EXPLORING THE DYNAMICS OF THE WIND ENERGY INDUSTRY

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ABSTRACT

Since the end of 1990s the growth of new energy and renewable energy production has been strong and increasing. Wind power energy has become one important source of energy almost all over the world. Europe, USA and Asia has become the leading markets in the development of wind energy. The total volume of global wind energy production has increased from 13,600 MW in 1999 to 318,137 MW in 2013.

Since 2006 the wind energy industry is showing very rapid growth as well as dynamics among major industry actors. Some companies has left the industry due to havy competion, some has used the growth as an opportunity to expand and the inceasing demand and the growth in the wind energy sector has opened opportunities for new actors to enter the industry. China has very fast become the largest country in the world in terms of installed wind energy capacity (28,7% share of total installed capacity and 45,4 % share of installed capacity in 2013). China is followed by Germany, UK and India. USA is now on the 6th place regarding the share of new installed capacity in 2013 with 3,1 %. Sweden is on the 9th global place, shared with Romania, with 2.0 % installed capacity in 2013.

The study focuses on the industry dynamics among major wind turbine producers during the period of 2006 and 2013. The study explores how the seven top wind energy companies, with the greatest market share of wind turbine manufacturing, used business model innovation to create competitive advantage, how they act to sustain competitive, and how they act business wise globaly in the wind energy industry.

Our analysis identifies three major industry clusters based on their mix of business model components. We have labeled those three as “Born in Wind – Stay In Wind”, “Born In Wind – Expand

In Others" and "Born In Others – Expand In Wind" due to the patterns of actors from their origin, growth and expansion strategies to diffusion in different markets. The majority of manufacturers have their origin outside wind energy industry, and they create success through new combinations of resources and new value creation for customers. Only one global actors is born in the wind energy and is still remaing in the wind energy industry. All actors have over the years reshaped their business model components, value propositions and value creation to customers in order to sustain competitive on the market. There are new comers in the wind turbine industry that in short of time has achieved high growth and high market shares. Our analysis shows that the business model innovation can be seen as one important perspective to understand the dynamics of wind power industry. Based on our analysis and findings we suggest that companies in the future even more should focus on the design and innovation of their business models, and that those should have the focus on the value creation for customers from a customer perspective and make differentiation from their competitors in the global wind power industry.

INTRODUCTION

Wind energy can be used to generate electricity by wind turbines (IEA, 2014). As a natural energy source, wind is free and inexhaustible, which accounts for its appeal given the high price of oil and natural gas. In addition, wind does not produce the harmful environmental effects that fossil fuels do (Gipe, 2004). Countries that use wind energy increases the security of their energy supply and promote economic growth (IEA, 2009). Because of these benefits, at both the micro and the macro levels, it is natural that increasingly countries are looking toward wind as an alternative energy source.

A number of energy policy drivers have behind the development of global wind energy. These drivers include the need to reduce the reliance on imported fossil fuels, to improve energy security, to encourage new industrial development, and to address environmental concerns (IEA, 2013). As Figure 1 illustrates, the global installed wind energy capacity has grown by 4632% since 1996. This growth trend will continue with expectations that 500 0000 MW of wind power capacity will be added in the next seven years (GWEC, 2012).

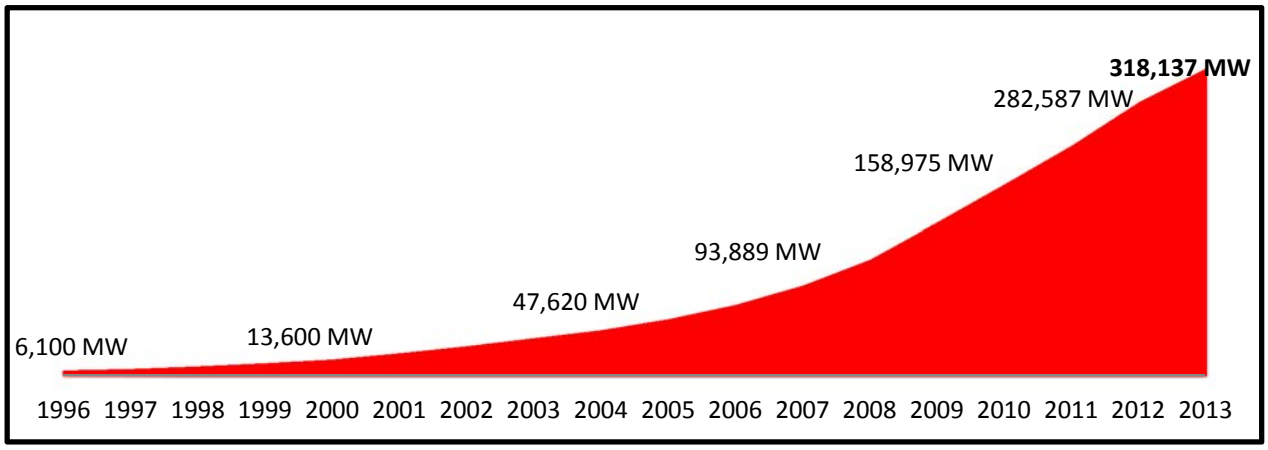

Figure 1. Global Installed Wind Energy Capacity (GWEC, 2014)

There are various reasons that explain why countries and energy companies have invested in wind energy. Among these reasons are concerns about nuclear energy safety, population growth, environmental issues such as global warming, and the possible reoccurrence of an oil embargo crisis (such as in the 1970s) (WEC, 2003; Duffield & Collins, 2006; Behrens & Glover, 2012). After 2006, the wind energy industry experienced its greatest growth era with the most wind turbine installations worldwide.

There are also regional differences in the growth of the wind energy industry. In recent years, the center of the growth has moved from Europe and North America to Asia, especially China. According to GWEC (2014), as of 2013, China had 46% of the world's total installed wind turbine capacity and ranked first in the world in terms of installed capacity rate (see Table 1). By 2013, among Western countries, the USA, Germany, and the UK ranked far behind China in cumulative capacity (see Table 2). Even though the USA is second in the ranking, the gap between the USA's percentage share (19,2%) of capacity and China's percentage share (28,7%) is still significant. It should also be noted that at present the USA has no offshore turbines although the USA may increase its annual installments of offshore investments in the future.

The German Renewable Energy Act, enacted in 1999, was a turning point in Germany's energy industry because the law sparked new investments in wind energy. Moreover, Germany has announced that it will close all its nuclear power plants by 2023, which means that Germany is likely to increase its investment in wind energy. By 2020, Germany aims to increase its energy from renewable sources by 20%. This means that Germany will increase its investment in the wind energy industry.

The Chinese Government, through legislation, has also supported renewable energy systems and energy investors. After 2005, wind energy investments rapidly increased in China. China aims to generate 15% of its energy from renewable energy sources by the end of 2020, which means more wind energy investment is expected. As of 2013, one-third of the world's MW turbines are installed in China (see Table 2). Therefore, energy policy changes in China, the USA, and Germany may increase future competition among these countries as far as wind energy installations.

