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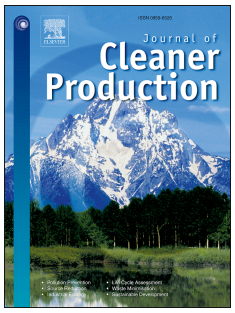

Innovation capability building in subsidiaries of multinational companies in emerging economies: Insights from the wind turbine industry

Ulrich Elmer Hansen, Thomas Hebo Larsen, Shikha Bhasin, Robin Burgers, Henrik Larsen

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Innovation capability building in subsidiaries of multinational companies in emerging economies: insights from the wind turbine industry

Ulrich Elmer Hansen, UNEP DTU Partnership, Dept. of Management Engineering, Technical University of Denmark, Marmorvej 51, UN City, Room 3.9.33, 2100 Copenhagen, Denmark. Direct telephone: (+45) 45335298. uleh@dtu.dk

Thomas Hebo Larsen, UNEP DTU Partnership, Dept. of Management Engineering, Technical University of Denmark, Marmorvej 51, UN City, 2100 Copenhagen, Denmark. Direct telephone: (+45) 45335296. thelar@dtu.dk

Shikha Bhasin, Council on Energy, Environment and Water, Sanskrit Bhawan, A-10, Qutab Institutional Area, Aruna Asaf Ali Marg, New Delhi – 110067, India. (+91) 9811161977 , (+91) 11 40733300, shikha.bhasin@ceew.in

Robin Burgers, Radboud University, Comenuislaan 4, 6525 HP Nijmegen, Holland. Burgers.robin@gmail.com

Henrik Larsen, Centre for Environmental Policy, Faculty of Natural Sciences, Imperial College London, South Kensington Campus, London SW7 1NA, UK. Telephone: (+44) (0)7517094389. H.larsen14@imperial.ac.uk

Innovation capability building in subsidiaries of multinational companies in emerging economies: insights from the wind turbine industry

Abstract

Research on the catching up of latecomer firms has generally overlooked whether, and how, subsidiaries of multinational companies (MNC) operating in emerging economies have developed innovation capabilities. Existing research on innovation capability building in MNC subsidiaries mainly employs quantitative research designs, comprising large samples of MNC subsidiaries using patent statistics to generate insights at a highly aggregated level of analyses. Accordingly, the existing research fails to capture the micro-level dynamics of learning and innovation capability development over time within individual MNC subsidiaries. To overcome this knowledge gap, we pursue a case study approach in this paper, drawing on qualitative data in order to generate an in-depth analysis of the processes underlying innovation capability building within a single MNC subsidiary. We examine the innovation capability development trajectory of a local Indian subsidiary of a Danish first-tier supplier of wind turbine blades. We adopt an analytical framework based on the literature on innovation capability building in latecomer firms, which is combined with insights from the literature on MNC subsidiary capability evolution. The paper points to the key role of the parent company and internal learning in the subsidiary as the basis for the advanced level of innovation capabilities achieved by the subsidiary, enabling it to become a supplier of innovations to its parent company. Contributions to the literature on innovation capability building in latecomer firms are presented and discussed.

Highlights

- Limited research on innovation capability building in MNC subsidiaries
- Paper adopts a micro-level perspective on innovation capability building
- Case study of an Indian subsidiary of a first-tier supplier of wind turbines
- Learning through intra-corporate knowledge transfer, and internal learning
- Bidirectional knowledge flows as innovation capability building progressed

