296	372,037	330,106	227,907	121,212
- of which renewable energy (MWh)	172,800	139,983	124,841	118,603	35,805
- of which renewable electricity (MWh)	167,311	138,035	124,841	118,603	35,805
Consumption of water (m^3)	479,958	554,516	343,084	226,410	96,911
- of which water of non-drinking quality (m^3)	103,066	14,809	14,954	0	0
Waste disposal					
Volume of waste (tons)	96,632	89,643	82,739	67,313	16,407
- of which collected for recycle (tons)	30,254	28,422	27,593	17,266	9,279
Emissions					
Emission of CO_2 (tonnes)	41,832	32,798	28,693	17,266	9,279
Local community					
Environmental accidents (number)	16	15	7	4	5
Breaches of internal inspection conditions (number)	5	5	6	5	1

[35] Vestas Annual Report 2008.

Exhibit 3 – Wind turbine family[36]



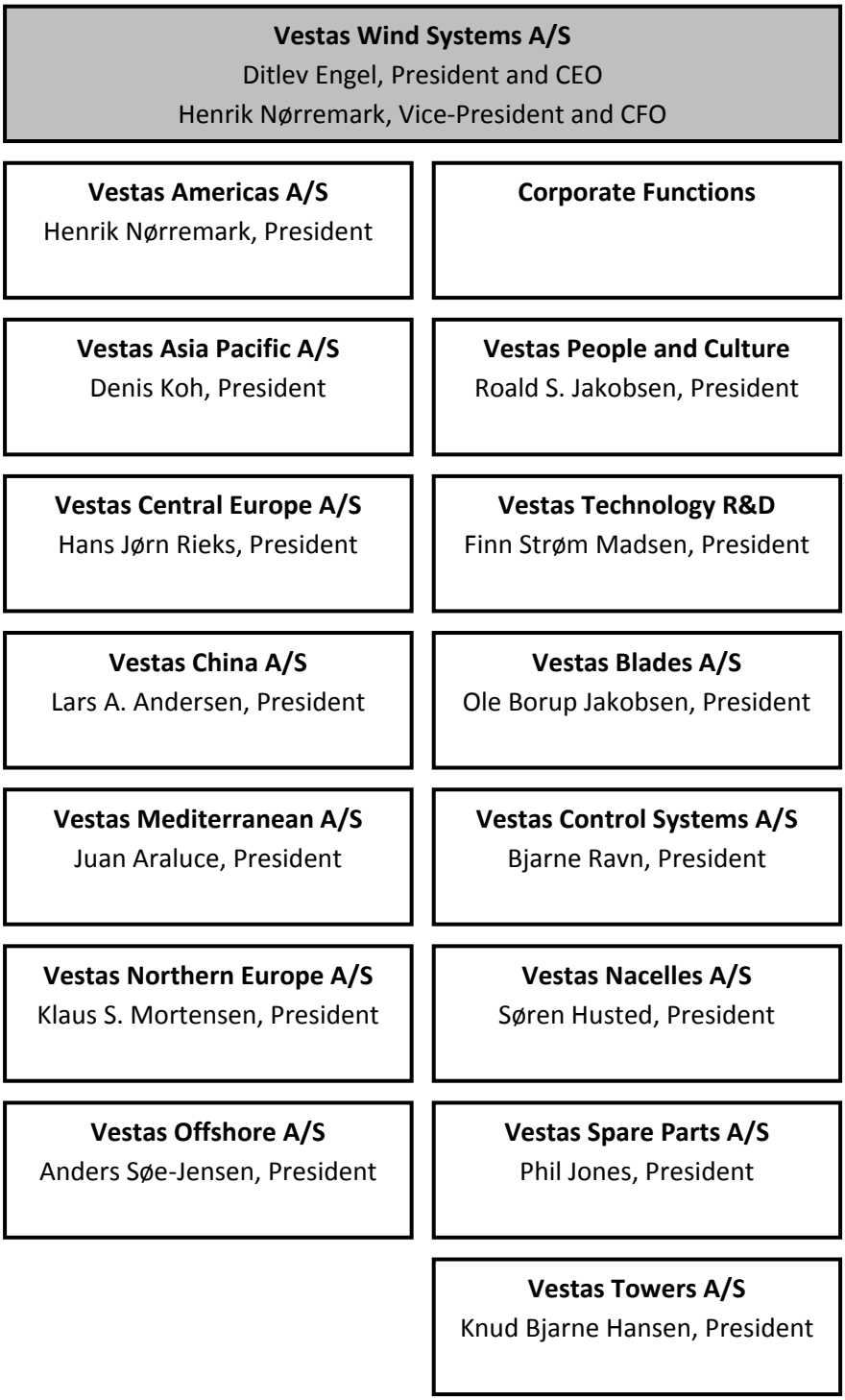
Product/Rotor diameter (m)	V15	V17	V19	V20	V25	V27	V39	V44	V47	V52	V66	V80	V90
Year of installation	1981	1984	1986	1987	1988	1989	1991	1995	1997	2000	1999	2000	2002
Capacity (kW)	55	75	90	100	200	225	500	600	660	850	1750	2000	3000
MWh/year	217	265	301	346	481	647	1304	1581	1947	2530	4705	6768	9152

[36] www.vestas.com.