Table 1. Top 10 New Installed Capacity In 2013

Country	MW	% Share
PR China	16 100	45.4
Germany	3 238	9.1
UK	1 883	5.3
India	1 729	4.9
Canada	1 599	4.5
USA	1 084	3.1
Brazil	948	2.7
Poland	894	2.5
Sweden	724	2.0
Romania	695	2.0
Rest of the World	*6 573*	*18.5*

Table 2.Top 10 Cumulative Capacity as of 2013

Country	MW	% Share
PR China	91 424	28.7
USA	61 091	19.2
Germany	34 250	10.8
Spain	22 959	7.2
India	20 150	6.3
UK	10 531	3.3
Italy	8 552	2.7
France	8 254	2.6
Canada	7 803	2.5
Denmark	4 772	1.5
Rest of the World	*48 352*	*15.2*

Country	MW	% Share	Country	MW	% Share
Total TOP 10	*28 894*	*81*	***Total TOP 10***	*269 785*	*84.8*
World Total	*35 467*	*100.0*	***World Total***	*318 137*	*100.0*

Source for Table 1 and Table 2: GWEC, 2014.

The movement away from fossil fuels to renewable energy sources, especially wind energy, has created the potential for significant profit and growth for existing wind energy companies and has motivated new companies to enter the wind energy industry. Among Asian countries, China especially has exerted its dominance in the industry. In the last decade, energy companies in China, such as Goldwind, have grown rapidly in order to meet domestic energy demand and to increase their energy exports. However, the Chinese wind energy industry has faced challenges that threaten its dominant position: the 2008 financial crisis, reduced demand from the West and more competition. These macro level challenges have influenced the growth of the industry in China.

CHANGING THE FOCUS FROM TECHNOLOGY TO BUSINESS MODEL INNOVATION

Wind energy companies are motivated to expand into new markets to keep their competitive advantage in the global wind energy industry (IEA, 2013). The 'new markets' opportunities exist in three fields: offshore wind power markets, emerging wind power markets, and maintenance and service markets for wind turbines (Lui et al., 2013). Campbell et al.'s (2014) study, which focuses on Business Model Innovation (BMI) in Emerging Economies (EE), indicates that once a company targets entry into a new market, it may be more successful if it first tries to establish itself as a local player rather than as a multinational player. The companies, Goldwind and Suzlon, for instance, are better positioned in Africa than Siemens because their business models (BM) are specifically designed for the African market. Campbell et al. also suggest that future research should focus on the main elements and drivers of change that shape BMI by adding new variables directly related to EE. Although these authors investigated drivers that cause enterprises to innovate and adapt their BMs in the African wind energy industry, they found different drivers for BMI. However, more research is needed on how wind energy companies use BMI when there are major industry changes such as the wind energy industry has experienced.

THE GLOBAL DYNAMICS OF THE WIND ENERGY INDUSTRY

This study covers the period between 2006 and 2013 – the greatest growth era in the wind energy industry in terms of worldwide installations. In this period, despite this increase, the top seven top wind energy companies lost market share or had disturbing variability in market share (see Figure 2). Moreover, the smaller wind energy companies gained over 30% of the wind energy market. This means, that by 2013, these new companies, which entered the market after 2006, manufactured about one-third of all wind turbines.

The competition in the wind energy industry was less in 2006 than in 2013, and there were fewer companies in the industry. In 2006, the total market share of the "Others" (i.e., the new entrants) was less than 3%; by 2013, that share was more than 30%. Repower in Germany, Mitsubishi in Japan and Envision in China are three of the better-known new entrants in this industry.

Between 2006 and 2008, competition in the industry increased even though at first mostly the established companies responded to the increased energy demand. However, the year 2008 was a difficult year because of the 2008 financial crisis that resulted in severe losses for most companies in the wind energy industry. This was also the year when the "Others" entered the industry and when industry competition increased the most (see Figure 2).

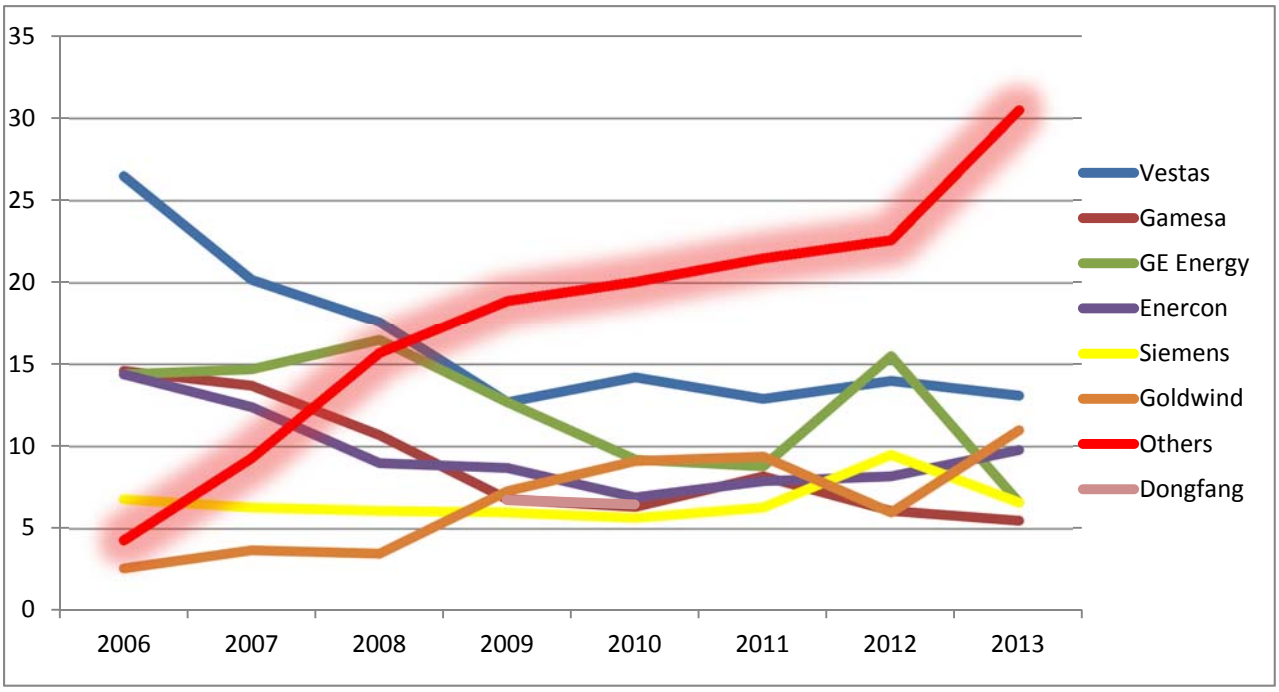

Figure 3. Market shares of the Top 7 Players and others in the Global Wind Energy Industry. (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013).[1 1]

In addition to dealing with the increase in competition and with the number of new players in the industry, between 2008 and 2010 the wind energy companies struggled with managing the industry consequences of the 2008 financial crisis. This was a period of recovery when the companies tried to maintain their competitive advantage and position in the industry by considering the effect of the crisis on industry policies (BTM, 2009).