Word count: 9149

1. Introduction

The process of how firms in emerging economies create sustainable competitive advantages based on the development of innovation capabilities has been a key topic of research over the past decades (Lall, 1992; Kim, 1997; Bell and Figueiredo, 2012a). Firms from emerging economies, frequently referred to as 'latecomer firms', are typically characterised by their initial disadvantaged position of being dislocated from technology sources and advanced markets, albeit with a strategic intent to catch up with incumbent firms (Mathews, 2002). Numerous studies in this field of research have explored the process whereby domestic latecomer firms build up a minimum base of technological knowledge enabling them to carry out more innovative activities with increasing complexity and novelty (Lall, 1992; Dutrénit, 2004; Figueiredo, 2003). Specifically, the research in this literature has focused on analysing the underlying learning processes for the accumulation of innovation capabilities in latecomer firms (Bell, 2007; Figueiredo, 2017). The literature on innovation capability building in latecomer firms generally considers subsidiaries of multinational companies (MNC) in emerging economies as a sub-category of latecomer firms (Bell and Figueiredo, 2012b). Indeed, MNC subsidiaries share a number of commonalities with domestic latecomer firms, such as their disfavoured position away from key sources of innovation and their potential to accumulate capabilities enabling them to move from an 'initially imitative' position toward becoming world-leading innovators. Such a perspective reflects the understanding of MNC subsidiaries as active and independent enterprises that may shape their own technological development paths (Figueiredo and Brito, 2011).

However, as pointed out by Li et al. (2013), surprisingly few studies in this literature have specifically explored innovation capability building in MNC subsidiaries operating in emerging economies. Accordingly, Amann and Cantwell (2012) argue that the extent to which, and how, MNC subsidiaries in emerging economies enhance their innovative capabilities is still far from clear. Existing research has shown considerable variation in the level of innovation capabilities achieved by MNC subsidiaries across various countries and sectors. Whereas some MNC subsidiaries in emerging economies have developed significant innovative capabilities, others are lagging far behind the world innovative frontier (see Rasiah, 2004; Marin and Bell, 2006; Quadros and Consoni, 2009). Possible explanations for this observed heterogeneity in the rates and levels of innovation capability building in MNC subsidiaries remain largely unknown. According to Bell and Figueiredo (2012b), a main reason for this limitation in our current understanding is the tendency, in previous studies, to pursue quantitative-based and cross-sectional research based on large samples of MNC subsidiaries. Most studies use patent statistics and R&D indicators as empirical data both as proxies of knowledge-inputs and innovative capability development. Li et al. (2013), for example, examined a sample of 317 MNC subsidiaries in China and pointed at the greater importance of R&D expatriates from the parent MNC compared to locally-recruited R&D personnel, in relation to innovative performance (measured by R&D expenditure and patent counts). Cantwell and Zhang (2013) used patent data to analyse innovation capability building in a sample of 51 MNC subsidiaries in China and found that knowledge inputs from other firms and organizations outside China played a more important role compared to local sources of knowledge. Conversely, Franco et al. (2011) analysed the innovation practices of over 1,200 affiliates of MNCs across various sectors in India and Brazil, and stressed the significance of locally available knowledge inputs compared to sources from abroad. Boehe (2007) studied a sample of 269 MNC subsidiaries in Brazil and found that diverse forms of local knowledge linkages played a central role in explaining why over half of the subsidiaries were able to contribute to the innovation activities of their parent MNCs. These studies typically pursue statistical correlations between selected variables, which generate insights at a highly aggregated level of analyses. Such a variable-oriented approach contrasts with qualitative research methods typically used in small-N studies in which many context-specific factors may be considered in order to understand in detail the mechanisms of change over time (George and Bennett, 2005). Due to the lack of studies adopting in-depth, qualitative case research methods focusing on

individual subsidiaries, or a small sample of such, existing research has failed to capture the learning processes underlying innovative capability building in MNC subsidiaries at a micro level (Michailova and Zhan, 2015). As argued by Figueiredo and Bell (2012a;32), "*we still know little about the role of learning mechanisms affecting differences between MNC subsidiaries in terms of capability building and innovation performance*".