Exhibit 4 – The wind turbine[37]

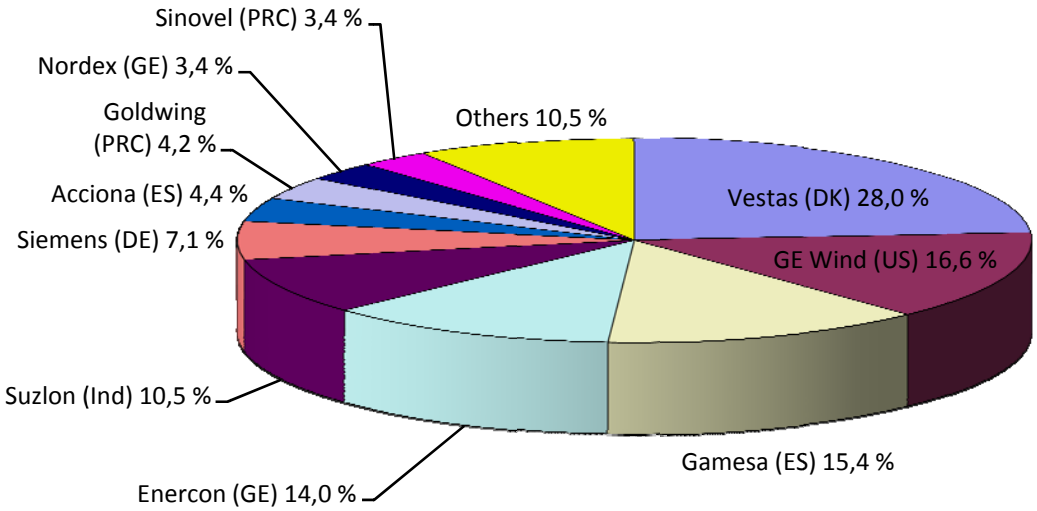
[37] www.vestas.com.

Exhibit 5 – Company structure[38] [39]



[38] www.vestas.com/en/about-vestas/company-structure.aspx.
[39] Corporate functions included Contract Review, Forecasting and Planning, Group Communication, Group Finance & Operations, Group Government Relations, Group Marketing and Customer Insight, Group IT, Treasury, and Vestas Excellence.

Exhibit 6 – Competitors' market share, 2007[40]



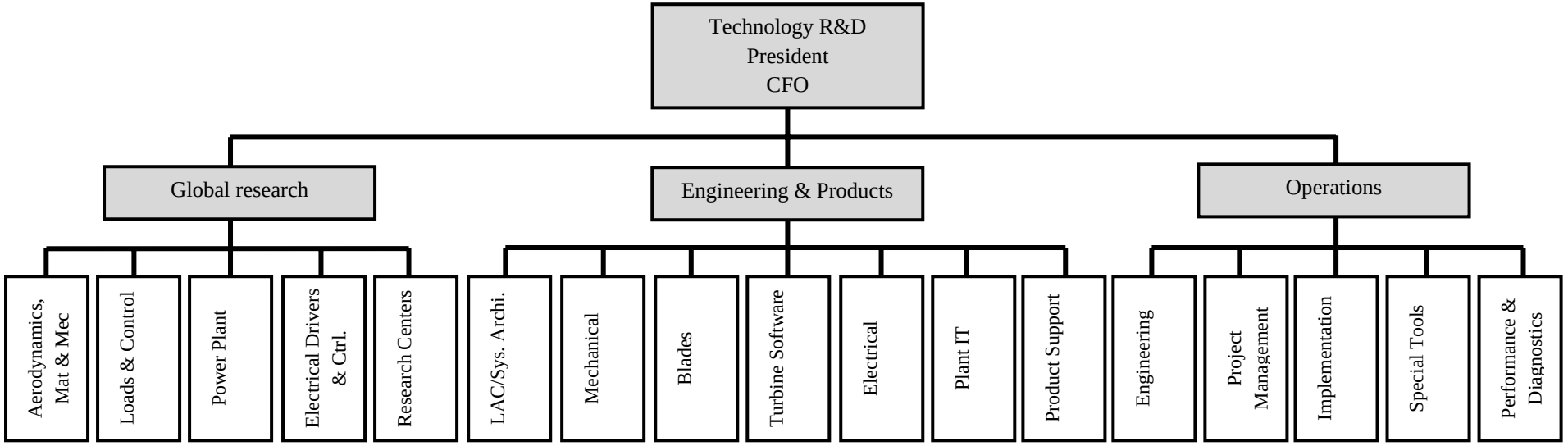
[40] BTM Consult press release, "*International Wind Energy Development – World Market Update 2007*", 03/27/2008.