Between 2010 and 2012, the new entrants increased their market shares at the same time that GE Energy and Siemens were still in a recovery mode. Dongfang and Goldwin saw a decline in market share, and Vestas and Enercon held their market share at the 2010 level.

The year 2012 was also difficult for the industry. GE Energy lost half its market share because of the policy gap created by the US Congress in 2012 (GWEC, 2014). 2012 was a stable year for Vestas and Enercon because conservative policies stabilized energy demand in the EU. Siemens had a strong recovery period in 2012 because of its entry into the offshore industry segment while Dongfang, Goldwind, and Gamesa lost market share in 2012.

In 2013, when China's annual domestic energy demand increased by 27% from 2012 (GWEC, 2014), the Chinese company, Goldwind, increased its market share as it met this demand. The other six top wind energy companies either lost or held market share, while the new entrants increased their total market share.

The research question of this study is the following: Why have the established companies generally lost market shares or seen variability in market share whereas the new entrants have steadily increased market share? The explanation of this dynamic in the wind energy industry is of interest to the industry, to governments, and to researchers. In this study, we examine and compare the seven top wind turbine manufacturers' use of Business Models and Business Model Innovation as a way to understand, in a period of rapid wind energy industry growth, how these players lost market share to new entrants.

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BUSINESS MODEL AND BUSINESS MODEL INNOVATION

Business Models

All organizations have a Business Model (BM), whether the organization is a new venture or an established player. The BM presents the core philosophy of the business (Magretta, 2011). According to Baden-Fuller and Morgan (2010), a BM provides a set of generic level descriptors of how a firm organizes so that it can create and distribute value in a profitable manner. In other words, a BM describes how a firm delivers value to customers and converts payment from its customers into profits (Teece, 2010). Companies whose BMs aim at building and sustaining competitive advantage will be successful in the long run (Porter, 1996). In order to build and sustain competitive advantage, however, a company's value creation process needs to be more effective and efficient (and also different) than that of its competitors. Competitors may copy innovations, imitate product life cycles, and, in low wage countries, compete with their considerable cost and price advantages (Matzler et al., 2013). A BM, then, is viewed as a source of competitive advantage (Zott & Amit, 2010) because it offers business strategists a new way to consider their options in fast-moving and unpredictable environments (McGrath, 2010).

Gambardella and McGahan (2010) define a BM as a mechanism that turns ideas into revenue at a reasonable cost. A BM explains how an organization proposes, creates, delivers, and captures value (Osterwalder & Pigneur, 2010). A BM describes a holistic and systematic approach that basically explains how enterprises do business (Casadesus-& Ricart, 2010; DaSilva& Trkman, 2013; Campbell et al., 2014). Various researchers have identified and examined the elements that make up this systematic and holistic structure although they disagree on the number of elements in their BMs.

Campbell et al. (2014, p. 6) describe a four-element BM as:

> "an abstract conceptual model representing the business and money-earning logic of an enterprise, consisting of four interlocking elements - value proposition, value creation system, value deliverance and value capture model".

Other researchers have also listed four elements in their BMs (Kamoun, 2008; Johnson, 2010). Osterwalder and Pigneur (2010) list nine elements in their BM: customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. Hedman and Kalling (2003) list six elements in their BM: customers, competitors, offering, activities and organization, resources, and supply of factor and production inputs.

In this study, we use Campbell et al.'s (2014) BM with its four elements because it allows us to simplify our analysis. Because our study examines seven wind energy companies over a period of eight years, this simplified model better addresses our research question.

The Four Elements of Business Models

The four elements of Campbell et al.'s (2014) BM are value proposition, value creation, value deliverance, and value capture. Companies combine and emphasize these four elements differently, depending on their capabilities and goals. Therefore, BMs differ from company to company.

Value proposition refers to the conceptualization of products/services intended to satisfy customer demand and to make a profit (Teece, 2010; Zott & Amit, 2010; Campbell et al., 2014; Johnson, 2010). Value proposition, then, involves an idea of what customers want.

Value creation refers to the use of internal resources and capabilities to produce products/services that appeal to customers who are willing to pay for them (Johnson, 2010; Campbell et al., 2014). Companies require financial, human, organizational, and technological resources as well as the capability to use these resources in ways that help sell their products/services.

Value deliverance refers to the transfer of products/services to customers. It involves industry segmentation, customer relations, and distribution channels (Kamoun, 2008; Giesen et al., 2009; Campbell et al., 2014).

Value capture refers to the action in which the benefits derived from the first three elements exceed their associated costs (Kamoun, 2008; Johnson, 2010; Giesen et al., 2009; Campbell et al., 2014).

The Business Model Innovation Approach

Given the challenges a company faces (e.g., competition, market shifts, and technological changes) a company has to continually update its BM once it is created (Hedman & Kalling, 2003) According to Bucherer et al. (2012), BMI is a process in which a company deliberately changes the core elements and business logic of its BM.

All companies have BMs, but some companies' BMs shape their industry structures more than others. BMs, like those from Google and Apple Computer, interact with customers and suppliers in unprecedented ways and inspire imitation by other companies (Gambardella & McGahan, 2010). Not all BMs have this effect. Xerox, for example, was less successful with its BM because it was unable to reap the fruits of its own labors (Johnson, 2010). However, some competitors have difficulty in imitating others' BMs when those models do not fit their long-term strategy, corporate culture, and core competencies (Bucherer et al., 2012).

A BM is a profit model, a business delivery system, and a learning system that presents the company's short-term profit goals and its potential for long-term learning (Itami & Nishino, 2010). As such, a BM may give a company a competitive advantage over other companies, for example, by its promotion of new products/services, its interface with customers, and its skilled labor force. New companies need a BM while established companies may need to update their existing BMs in response to changes in internal and external conditions. Because both groups have to create stakeholder value, including sufficient value for them, as time passes, a BM's sustainability may change with new developments in products, competitors, regulations, and financial availability (Sosna et al., 2010; Johnson et al., 2011).

BMI is warranted when such new developments occur. According to Kaplan (2012), companies become BM innovators when they make changes by first using their existing business models to map the organization's genome. Therefore, before launching a BMI, companies reexamine their values and evaluate their history in the context of their current BM (Mitchell & Coles, 2004). In this process, BM innovators find ways to provide new benefits at lower cost, both for themselves and for their customers (Donald & Coles, 2003).

When companies launch BMIs, they may have to alter certain elements in their current BMs as they address shifts in their industry from, for example, external technological, demographic, legal, and economic changes as well as internal product/service and organizational changes. These changes may present both threats and opportunities (Bucherer et al., 2012). If customers demand new products/services, or a new resource becomes available, or a new competitor appears, a company may need to re-think its BM to take advantage of new opportunities or to manage new threats (Giesen et al., 2009; Campbell et al., 2014).

External drivers of change, which appear at the macro level, indirectly influence BMI. Internal drivers of change, which appear at the micro level, directly influence BMI. Sometimes external and internal drivers simultaneously require changes in a company's BM. This is the impetus for BMIs intended to increase both customer and company value. Companies that neither create satisfactory value for customers nor develop a system of value creation are unlikely to succeed (Matzler et al., 2013; Campbell et al., 2014).