A number of studies have, nevertheless, made some progress in this direction, building on smaller samples of MNC subsidiaries and drawing mainly on qualitative research methods. Ariffin (2010), for example, provided a detailed account of the sources of learning residing within the corporate network of the MNCs as having played a critical role in the development of innovation capabilities in MNC subsidiaries in the Malaysian electronics industry (see also Ariffin and Bell, 1999). Variations in the rates and levels of innovation capability development across the 26 MNC subsidiaries studied were explained by the varying degrees of engagement with learning through parent-subsidiary linkages. Similarly, Ariffin and Figueiredo (2004) pointed at the importance of the level of engagement with the parent MNCs as a main determinant accounting for the variation in innovation capability building across 42 MNC subsidiaries in the Malaysian and Brazilian electronics industry. Further, Figueiredo (2011) presented an in-depth study of the development of innovation capabilities in 7 MNC subsidiaries in the electronics industry in Brazil, distinguishing between learning mechanisms within the corporate network of the MNC (including parent companies and sister subsidiaries) and external sources locally (such as local universities, suppliers and customers). MNC subsidiaries that maintained frequent interaction with multiple firm internal and external linkages were found to have developed the highest levels of innovative capabilities. Finally, Figueiredo and Brito (2011) explained the variation in the rate and level at which 7 MNC subsidiaries in the Brazilian ICT industry developed innovation capabilities, through differences in the learning efforts made to acquire knowledge from local organizations.

In this paper, we aim to contribute to the above studies specifically related to research on MNC subsidiaries in emerging economies, to further advance the literature on innovation capability building in latecomer firms. Specifically, we examine the development trajectory of a local Indian subsidiary of a Danish first-tier supplier of wind turbine blades in the global wind turbine industry. We explore the research question, *how has the local Indian subsidiary managed to develop the capabilities to become a supplier of innovations to its parent company*? We draw on the literature on innovation capability building in latecomer firms as a frame of analyses, which is complimented with insights from the literature on MNC subsidiary capability evolution.

The paper is structured as follows. The conceptual framework is presented in Section 2, while Section 3 provides a description of the research methods used. Section 4 describes the empirical context and the firm used as a case study. In Section 5, the main empirical findings are presented regarding the innovation capability development trajectory of the Indian subsidiary and the underlying learning mechanisms. Section 6 discusses the empirical findings, with the main conclusions being drawn in Section 7.

2. Conceptual framework

2.1. Firm-level innovation capabilities

In this paper, we draw on the literature on the development of innovation capabilities in latecomer firms in emerging economies. A distinction is often made in this literature between so-called 'production' capabilities', which denote the ability of firms to carry out tasks related to operating existing production systems and 'innovation capabilities', which comprise the ability of firms to generate and manage technical change in their products, equipment and internal processes (Bell and Pavitt, 1995). We focus in this paper on the development of such innovation capabilities, which, as pointed out by Lall (1992), is related to technical aspects in the firm as opposed, for example, to organisational or investment related capabilities (see also Dutrénit, 2000). A key

element of empirical research in the literature involves the development of a detailed taxonomy of innovation capabilities tailored to the specific industry or sector in question (see e.g. Tacla and Figueiredo, 2006). Such taxonomies are needed in order to study whether and how firms progress across levels of innovation capabilities based on a continuum, which typically range from the ability of firms to implement minor technological modifications that are new to the firm to the ability to generate new to the world innovations (for empirical examples, see Ariffin, 2000; Dutrénit, 2000; Figueiredo, 2003; Ariffin and Figueiredo, 2004). Progression in the innovation capability of individual latecomer firms thus involves an 'upward' vertical movement across these levels toward world leading firms operating at the technology frontier at the highest level of innovation capabilities (Winter, 2003; Zollo and Winter, 2002; Teece, 2007). In this paper, we make use of the capability matrix previously developed by Hansen and Lema (2019), which is specifically tailored to the wind turbine industry (see Figure 1).

(Insert Figure 1 around here)