Exhibit 7 – Vestas's R&D before and after the *Will to Win*[41]

Before	After
• Responsibility decentralized • Mostly prototypes • Limited test and verification • Mix new products and unproven technology • Limited use of project model stage gate • No centralized overview of Wind Turbine Generators (WTG) under warranty • Lack of process overview • Premature launch of products • Limited risk management	• Responsibility centralized in Technology R&D • Test, verification and prototypes • Only use of proven technology • Disciplined use of project model • Database providing global overview • Systematic Continuous Improvement Management(CIM) process • Controlled release of products • Technical risk management

[41] Vestas Technology R&D Capital Market Day, 08/28/2006, Finn Strøm Madsen.

Exhibit 8 – Vestas Technology R&D Structure[42]



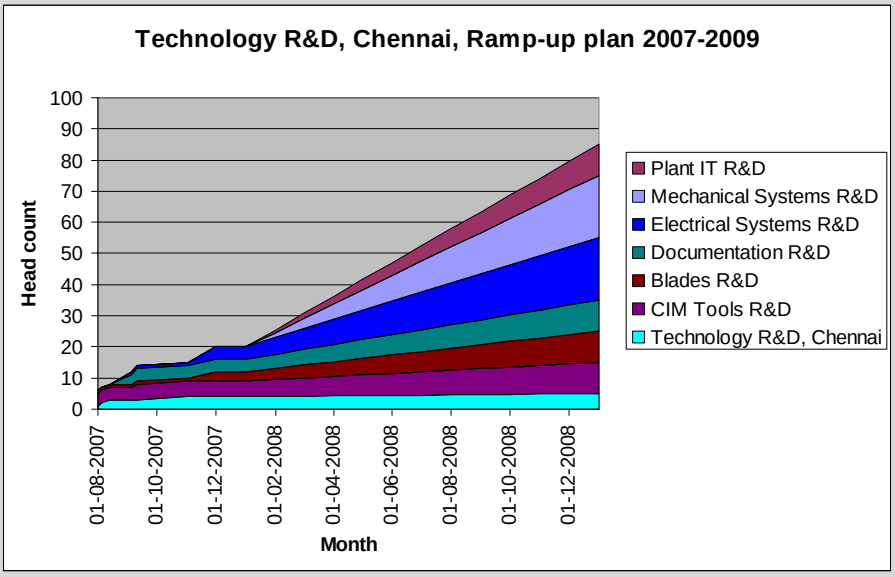
[42] Vestas Technology R&D Chennai, slides – Michael Høgedal.

Exhibit 9 – Vestas Technology R&D, Chennai, India[43]

Vestas Technology R&D's center in Chennai, India proclaimed itself as "a regional research centre leveraging all activities in Technology R&D by drawing on the competences readily available in India and here recruit outstanding engineering for attractive global R&D positions providing challenging jobs, attractive training and career opportunities at an international scale in the most exciting technology company within the business." Headed by Michael Høgedahl, the R&D center should balance global needs in Technology R&D and leverage the entire organization by: 1) offering attractive positions across Technology R&D, 2) recruiting talented and experienced Indian engineers, and 3) boosting efficiency and innovation in Technology R&D's value chain by supporting in terms of product support, new products, building bricks, development and to, some extent, applied research.