Companies should not delay in updating their BMs. They need to view such innovation in the same way they view product or process innovation: both are necessary for long-term success. BMI needs to be a systematic, manageable process rather than one that relies on luck, serendipity, and inspiration (Johnson, 2010). When external and internal drivers force changes, a company with foresight will detect these changes early and respond with effective changes to its BM (Johnson et al., 2011, Campbell et al., 2014).

METHODOLOGY

Yin (2003) describes business research as a complex social phenomenon that requires a qualitative approach. Because the qualitative research approach allows the researcher to make interpretations of empirical data (Freund, 2013), data collection is crucially important to overcome any problems of interpretation. To answer the research question in this study, we therefore took a qualitative research approach and used the deductive research method (Bryman & Bell, 2007). Our research, which was exploratory, allowed us to examine different regions and different business models using secondary data (companies' annual reports and other statistical data), Duriau et al. (2007). Based on this data, we developed case studies of the seven wind turbine manufacturers selected for study.

In order to examine the wind energy industry, taking the perspective of BMI, we required cases from the industry. We patterned our multi-case study after Freund's (2013) single-case study of British Petroleum's solar energy activity. To ensure the reliability of our data (Silverman, 2001), we referred to reports by BTM Consult, a Danish company that is the main data source for the international wind industry.

Case Selection

We selected seven wind energy companies, all of which appeared in the last eight years (2006-2013) of BTM Consult's wind energy industry reports. These reports are published annually and describe the ten top players in the industry as well as industry developments. The seven companies we selected are based in different countries, operate in different regions, and have different BMIs. We chose companies that provided information sufficient for the purpose of our study. We examined

these companies' BMIs individually and comparatively. Their diversity of location meant we had rich data for our research (Eisenhardt, 1989).

However, because some of the companies are not publicly owned, we were limited in accessing certain financial information including sales figures. In addition, the use of secondary data, despite its timesaving advantage in research, can introduce potential bias that leads to information asymmetry between sender and recipient (Bowen, 2009). To overcome this limitation, we compared the companies' reporting with international institutions' wind industry reports.

RESULTS AND ANALYSIS

The seven companies we selected are Dongfang, Enercon, Gamesa, GE Energy, Goldwind, Siemens, and Vestas. In addition to these companies, BTM Consult lists "Others", a group of new industry entrants that had less than 3% of the market in 2006 and more than 30% in 2013. The appearance of these new entrants in these years, as well as the steady growth in their market share, is evidence of the changing dynamics in the industry with its increasing level of competition.

To reduce their costs and to expand their distribution channels in these years, established companies in the global wind energy industry made innovations in their BMs as the new entrants tried to gain a presence in the industry. As Campbell et al. (2014) found, innovations in BMs were developed in response to external and internal drivers of change in the wind energy industry. A major aspect of these BMIs was downstream integration of the value chain – an innovation that avoids profit sharing with suppliers and outsources providers.

Dongfang, a state-owned company, founded in 1984 in China, has its roots in the manufacture of power generators. Dongfang uses government support effectively to expand domestically and globally (Dongfang, 2010). Dongfang has operations in every part of the energy industry including wind energy. Its experience and presence in the manufacture of power generators has been an advantage for its wind energy industry activities. See Figure 3.

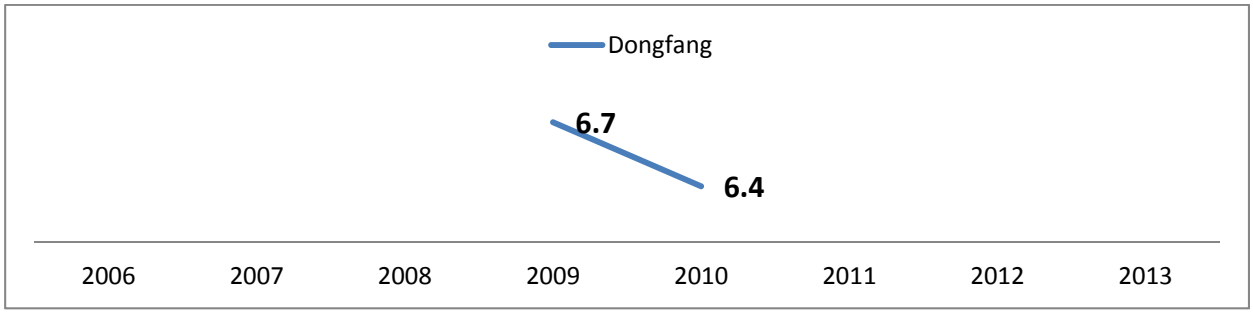

Figure 4. Market Shares of Dongfang (2006-2013). (BTM, 2009; BTM, 2010)

From 2006 to 2013, Dongfang lost market share, and by 2013 its market share was lower than 3%. Dongfang's BMI aimed at value proposition and value creation in the energy industry. Its value proposition was to target domestic demand for new products/services in China. Its value creation was to optimize the number of its employees, consolidate its technological innovations, and use its experience and knowledge effectively (Dongfang, 2008; Dongfang, 2009; Dongfang, 2011; Dongfang, 2012). Both its value proposition and its value creation were supported by well-organized value deliverance that used Dongfang's various resources. As Dongfang worked with its BMI, it adopted downstream integration in the expectation that this strategy could create greater value capture in

an increasingly competitive environment. This resulted in the creation of new distribution channels. However, when Dongfang tried to integrate its downstream activities, it lost economies of scale as well as market share.

Enercon, founded in 1984 in Germany, began with activities in the wind energy industry and then expanded into other segments of the renewable energy industry (Enercon, 2014). Enercon's progression from wind energy to other energies is quite different, from that of the companies that generally developed in the opposite direction. Enercon targeted the domestic market first and the international market second as it increased its *value capture* (Enercon, 2011; Enercon, 2012, (Enercon, Windblatt, 2011). See Figure 4.

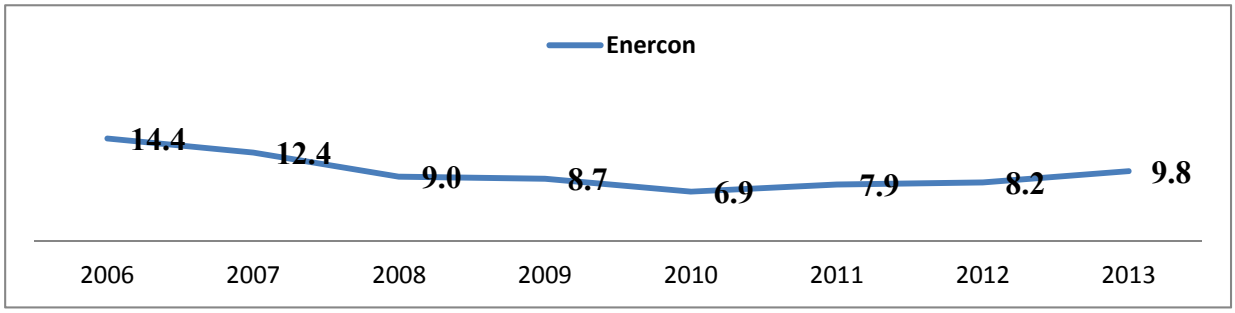

Figure 5. Market Shares of Enercon (2006-2013). (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013)

Enercon's value proposition in its BMI was to add products/services that complemented its existing products/services. Hence, Enercon, which began in the wind energy industry, used its experience and know-how to move into the shipping and hydropower industries (Enercon, 2012). Enercon's new value deliverance system, based on its original customer portfolio, supported its value creation and value proposition in a way that led to greater value capture. Downstream integration was an important feature of the BMI.