2.2. Learning mechanisms in innovation capability building

The literature has repeatedly pointed at the specific learning mechanisms that firms engage with as the main determinant factor accounting for variation in the rates and levels of innovation capabilities achieved by latecomer firms. Indeed, it is the functioning of individual learning mechanisms and their specific combination over time that matter for the progress made by individual firms in terms of the development of innovation capabilities. In line with Bell (1984), we understand learning as the various types of processes by which additional technical skills and knowledge are acquired by individuals and by the organisation. Accordingly, learning involves all ways in which firms may acquire knowledge, skills and other cognitive resources needed to engage in innovative activities. In the literature, numerous studies have analysed a broad range of different types of learning mechanisms, typically distinguishing between firm internal and external sources of learning (for an overview, see Figueiredo and Bell, 2012a; Hansen and Lema, 2019). We consider the literature as providing an inventory of learning mechanisms of possible relevance in this paper. Specifically, we make use of the specific learning mechanisms elaborated in the literature focusing explicitly on learning in vertically integrated relationships involving a parent MNC and its local subsidiary in an emerging economy (Ariffin, 2000; Figueiredo, 2011; Figueiredo and Brito, 2011; Pietrobelli and Rabellotti, 2011). In this context, a number of learning mechanisms have been found that are critical in the process of developing innovation capabilities in MNC subsidiaries, which include knowledge transfer from face-to-face interaction, training and supervision, and the transfer of codified knowledge in the form of technical specifications and standards (Mudambi and Navarra, 2004; Rabbiosi and Santangelo, 2013; Michailova and Zhan, 2015). Such learning mechanisms are conceptualised as residing within the parent MNC–subsidiary relationship, as opposed to learning mechanisms that are external to or within the local subsidiary (see Table 1). These include learning from internal efforts undertaken within the local subsidiary (independently of the parent MNC), imitation of local competitors and cooperation with local universities (Ariffin, 2000).

(Insert Table 1 around here)

We compliment the above with supplementary insights from the international business literature on MNC subsidiary capability evolution. This literature has ascribed importance to the key role of the MNC headquarters in the development of innovation capabilities in local MNC subsidiaries in emerging economies (Birkinshaw and Hood, 1998). Indeed, knowledge transfer from the parent MNC to its local subsidiaries (Flow 4 in Figure 2) is often part of strategic efforts enabling the local subsidiary to progress from a mandate based on exploitation of the existing knowledge to becoming able to innovate and generate new knowledge in its own right. As the local subsidiaries

acquire higher levels of innovative capabilities, it may progress from a 'knowledge exploitation' mandate to a 'knowledge augmentation' mandate (Cantwell and Mudambi, 2005). In such cases, the reverse flow of knowledge from the subsidiary to its parent MNC will become more prominent (Rabbiosi and Santangelo, 2013; Mudambi et al., 2014) (Flow 1 in Figure 2).

(Insert Figure 2 around here)

Drawing on a combination of the key learning mechanisms elaborated in the literatures on innovation capabilities in latecomer firms and MNC capability subsidiary evolution, we derive a set of learning mechanisms to be analysed of this paper, which is shown in Figure 3.

(Insert Figure 3 around here)

3. Research methodology

3.1. Case selection strategy

A case study research design was considered appropriate for this paper, as it involves exploratory research on a contemporary phenomenon that has not been previously explored in detail, and where the context is difficult to separate from the study object (Sharma and Vredenburg, 1998; Yin, 2009). Indeed, micro-level research adopting a longitudinal perspective to explore the learning and innovation capability development trajectory in individual MNC subsidiaries is generally lacking (Bell and Figueiredo, 2012a). Consequently, the existing literature does not provide an established set of theoretical propositions and conceptual constructs to address this phenomenon (Mills et al., 2010). The paper, thus, provides an attempt at generating new knowledge in this field by providing a detailed account on the basis of the insights that can be obtained from the empirical material collected and the conceptual framework adopted. The insights generated from the analysis presented in this paper allow us to contribute to theory development by generating new conceptual propositions of theoretical relevance through a process of analytical generalisation (Eisenhardt and Graebner, 2007).