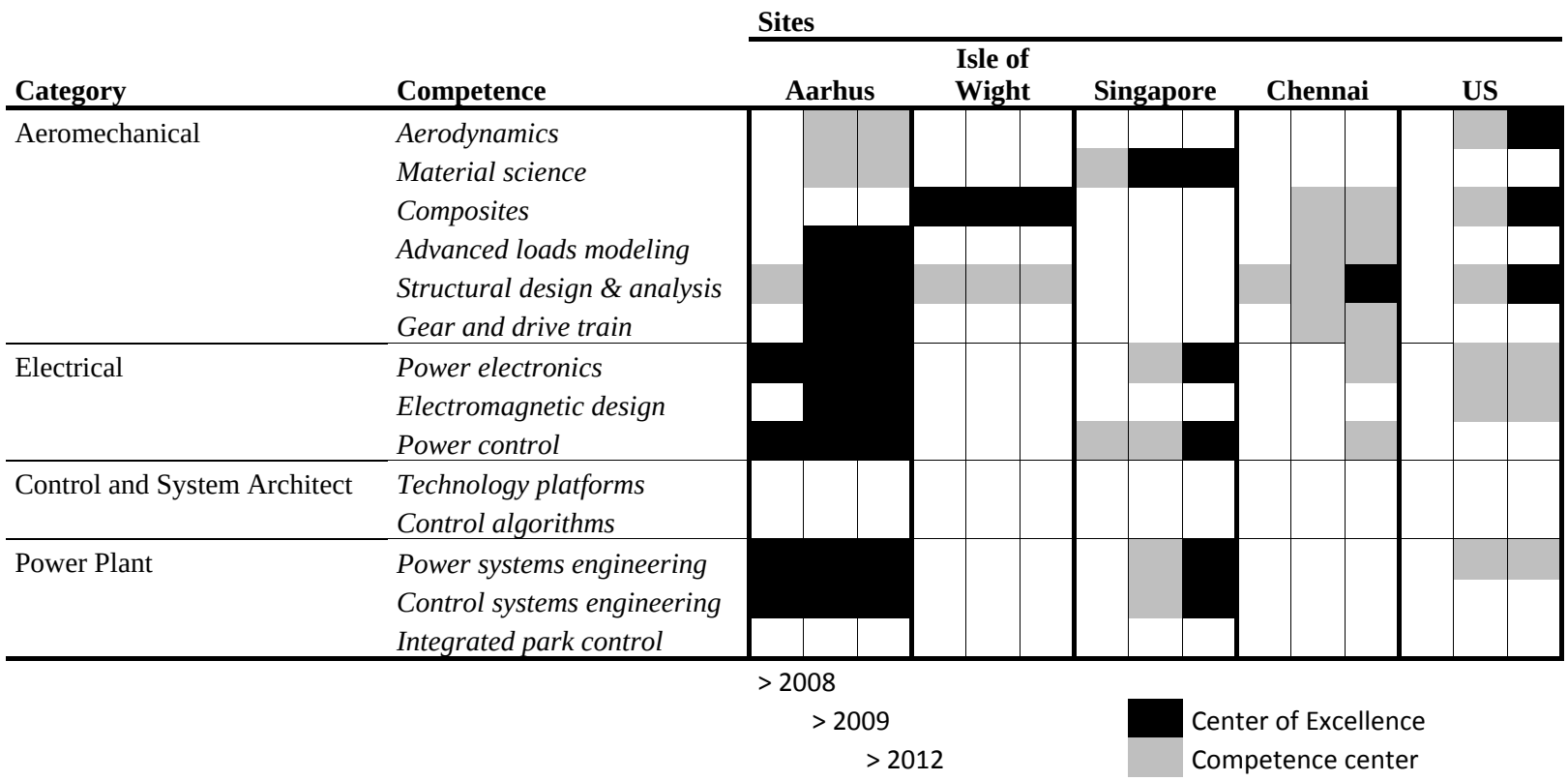
However, what had grown to become an R&D Center of Excellence in Vestas's global R&D network was purposely established in August 2007 as an R&D back-office. It originally attracted engineers who primarily should supplement the existing functions in Vestas's development department (i.e. no specialized technical focus), such as IT and R&D documentation. Yet, after Michael Høgedahl presented the prospects of the newly established Indian division to the existing organization in Denmark in order to map out potential areas of supplementation, full management teams were sent to Chennai to interview the candidates. As a result, it was decided that, given the identified qualifications, independent specialist teams in aeromechanical structural design and analysis, composites, advanced loads modeling, and gear and drive trains should be created, and that the level of responsibilities should be expanded towards higher levels of the R&D value chain (see Exhibit 11). By 2008, the Chennai center had 11 R&D departments with respective managers or team leaders in different areas of the general Technology R&D structure.

The planned development of different functions of the R&D center is presented in the following figure.



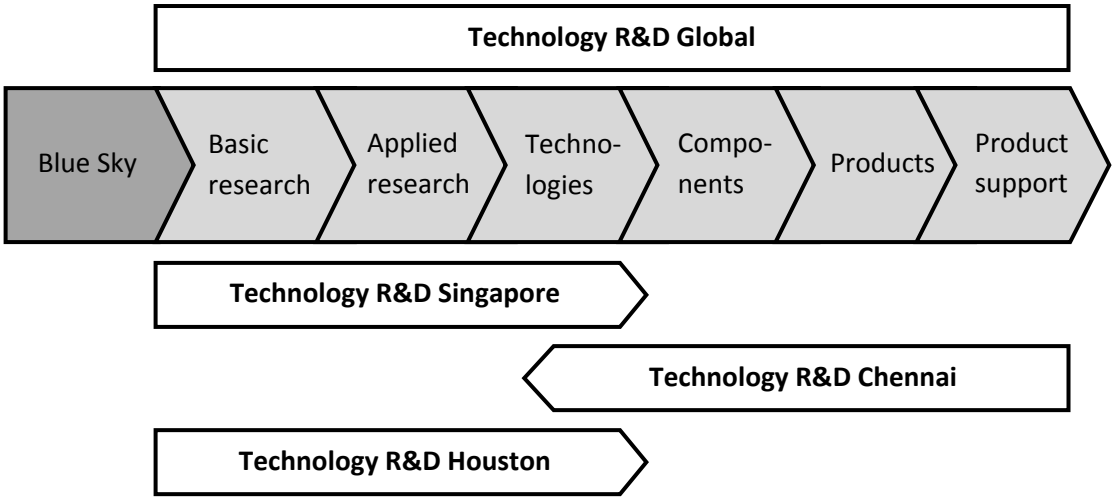
[43] Michael Høgedahl, STPI meeting 01/17/2008; Michael Høgedahl Interview, December 2008

Exhibit 10 – Vestas Technology R&D Global Operation Model[44]