Gamesa, founded in 1976 in Spain, has its roots in robotics and aeronautics. The company entered the wind energy industry with the creation of a subsidiary in the mid-1990s. Although Gamesa had other activities in its wide product range, including solar energy, in 2006 the company closed down these activities and focused on the wind energy industry. However, in 2012, when Gamesa reorganized, it decided to provide products/services in every area of the energy industry under the name Gamesa Electric (Gamesa, 2013). This shift in industry focus meant the loss of its wind knowledge and experience. See Figure 5.

Following the 2008 financial crisis, Gamesa lost market share. However, the policy changes, reflected in its BMI, resulted in an increase in its market share from almost 7% in 2009 to over 8% in 2011.With the closing of its aviation division and other energy activities, its BMI reflected both *value proposition* and *value creation* Instead of downstream integration, Gamesa focused only on the wind energy industry. That was a radical BMI, resulting in a decline in its *value proposition* and also in its *value creation.* Gamesa's advanced technology knowledge and skills, plus its heavy investment in related R&D activities, were lost when it developed other knowledge and skills in the wind industry.

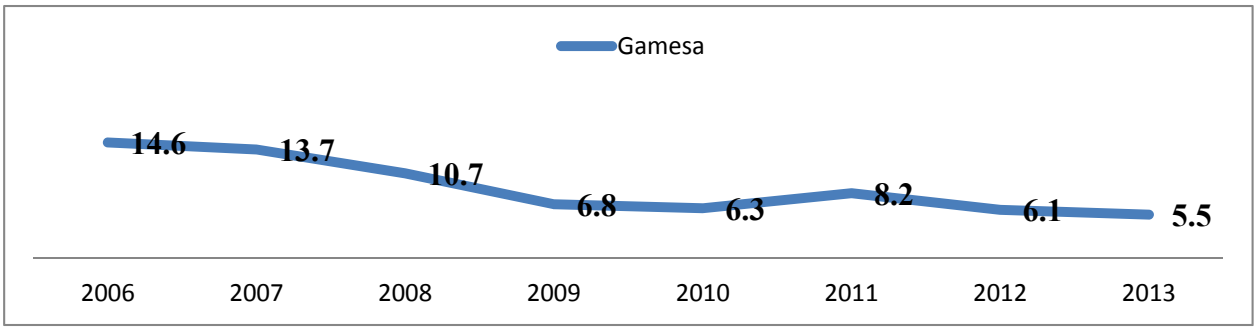

Figure 6. Market Shares of Gamesa Between 2006-2013. (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013)

Gamesa used its value deliverance to take advantage of its corporate customer portfolio. Because of this advantage, Gamesa would have been better positioned if the company had developed downstream integration by maintaining its value proposition and even enriching it with sub-industries or products. Gamesa's objective in outsourcing its service and maintenance activities to other companies was to provide service to every area of the energy industry. Recently, Gamesa has broadened its scope by announcing it will be involved with other energy areas, including solar energy and nuclear energy. This announcement indicates that Gamesa has realized its wind energy BMI was too exclusive.

Gamesa's BMI resulted in the loss of experience and knowledge, a decline in economies of scale, less profit, and a 60% loss in market share in the eight years covered by this study (Gamesa, 2009; Gamesa, 2010; Gamesa, 2011). The decreased energy demand in the USA and the EU also reduced Gamesa's wind energy sales (Gamesa, 2014). At present, Gamesa is trying to recover by offering a BMI – with a new value proposition and a new value creation – by its entry into the solar and nuclear industry. It appears downstream integration is a possibility.

GE Energy is a subsidiary of General Electric (GE) that was founded in the USA in 1892. GE, the parent company, sells products/services in numerous industries worldwide. In 2002, GE entered the energy industry with the founding of GE Energy that sells products/services in every part of the energy industry, including the wind industry. GE Energy, through GE Wind Energy, manufactures, sells, and services wind turbines as well as provides financial assistance through subsidiaries (GE, 2008; GE, 2009; GE, 2010). GE Energy has developed its BMI with value proposition and value creation. See Figure 6.

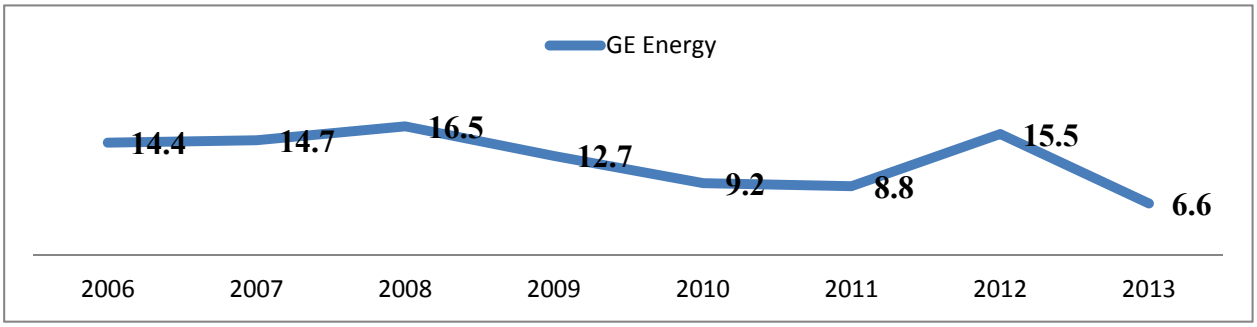

Figure 7.Market Shares of GE Energy (2006-2013). (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013)

Because of the 2008 financial crisis, GE Energy sustained a loss in that year. It continued to lose market share through 2011. However, by 2012, through acquisitions and new capacity additions (its value proposition), GE Energy accounted for 40% of the USA's domestic energy installations. The company was integrated downstream from the parent company and thereby could take advantage

of the knowledge and experience acquired from existing activities as well as the parent company's customer portfolio (its value creation). GE Energy has increased its production capacity and expanded its product range by acquisitions in the wind energy area and by consolidating technological innovation and budgeting within the entire corporation (GE, 2009; GE, 2011).

By 2013, because of increased competition in the wind energy industry, as its market share declined, GE Energy began to offset its wind energy revenues with revenues from its other energy branches and also to offer wind energy service and maintenance (GE, 2013). The USA market remained GE Energy's main target.