It has repeatedly been stressed in the literature that innovation capability building in latecomer firms is a highly firm-specific and path-dependent process (Lall, 1992; Bell, 2007). Accordingly, a focus on investigating the innovation capability development trajectory of a single MNC subsidiary was considered useful in this paper, in order to generate new knowledge on the underlying learning processes involved. A main advantage of single case studies is precisely their ability to unravel, in-depth, the causal mechanisms of change operating within the firm, taking into consideration a range of interacting factors involved (Tokatli, 2015). The case study presented in this paper focuses on an Indian subsidiary of the Danish (parent) multinational company, LM Wind Power - a leading global supplier of wind turbine blades. The Indian subsidiary was considered to have achieved a highly advanced level of innovation capabilities, which would enable us to study in detail the key features of the learning processes involved. The case study provided an interesting basis for addressing the call made by Amann and Cantwell (2012) for more research aimed at illuminating how and why some MNC subsidiaries manage to develop advanced innovation capabilities, while others fail in doing so. In particular, following Bell and Figueiredo (2012a), the case study presented an opportunity to enhance the understanding of the nature and functioning of specific learning mechanisms involved in innovation capability development in MNC subsidiaries. The global wind turbine industry provides a well-suited context for this paper, as it represents a typical example of the on-going global relocation of innovation activities from parent MNCs in advanced countries to their subsidiaries in emerging economies (Awate et al., 2012; Michailova and Zhan, 2015).

3.2. Data collection and analytical procedures

The empirical data for this paper are qualitative in nature and were collected through twelve firm-level semi-structured interviews with representatives of the Danish company LM Wind Power conducted in 2016, 2017 and 2018 and analyses of documentary sources. This triangulation of methods was aimed at cross-checking the consistency of the collected data in order to enhance the overall reliability of the findings (Meijer et al., 2002). Furthermore, to support triangulation by data source, interviewees included employees across divisions and levels of the organisation at the Danish headquarters of LM Wind Power, the Indian subsidiary and the technical support centre in the Netherlands (see Table 2). Two Danish industry experts were also consulted as informants providing information about the global wind turbine industry and the technical aspects in relation to wind turbines. If allowed by the interviewee, the interview was recorded digitally and the audio file subsequently transcribed. In all cases, detailed notes were also taken during the interviews. As for the documentary sources of data collected for this paper, these mainly involve firm-specific archival documents, such as LM Wind Power's annual reports and industry-specific reports, including peer-reviewed journal papers and consultancy reports.

(Insert Table 2 around here)

An interview guide was prepared in advance of the interviews comprising two main elements: (i) questions addressing the rate and levels of innovation capability achieved over time in the subsidiary; and (ii) questions addressing the most important sources of learning over time in the development of innovation capability in the subsidiary (see Appendix A).

The questions asked in order to obtain a detailed understanding of the former started out by allowing the interviewee to provide a broad description of the overall history and nature of the activities undertaken in the local subsidiary. Subsequently, the interviewees were asked a set of probing questions aimed at identifying specific landmark projects, technical milestones and achievements over time in the local subsidiary with the aim of generating a detailed account of the trajectory of innovation capability development. These questions made use of pre-formulated indicators of innovation capability with a basis in the literature and previous research on innovation capability in relation to wind turbines (see e.g. Hansen and Lema, 2019 and Figure 1). These indicators focused on identifying an increase in the ability of the local subsidiary to engage in R&D and innovation activities with an increasing degree of complexity and knowledge content (Bell and Pavitt, 1995; Amsden and Tschang, 2003, Bell and Figueiredo, 2012b). First, such an increase could involve a move from engaging in routine-based and labour-intensive engineering tasks, such as detailed technical drawings and calculations, into more complex tasks, such as basic and conceptual engineering. An increase in innovation capability could also be discerned in a change in the ability of the local subsidiary to execute specific and well-defined problem-solving tasks to its engaging increasingly in the framing of the basic problem to be solved (Lema, 2014). With a basis in the literature on MNC subsidiary capability evolution, a second indicator involved asking interviewees to specify the role of the local subsidiary in leading specific R&D projects and innovation activities within the global organisation of the MNC. Finally, other questions were aimed specifically at obtaining a detailed understanding of the number and qualifications of the R&D personnel and the possible patenting activities in the local subsidiary (see Figure 1). These indicators were combined to assess whether an 'upward' movement in the level of innovation capabilities had taken place, enabling the subsidiary to venture into activities that require the ability to engage creatively with technology and to generate new innovations.