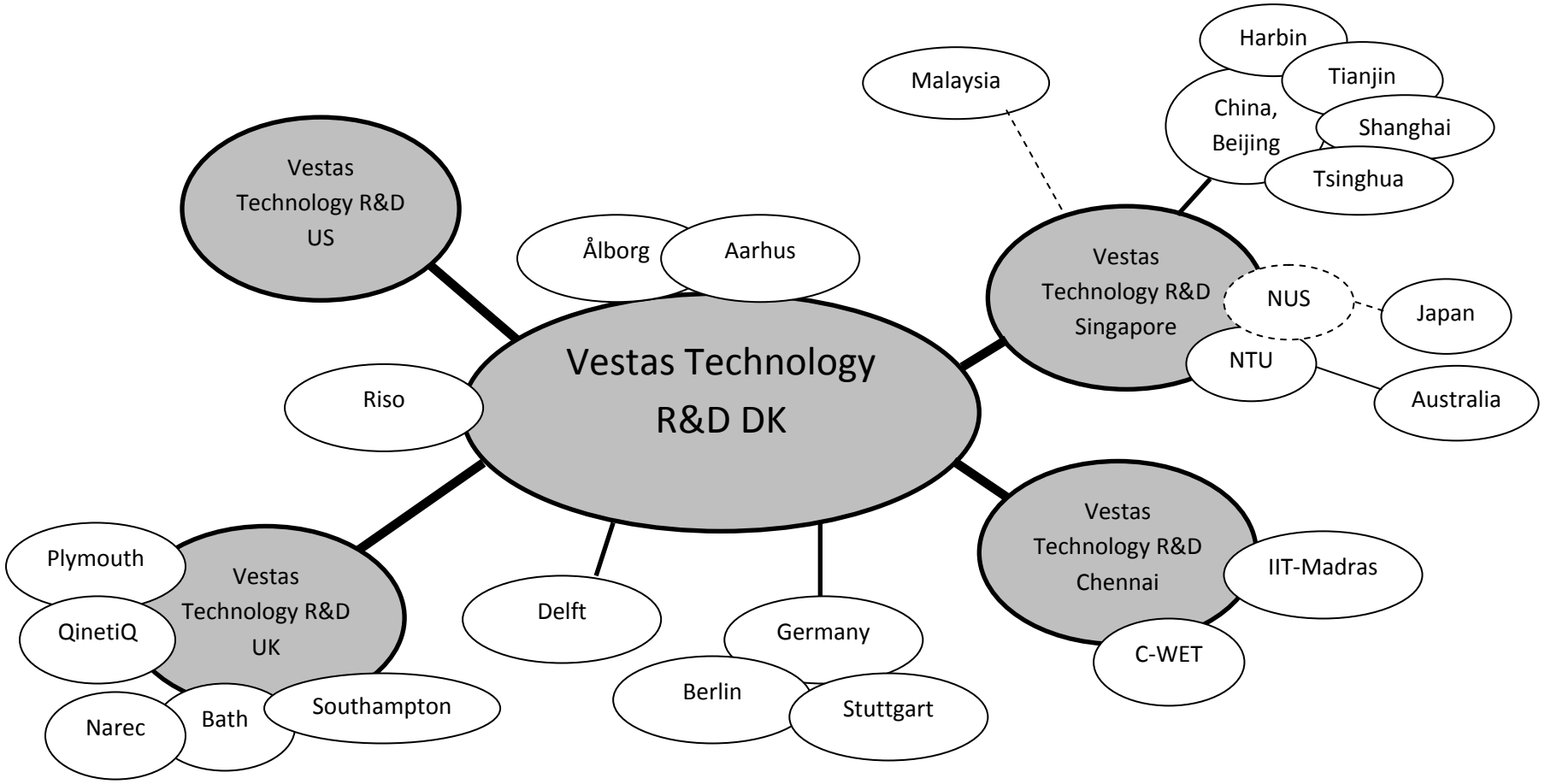
[44] Vestas Technology R&D Chennai, slides – Michael Høgedal.

Exhibit 11 – Vestas Technology R&D Value Chain[45]



[45] Vestas Technology R&D Chennai, slides – Michael Høgedal.

Exhibit 12 – Global R&D Network[46]



[46] Vestas Technology R&D Chennai, slides – Michael Høgedal.

SMG – Working Papers
www.cbs.dk/smg
2003

2003-1: Nicolai J. Foss, Kenneth Husted, Snejina Michailova, and Torben Pedersen: Governing Knowledge Processes: Theoretical Foundations and Research Opportunities.

2003-2: Yves Doz, Nicolai J. Foss, Stefanie Lenway, Marjorie Lyles, Silvia Massini, Thomas P. Murtha and Torben Pedersen: Future Frontiers in International Management Research: Innovation, Knowledge Creation, and Change in Multinational Companies.

2003-3: Snejina Michailova and Kate Hutchings: The Impact of In-Groups and Out-Groups on Knowledge Sharing in Russia and China CKG Working Paper.

2003-4: Nicolai J. Foss and Torben Pedersen: The MNC as a Knowledge Structure: The Roles of Knowledge Sources and Organizational Instruments in MNC Knowledge Management CKG Working Paper.

2003-5: Kirsten Foss, Nicolai J. Foss and Xosé H. Vázquez-Vicente: "Tying the Manager's Hands": How Firms Can Make Credible Commitments That Make Opportunistic Managerial Intervention Less Likely CKG Working Paper.