Goldwind, founded in China in 1998, only operates in the wind energy industry. Goldwind manufactures and services wind turbines with a special focus on mid-scale wind turbines because of domestic requirements. Goldwind is a technology-oriented company that focuses on innovation and product development. The company also cooperates with universities in advancing its capabilities and efficiency in the wind energy industry (Goldwind, 2011; Goldwind, 2012). See Figure 7.

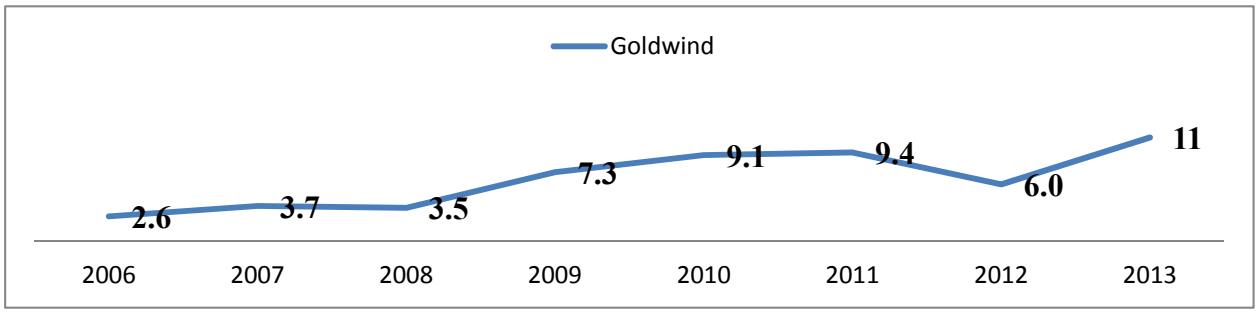

Figure 8.Market Shares of Goldwind (2006-2013). (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013)

Goldwind's BMI reflects value creation by restricting activities to the wind energy industry, by increasing production capacity, and by optimizing the number of its employees (Goldwind, 2010). Its BMI also reflects value capture in the company's targeting of the domestic market. Compared to the other top energy players in this study, Goldwind was less negatively affected by the 2008 financial crisis because of its domestic market focus. This market has grown steadily since 2005.

However, competition in the wind energy industry, even in the Chinese market, has increased. As a result, Goldwin's revenues and sales decreased in 2012 (Goldwin, 2012). In 2013, when domestic demand in China increased by 27% from 2012, Goldwind took the advantage of this rapid growth (Goldwind, 2014). In that year, Goldwin began to combine its BMI in value creation by creating downstream integration and by expanding into the international market, notably the USA and Thailand (Goldwind, 2011). Goldwind also tried to offset its reduced turbine revenues with revenues from the service and generator business, instead of sharing its profit with service providers or generator suppliers. That was a reflection of value proposition in Goldwind's BMI.

Vestas, founded in 1945 in Denmark, began manufacturing household appliances and other industrial equipment. It entered the wind turbine industry in 1979, and now manufactures and services only wind turbines (Vestas, 2010; Vestas, 2013). Its BMI reflects value creation and value deliverance owing to its strategy of "in the region, for the region". See Figure 8.

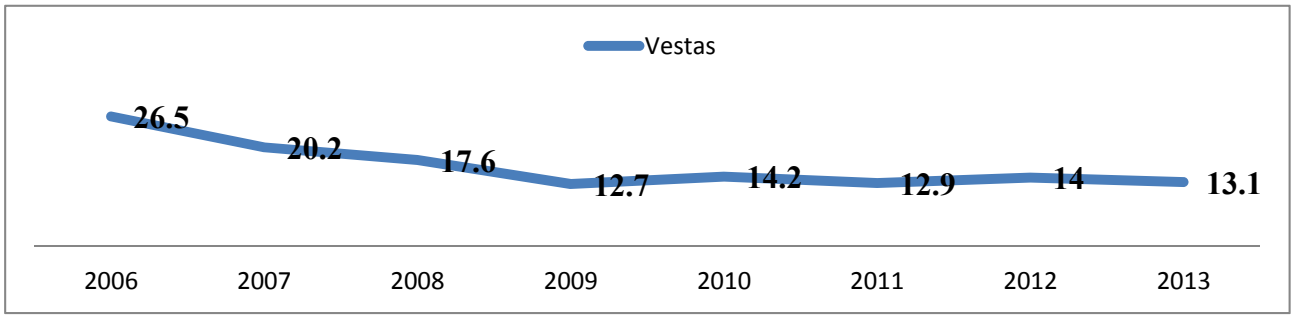

Figure 9. Market Shares of Vestas (2006-2013). (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013)

In line with this strategy, which means manufacturing wind turbines in the customers' localities, Vestas moved its factories and facilities from Europe (mainly Denmark) to Asia (mainly China) and the USA (Vestas, 2010; Vestas 2011). When Vestas expanded its production capacity by increasing the number of employees and factories, a company-wide reorganization resulted that meant closing down R&D facilities globally. These changes were part of its BMI in value creation. During this reorganization process, Vestas adopted a long-range, revenue-enhancing plan that meant viewing its existing customers as its "key customers" (Vestas, 2010). Value deliverance was reflected in its BMI by the relocation of employees and factories that reduced transportation costs and provided more information about the regions' specific requirements. Value creation was reflected by the changes in the customer portfolio, facilities, and equipment, supported by the introduction of new products/services.

Vestas responded to the 2008 financial crisis and the decline in its market share with a series of employee layoffs (Vestas, 2009). By 2010, losses had increased to the point where company reorganization, including more reduction of expenditures, was necessary (Vestas, 2010). Ultimately, the company was downsized owing to the financial crisis as well as the increased competition in the wind energy market (Vestas, 2009; Vestas, 2010). With less revenue from wind turbine sales, Vestas began to offset this revenue with service revenues to increase its value capture (Vestas, 2014). Downstream integration also reflected the value proposition focus in the company's BMI.

Siemens, founded in 1847 in Germany, is a multinational company involved in numerous industries. It entered the wind energy industry in 1980. Siemens's presence in these other industries gives it enormous advantages because it can use its consolidated R&D technology and its large financial structure to support its wind energy activities. Siemens is a company that continually uses BMI for value creation and value proposition by creating strong downstream integration. See Figure 9.

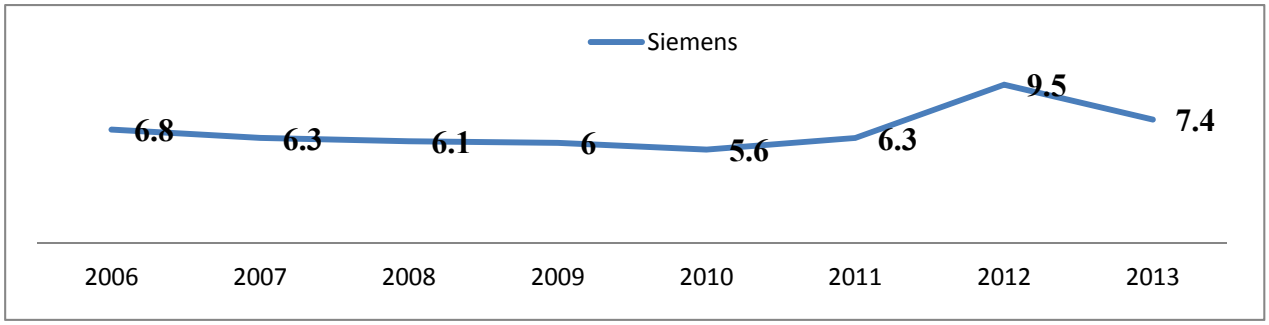

Figure 10. Market Shares of Siemens (2006-2013). (BTM, 2006; BTM, 2007; BTM, 2008; BTM, 2009; BTM, 2010; BTM, 2011; BTM, 2012; Navigant Research, 2013)

Siemens' expertise in grid systems, its knowledge of the energy industry, its facilities, and its customer portfolio were advantages when the company began developing wind turbines (Siemens, 2009; Siemens, 2011). Moreover, the introduction of offshore turbines in 2012 was a BMI consistent with its existing BM's value proposition and value creation. Manufacturing wind turbines and providing service solutions to its customers were both part of the company's downstream integration that led to greater economies of scale and thus to more effective value deliverance and to greater value capture. Siemens's initial step was to meet the domestic demand for wind energy. Its second step was to expand its operations and sales to many other countries (Siemens, 2011).

However, due to increased competition in the wind energy industry, Siemens's profitability steadily decreased until 2012. Therefore, Siemens began to offset its reduced wind turbine sales revenues with revenues from its wind turbine service and maintenance activities and from its other activities in the energy industry. Although the industry as a whole lost profitability in the early 2000s, exacerbated by the 2008 financial crisis and increased competition, Siemens was able to temporarily increase its market share in 2012. Downstream integration played an important role in this recovery.

BUSINESS MODEL INNOVATION BY THE TOP SEVEN PLAYERS IN THE GLOBAL WIND ENERGY INDUSTRY

These seven companies' BMIs involved value creation and value proposition. The companies either added new products/services – a change in value proposition – or changed their factories, HR policies, and technology policies – a change in value creation.

We can group these companies according to their BMIs into three major groups (types) in a Typology, (see Table 3). The first group is labeled "Born in the wind-stay in the wind", consisting of Goldwind and Vestas, acted more conservatively by remaining in the wind energy industry where they were born. In this way, they did not change their BMI value proposition. They innovated only with value creation.

The second group is labeled as "Born in the wind-expand into others", consists only of Enercon, which was born in the wind industry, expanded into other industries using its experience and resources from its wind energy activities. Enercon's BMI used the value proposition and value creation from its existing BM. The third group, Dongfang, GE Energy, Siemens, and Gamesa, which were born in other industries, used existing BMs to expand into the wind energy industry through downstream integration.

The third is labeled as “Born outside-moved into the wind”, were companies in this group were more successful than the companies in the first group as far as value capture and market share. The only difference between the first, second, and third groups companies relates to their use of existing BMs in their BMIs. In addition to value creation in their BMIs, companies in the first and third groups used value proposition. This led to downstream integration.

The first group of companies began in the wind energy industry and retained that position (see W2W in Table 3). These companies’ BMs were less innovative in value creation and value proposition because they made only incremental changes. The one company in the second group also began in the wind energy industry, but used its experience and knowledge from that industry to expand into other energy industry areas (see W2O in Table 3). Companies that fit into this second group are most innovative with value proposition and value creation in their BMIs. In the third group, the companies began in the energy industry although not originally in wind energy. They entered the wind energy industry after recognizing its profitability. These companies used their existing energy industry knowledge and experience to manufacture wind turbines by creating vertically integrated structures (see O2W in Table 3). These companies used BMIs with value creation and value proposition through downstream integration.

Although each of the seven companies has its own BM, there are similarities in how they used BMI to capture value in the wind energy industry.

Born in Wind and Stay in Wind (W2W)

W2W companies are born in the wind energy industry and remain exclusively in that industry. Thus, they offer a wide range of wind industry products. However, they have high start-up costs and are unable to offset losses with revenues from other energy industry activities. The service and maintenance division is therefore extremely important for these companies because it is an activity that provides an opportunity to offset losses and *capture value.* This was the situation when Vestas and Goldwind, after seeing diminishing economies of scale and loss of profits to suppliers (see Teece, 1986), changed their BMIs. They did not create downstream integration in the *value proposition* of their BMIs. In contrast with O2W and W2O companies, W2W companies capture a small part of the value in the wind energy industry and make few changes in their existing BMs as far as *value proposition.*

Born in Wind and Expand to Others (W2O)

W2O companies, which try to capture value in every part of the energy industry, are limited the by their lack of other energy experience and knowledge. They may capture greater value in the long run after they have successfully created downstream integration in other energy areas. However, such companies (in this study, only Enercon) may be unable to capture enough value from the wind energy industry to make large investments in other industries; they lack the necessary resources. However, these companies innovate to some degree with their *value proposition* and *value creation* by using their wind energy experience, knowledge, and resources. Therefore, the level of value captured by W2O companies is generally less than that captured by O2W companies but more than that captured by W2W companies.

Table 3: Business Model Typologies in the Global Wind Energy Industry

	W2W - (Born in Wind, Stay in Wind) - Goldwind and Vestas	**W2O - (Born in Wind, Expand in Others) - Only Enercon**	**O2W - (Born in Others, Expand in Wind) - Dongfang, Gamesa, GE Energy and Siemens**
Customer Value Proposition	Any product and services in the wind energy industry.	Wide product range in several segments of energy industry. Innovates its business model via value proposition.	Born in other segments of energy industry, and expanded into wind industry. Wide product range in several segments of energy industry. Constantly innovates its business model via value proposition.
Value Creation	Focus on wind energy by dedicating all financial and innovative activities to wind energy. Constantly innovates its business model via value creation.	Consolidated budgets and innovation activities in wind energy to expand in other industries. Complementary Assets (Ready network, facilities and experience) gained in wind energy industry to use for the activities in other segments of energy industry. Constantly innovates its business model via value creation.	Consolidated budgets and innovation activities for wind energy. Complementary Assets (Ready network, facilities and experience) to use for the activities in wind energy industry. Constantly innovates its business model via value creation.
Value Deliverance	Starts from zero level. New channels and expanding existing channels with the support of "key customers", existing customers.	Starts from zero level. Creates new channels and expanding in wind energy industry, which is actually creating complementary assets. These channels are later used to expand in other segments of energy industry rapidly.	Used existing customer portfolio which is a part of its complementary assets in other segments of energy industry to enter and expand in wind energy industry rapidly.
Value Capture	Revenue from sales and service activities is the only income, in addition to governmental supports. Service and sales are used to offset each other.	Revenue from wind turbine sales and service activities are combined with other businesses in energy industry. Business activities in different segments of energy industry are used to offset each other.	Revenue from other segments of energy industry are combined with wind energy and service activities. Business activities in different segments of energy industry are used to offset each other.

Increasing level of product range.