2003-6: Marjorie Lyles, Torben Pedersen and Bent Petersen: Knowledge Gaps: The Case of Knowledge about Foreign Entry.

2003-7: Kirsten Foss and Nicolai J. Foss: The Limits to Designed Orders: Authority under "Distributed Knowledge" CKG Working Paper.

2003-8: Jens Gammelgaard and Torben Pedersen: Internal versus External Knowledge Sourcing of Subsidiaries - An Organizational Trade-Off.

2003-9: Kate Hutchings and Snejina Michailova: Facilitating Knowledge Sharing in Russian and Chinese Subsidiaries: The Importance of Groups and Personal Networks Accepted for publication in *Journal of Knowledge Management.*

2003-10: Volker Mahnke, Torben Pedersen and Markus Verzin: The Impact of Knowledge Management on MNC Subsidiary Performance: the Role of Absorptive Capacity CKG Working Paper.

2003-11: Tomas Hellström and Kenneth Husted: Mapping Knowledge and Intellectual Capital in Academic Environments: A Focus Group Study Accepted for publication in *Journal of Intellectual Capital* CKG Working Paper.

2003-12: Nicolai J Foss: Cognition and Motivation in the Theory of the Firm: Interaction or "Never the Twain Shall Meet"? Accepted for publication in *Journal des Economistes et des Etudes Humaines* CKG Working Paper.

2003-13: Dana Minbaeva and Snejina Michailova: Knowledge Transfer and Expatriation Practices in MNCs: The Role of Disseminative Capacity**.**

2003-14: Christian Vintergaard and Kenneth Husted: Enhancing Selective Capacity Through Venture Bases**.**

2004

2004-1: Nicolai J. Foss: Knowledge and Organization in the Theory of the Multinational Corporation: Some Foundational Issues

2004-2: Dana B. Minbaeva: HRM Practices and MNC Knowledge Transfer

2004-3: Bo Bernhard Nielsen and Snejina Michailova: Toward a Phase-Model of Global Knowledge Management Systems in Multinational Corporations

2004-4: Kirsten Foss & Nicolai J Foss: The Next Step in the Evolution of the RBV: Integration with Transaction Cost Economics

2004-5: Teppo Felin & Nicolai J. Foss: Methodological Individualism and the Organizational Capabilities Approach

2004-6: Jens Gammelgaard, Kenneth Husted, Snejina Michailova: Knowledge-sharing Behavior and Post-acquisition Integration Failure

2004-7: Jens Gammelgaard: Multinational Exploration of Acquired R&D Activities

2004-8: Christoph Dörrenbächer & Jens Gammelgaard: Subsidiary Upgrading? Strategic Inertia in the Development of German-owned Subsidiaries in Hungary

2004-9: Kirsten Foss & Nicolai J. Foss: Resources and Transaction Costs: How the Economics of Property Rights Furthers the Resource-based View

2004-10: Jens Gammelgaard & Thomas Ritter: The Knowledge Retrieval Matrix: Codification and Personification as Separate Strategies

2004-11: Nicolai J. Foss & Peter G. Klein: Entrepreneurship and the Economic Theory of the Firm: Any Gains from Trade?

2004-12: Akshey Gupta & Snejina Michailova: Knowledge Sharing in Knowledge-Intensive Firms: Opportunities and Limitations of Knowledge Codification

2004-13: Snejina Michailova & Kate Hutchings: Knowledge Sharing and National Culture: A Comparison Between China and Russia

2005

2005-1: Keld Laursen & Ammon Salter: My Precious - The Role of Appropriability Strategies in Shaping Innovative Performance

2005-2: Nicolai J. Foss & Peter G. Klein: The Theory of the Firm and Its Critics: A Stocktaking and Assessment

2005-3: Lars Bo Jeppesen & Lars Frederiksen: Why Firm-Established User Communities Work for Innovation: The Personal Attributes of Innovative Users in the Case of Computer-Controlled Music

2005-4: Dana B. Minbaeva: Negative Impact of HRM Complementarity on Knowledge Transfer in MNCs

2005-5: Kirsten Foss, Nicolai J. Foss, Peter G. Klein & Sandra K. Klein: Austrian Capital

Theory and the Link Between Entrepreneurship and the Theory of the Firm

2005-1: Nicolai J. Foss: The Knowledge Governance Approach

2005-2: Torben J. Andersen: Capital Structure, Environmental Dynamism, Innovation Strategy, and Strategic Risk Management

2005-3: Torben J. Andersen: A Strategic Risk Management Framework for Multinational Enterprise

2005-4: Peter Holdt Christensen: Facilitating Knowledge Sharing: A Conceptual Framework

2005-5 Kirsten Foss & Nicolai J. Foss: Hands Off! How Organizational Design Can Make Delegation Credible

2005-6 Marjorie A. Lyles, Torben Pedersen & Bent Petersen: Closing the Knowledge Gap in Foreign Markets - A Learning Perspective

2005-7 Christian Geisler Asmussen, Torben Pedersen & Bent Petersen: How do we Capture "Global Specialization" when Measuring Firms' Degree of internationalization?