Increasing level of value delivery channels and customer portfolio.

Increasing level of value delivery channels and customer portfolio.

Increasing level of value capturing.

Business model innovation mainly in value creation.

Business model innovation mainly in value creation and supported with customer value proposition.

Business model innovation mainly in value customer value proposition and value creation at the same time

In contrast with **O2W** companies, **W2O** and **W2W** companies, which invest in the new wind industry activity, have high costs in their early years. For example, Vestas (a W2W company) and Enercon (a W2O company) experienced serious financial problems in their *value creation* as they built capacity. However, when such companies overcome financial difficulties, they can use their wind energy experience and facilities to expand into other energy industry areas.

The seven companies in this study made changes in their *value creation* and *value proposition* as they reinvented their BMs that resulted in downstream integration. Innovations in *value creation* and *value proposition,* which are linked, are appropriate for the entire BM. For example, although Gamesa was in the solar industry, in 2007 it exited that industry with its decision to focus on the wind industry. It is of interest that subsequently Gamesa acquired a solar energy company. Such changes can result in the loss of a company's knowledge and experience. Therefore, the innovation of a *value proposition* should be consistent with a company´s existing BM.

Born Outside and Expand in Wind (O2W)

O2W companies have a presence in the energy industry when they enter the wind energy industry. They have certain advantages such as industry channels, financial resources, and facilities that support them in the new area. Such companies quickly achieve economies of scale in the wind energy industry as they increase their production capacity and adapt rapidly to increased customer demand. O2W companies usually have more integrated and interdisciplinary R&D departments. They create downstream integration by integrating the wind energy activities with their existing activities as they continually innovate their *value proposition* in their BMIs. Therefore, O2W companies *capture value* in every part of the energy industry, not only the wind energy industry.

GE Energy, for instance, consolidated its wind energy activities with its aviation activities and other energy activities. To create its wind products/services, the company used its aviation knowledge and experience in its wind energy activities. Gamesa used its experience in aviation and solar energy to develop wind turbine plants. Siemens used its global experience and customer base in grid connections in its wind activities. The integration of experience, knowledge, and resources within a company's different areas is a way to retain profits rather than transfer them to suppliers and outsource providers (Teece, 1986). In sum, O2W companies have important advantages as far as an existing employee base, R&D facilities, customer and supplier networks, and factories/equipment. Their downstream integration is reflected by *value proposition* and *value creation* in their BMIs.

CONCLUSIONS

From 2006 to 2008, as demand for wind energy increased along with increased competition in the wind industry, existing energy companies tried to meet this demand and competition in various ways. As a whole, the companies experienced difficulties. Both profit and market share fell. Simultaneously the "Others" – the new industry entrants – increased the competition. By 2013, the "Others" had more than 30 % of the market.

The seven companies tried to understand and manage the challenges they faced from 2008 to 2010. Their market shares, with the exception of Goldwind's, generally continued to fall. Then the companies revisited their BMs, resulting in BMIs. The most successful of these companies were able

to adapt their BMs taking into consideration the changing dynamics of the wind industry. In some cases, their market shares increased

Eventually, the seven companies grasped these changing dynamics, although in different ways. From 2010 to 2013, most of the companies' market shares gradually increased although not to the levels enjoyed in 2006. In all cases, the companies came up with BMIs that took account of these changes. Their BMIs have both differences and similarities. The companies that made innovations to their BMs that changed their value creation and value proposition at the same time were in better industry positions in the long run. Because these companies addressed the changing industry dynamics by launching new wind energy products/services, they changed their BMs. Ultimately, they were better at value capture because they could offset their wind energy losses with profits from other energy activities. They created downstream integration in which wind energy products/services were linked with other energy products/services. Our conclusion is that companies that use BMIs to expand their product/service range, that enter emerging markets, and that engage in offshore activities are better positioned to capture future value.

In our research we have identified a pattern of corporate development. This pattern shows three distinctive types (Typologies),

Born in Wind and Stay in Wind (W2W). Here we see that only two companies are born and stay all their life in the wind industry. They have succeeded to survive and to establish a strong position on the market.

Born in Wind and Expand to Others (W2O). Here we only find one company that has found it interesting to expand into other areas outside the wind industry.

Born Outside and Expand in Wind (O2W). The most interesting group of companies is those born outside wind industry but later found it interesting to move into wind. Among those companies the combination of assets has been important to develop strong position on the market. We have seen that complementary asset combinations and recombination's are enabling strong position that is not easy for companies born in wind and staying in wind.

Base on this we have reasons to consider the future of this industry. We see also that some new entrants into the wind energy industry are coming outside, such as Mitsubishi, Samsung etc. Also in those cases these new companies build their new positions in wind based on experiences and assets from other areas.

What is important to notice for new entrants is that the barriers for entering is raising as the fleet is growing and the demand for service & maintenance in life-cycle perspective is becoming more and more crucial. IN the future the complementary assets are probably going to shift into new areas that create competitive advantage primarily in the maintenance & service field to ensure lowest life-cycle cost for users and operators of wind turbines and wind farms.

IMPLICATIONS FOR RESEARCHERS

This research shows that the deep understanding of Business models and the innovation of new Business models need to take into account the longitudinal aspect of business model in use. To really understand what component or which components a company has changed need to be put in relation with the history of a company. In these cases it is obvious that the history of each company

is to certain level explain their changes in business model. Gamesa, GE and Siemens have a history of coming outside the wind energy area and that historical background creates important force or driver for changes that those companies that do not have this variety background cannot have. They are on the other hand forced to act differently in order to create a competitive advantage.

This research is based only on secondary and open information. In our research we see that there is a need for deeper understanding of the dynamics underlying each companies business model in use or the innovation process in innovating new business model. The combination of secondary based research and qualitative based case study would enable us to grasp and understand the logic and dynamics in each case.

IMPLICATIONS FOR MANAGERS

To increase product/service range, a reorganization of facilities may lead to more efficient production and to a larger customer portfolio. In this way, companies may be better positioned to meet international demand in new markets, especially emerging markets.

Because of increased energy demands in Asia, the locus of the wind energy industry has shifted from Europe and North America to Asia, especially China. This change, which reflects industrial leadership (measured by installed capacities) and wind energy technology, is most evident in China. Currently, one-third of the world's wind turbines are located in China. There is no indication that this trend will diminish. It is also possible that China will continue to increase its wind turbine service expertise to the extent that it will become the dominant global player.

Because of the interest by many EU countries in renewable energy sources, investments in the wind energy industry will likely increase in Europe as well. As public awareness of the advantages of wind energy has increased, governments in some EU countries have revised their energy policies. These countries have significant industrial experience in and knowledge of wind energy that can be used to move from fossil fuel energy sources to renewable energy sources, especially wind. With the expansion of wind turbine manufacturing, companies will also expand their service and maintenance capacity. In short, according to Lui et al. (2013), the service/maintenance sector of the wind industry may increase in proportion to the increase in wind energy installations. EU countries with experience in the wind energy industry may benefit most by using their experience and knowledge to become or challenge industry leaders.

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