2005-8 Kirsten Foss & Nicolai J. Foss: Simon on Problem-Solving: Implications for New Organizational Forms

2005-9 Birgitte Grøgaard, Carmine Gioia & Gabriel R.G. Benito: An Empirical Investigation of the Role of Industry Factors in the Internationalization Patterns of Firms

2005-10 Torben J. Andersen: The Performance and Risk Management Implications of Multinationality: An Industry Perspective

2005-11 Nicolai J. Foss: The Scientific Progress in Strategic Management: The case of the Resource-based view

2005-12 Koen H. Heimeriks: Alliance Capability as a Mediator Between Experience and Alliance Performance: An Empirical Investigation Into the Alliance Capability Development Process

2005-13 Koen H. Heimeriks, Geert Duysters & Wim Vanhaverbeke: Developing Alliance Capabilities: An Empirical Study

2005-14 JC Spender: Management, Rational or Creative? A Knowledge-Based Discussion

2006

2006-1: Nicolai J. Foss & Peter G. Klein: The Emergence of the Modern Theory of the Firm

2006-2: Teppo Felin & Nicolai J. Foss: Individuals and Organizations: Thoughts on a Micro-Foundations Project for Strategic Management and Organizational Analysis

2006-3: Volker Mahnke, Torben Pedersen & Markus Venzin: Does Knowledge Sharing

Pay? An MNC Subsidiary Perspective on Knowledge Outflows

2006-4: Torben Pedersen: Determining Factors of Subsidiary Development

2006-5 Ibuki Ishikawa: The Source of Competitive Advantage and Entrepreneurial Judgment in the RBV: Insights from the Austrian School Perspective

2006-6 Nicolai J. Foss & Ibuki Ishikawa: Towards a Dynamic Resource-Based View: Insights from Austrian Capital and Entrepreneurship Theory

2006-7 Kirsten Foss & Nicolai J. Foss: Entrepreneurship, Transaction Costs, and Resource Attributes

2006-8 Kirsten Foss, Nicolai J. Foss & Peter G. Klein: Original and Derived Judgement: An Entrepreneurial Theory of Economic Organization

2006-9 Mia Reinholt: No More Polarization, Please! Towards a More Nuanced Perspective on Motivation in Organizations

2006-10 Angelika Lindstrand, Sara Melen & Emilia Rovira: Turning social capital into business? A study of Swedish biotech firms' international expansion

2006-11 Christian Geisler Asmussen, Torben Pedersen & Charles Dhanaraj: Evolution of Subsidiary Competences: Extending the Diamond Network Model

2006-12 John Holt, William R. Purcell, Sidney J. Gray & Torben Pedersen: Decision Factors Influencing MNEs Regional Headquarters Location Selection Strategies

2006-13 Peter Maskell, Torben Pedersen, Bent Petersen & Jens Dick-Nielsen: Learning Paths to Offshore Outsourcing - From Cost Reduction to Knowledge Seeking

2006-14 Christian Geisler Asmussen: Local, Regional or Global? Quantifying MNC Geographic Scope

2006-15 Christian Bjørnskov & Nicolai J. Foss: Economic Freedom and Entrepreneurial Activity: Some Cross-Country Evidence

2006-16 Nicolai J. Foss & Giampaolo Garzarelli: Institutions as Knowledge Capital: Ludwig M. Lachmann's Interpretative Institutionalism

2006-17 Koen H. Heimriks & Jeffrey J. Reuer: How to Build Alliance Capabilities

2006-18 Nicolai J. Foss, Peter G. Klein, Yasemin Y. Kor & Joseph T. Mahoney: Entrepreneurship, Subjectivism, and the Resource – Based View: Towards a New Synthesis

2006-19 Steven Globerman & Bo B. Nielsen: Equity Versus Non-Equity International Strategic Alliances: The Role of Host Country Governance

2007

2007-1 Peter Abell, Teppo Felin & Nicolai J. Foss: Building Micro-Foundations for the Routines, Capabilities, and Performance Links

2007-2 Michael W. Hansen, Torben Pedersen & Bent Petersen: MNC Strategies and Linkage Effects in Developing Countries

2007-3 Niron Hashai, Christian G. Asmussen, Gabriel R.G. Benito & Bent Petersen: Predicting the Diversity of Foreign Entry Modes

2007-4 Peter D. Ørberg Jensen & Torben Pedersen: Whether and What to Offshore?

2007-5 Ram Mudambi & Torben Pedersen: Agency Theory and Resource Dependency Theory: Complementary Explanations for Subsidiary Power in Multinational Corporations

2007-6 Nicolai J. Foss: Strategic Belief Management

2007-7 Nicolai J. Foss: Theory of Science Perspectives on Strategic Management Research: Debates and a Novel View

2007-8 Dana B. Minbaeva: HRM Practices and Knowledge Transfer in MNCs

2007-9 Nicolai J. Foss: Knowledge Governance in a Dynamic Global Context: The Center for Strategic Management and Globalization at the Copenhagen Business School

2007-10 Paola Gritti & Nicolai J. Foss: Customer Satisfaction and Competencies: An Econometric Study of an Italian Bank

2007-11 Nicolai J. Foss & Peter G. Klein: Organizational Governance

2007-12 Torben Juul Andersen & Bo Bernhard Nielsen: The Effective Ambidextrous Organization: A Model of Integrative Strategy Making Processes.

2008

2008-1 Kirsten Foss & Nicolai J. Foss: Managerial Authority When Knowledge is Distributed: A Knowledge Governance Perspective

2008-2 Nicolai J. Foss: Human Capital and Transaction Cost Economics.

2008-3 Nicolai J. Foss & Peter G. Klein: Entrepreneurship and Heterogeneous Capital.

2008-4 Nicolai J. Foss & Peter G. Klein: The Need for an Entrepreneurial Theory of the Firm.

2008-5 Nicolai J. Foss & Peter G. Klein: Entrepreneurship: From Opportunity Discovery to Judgment.

2008-6 Mie Harder: How do Rewards and Management Styles Influence the Motivation to Share Knowledge?

2008-7 Bent Petersen, Lawrence S. Welch & Gabriel R.G. Benito: Managing the Internalisation Process – A Theoretical Perspective.

2008-8 Torben Juul Andersen: Multinational Performance and Risk Management Effects: Capital Structure Contingencies.

2008-9 Bo Bernard Nielsen: Strategic Fit and the Role of Contractual and Procedural Governance in Alliances: A Dynamic Perspective.

2008-10 Line Gry Knudsen & Bo Bernhard Nielsen: Collaborative Capability in R&D Alliances: Exploring the Link between Organizational and Individual level Factors.

2008-11 Torben Juul Andersen & Mahesh P. Joshi: Strategic Orientations of Internationalizing Firms: A Comparative Analysis of Firms Operating in Technology Intensive and Common Goods Industries.

2008-12 Dana Minbaeva: HRM Practices Affecting Extrinsic and Intrinsic Motivation of Knowledge Receivers and their Effect on Intra-MNC Knowledge Transfer.

2008-13 Steen E. Navrbjerg & Dana Minbaeva: HRM and IR in Multinational Corporations: Uneasy Bedfellows?

2008-14 Kirsten Foss & Nicolai J. Foss: Hayekian Knowledge Problems in Organizational Theory.

2008-15 Torben Juul Andersen: Multinational Performance Relationships and Industry Context.

2008-16 Larissa Rabbiosi: The Impact of Subsidiary Autonomy on MNE Knowledge Transfer: Resolving the Debate.

2008-17 Line Gry Knudsen & Bo Bernhard Nielsen: Organizational and Individual Level Antecedents of Procedural Governance in Knowledge Sharing Alliances.

2008-18 Kirsten Foss & Nicolai J. Foss: Understanding Opportunity Discovery and Sustainable Advantage: The Role of Transaction Costs and Property Rights.

2008-19 Teppo Felin & Nicolai J. Foss: Social Reality, The Boundaries of Self-fulfilling Prophecy, and Economics.

2008-20 Yves Dos, Nicolai J. Foss & José Santos: A Knowledge System Approach to the Multinational Company: Conceptual Grounding and Implications for Research

2008-21 Sabina Nielsen & Bo Bernhard Nielsen: Why do Firms Employ foreigners on Their Top Management Teams? A Multi-Level Exploration of Individual and Firm Level Antecedents

2008-22 Nicolai J. Foss: Review of Anders Christian Hansen's "Uden for hovedstrømmen – Alternative strømninger i økonomisk teori"

2008-23 Nicolai J. Foss: Knowledge, Economic Organization, and Property Rights

2008-24 Sjoerd Beugelsdijk, Torben Pedersen & Bent Petersen: Is There a Trend Towards Global Value Chain Specialization? – An Examination of Cross Border Sales of US Foreign Affiliates

2008-25 Vikas Kumar, Torben Pedersen & Alessandro Zattoni: The performance of business group firms during institutional transition: A longtitudinal study of Indian firms

2008-26 Sabina Nielsen & Bo B. Nielsen: The effects of TMT and Board Nationality Diversity and Compensation on Firm Performance

2008-27 Bo B. Nielsen & Sabina Nielsen: International Diversification Strategy and Firm Performance: A Multi-Level Analysis of Firm and Home Country Effects

2009

2009-1 Nicolai J. Foss: Alternative Research Strategies in the Knowledge Movement: From Macro Bias to Micro-Foundations and Multi-Level Explanation

2009-2 Nicolai J. Foss & Peter G. Klein: Entrepreneurial Alertness and Opportunity Discovery: Origins, Attributes, Critique

2009-3 Nicolai J. Foss & Dana B. Minbaeva: Governing Knowledge: The Strategic Human Resource Management Dimension

2009-4 Nils Stieglitz & Nicolai J. Foss: Opportunities and New Business Models: Transaction Cost and Property Rights Perspectives on Entrepreneurships

2009-5 Torben Pedersen: Vestas Wind Systems A/S: Exploiting Global R&D Synergies