A second set of questions addressed the main sources of learning in innovation capability development in the Indian subsidiary. Initially, interviewees were asked to provide a broad description of the underlying learning processes enabling an increase in the level of innovation capability with a basis in the indicators described above. As a guiding device, the interviewees were presented with the various types of learning mechanisms in MNC-subsidiary innovation capability

development utilising the learning sources shown in Figure 3. The interviewees were then asked to provide a more detailed description of the nature and functioning of specific learning mechanisms and their relative importance over time. More specifically, they were encouraged to describe, in as much detail as possible, the specific individuals involved from the Danish headquarters of the MNC and the local subsidiary in India, the resources allocated and the nature of the learning processes. Similarly, other questions addressed possible internal learning efforts and the process of learning by imitating competitors and cooperating with local research institutions.

The data collected from interviewees were organised into pre-defined thematic categories using the tabular approach described in Miles and Huberman (1994). These categories comprised two separate tables with a matrix structure in which direct interviewee quotes could be inserted into the two overarching themes of (i) innovation capability development, and (ii) specific learning mechanisms (see Table 3). The subsequent coding and interpretation procedure followed a logic in which interviewee quotes categorised within the specific themes were meticulously analysed, allowing intermediate interpretations to be distilled and final conclusions to be drawn, which could subsequently be inserted into the paper in a shorter and narrative form (see Appendixes B and C).

(Insert Table 3 around here)

However, while the analytical procedures were based on pre-defined thematic categories within the adopted theoretical framework, the coding and interpretation process proceeded iteratively, allowing new themes to emerge based on the empirical data that had been collected and analysed. These themes then fed into additional data collection, which included continuing revision of the interview guide in successive rounds of interviews in order to increase the relevance and internal validity of the study (Denzin and Lincoln, 1994). Initial thematic categories that were found to be irrelevant due a lack of analytical leverage and insignificance in the empirical data were thus excluded from the analyses. Therefore, the learning mechanisms that were found not to have influenced the innovation capability development process were excluded from further analysis. Accordingly, as various interviewees did not ascribe importance to the role of learning from sources in the local/regional cluster (see Figure 3), this was excluded due to non-significance.

Following Eisenhardt (1989), this iterative data collection and coding process involved a constant process of revisiting and comparing the empirical data collected with the theoretical literature presented in Section 2. During the research process, a comprehensive understanding gradually emerged of the development of innovation capability and the main underlying sources of learning in the Indian subsidiary. These findings will be presented in the following, starting with a short introduction to the empirical context and the case study.

4. Empirical context and case study

Globally the market for wind turbines experienced an average annual growth rate of nearly 22% between 2001 and 2017 (GWEC, 2017). This high growth rate has been driven mainly by significant cost reductions and efficiency improvements in the core wind turbine components, supportive policies and the rising costs of alternative sources of energy, such as oil and diesel. Whereas until now the demand for wind power has mainly been driven by the US and Europe, it is increasingly coming from emerging markets, particularly China and India (Awate et al., 2012).

The development of modern, advanced, large-scale wind turbines is a highly capital- and technology-intensive process. Hence, the global wind turbine industry resembles a so-called producer-driven chain (Gereffi, 2001) in which lead firms coordinate the production networks of component suppliers and where competition is mainly based on technological progress through continued R&D. The industry is dominated by a few large lead firms: in 2016, the ten largest wind turbine suppliers accounted for 76% of the global market (Wind Power Monthly, 2017). The tendency among these lead firms, which include Vestas, Siemens, General Electric, Gamesa, Enercon

and Nordex, is to focus their activities increasingly on the parts of the value chain with the highest value-added, such as R&D, engineering and other knowledge-intensive activities (Lema and Lema, 2012). Wind turbine blades constitute a critical component in influencing the operational efficiency, and hence the economic feasibility, of wind-power plants. Given the sensitive nature and complexity of wind turbine blades, lead firms typically retain in-house control of the development and production of core wind turbine components, while the remainder of the up to 8,000 non-core components which a standard wind turbine consists of, are outsourced to an extensive global network of external sub suppliers. In some cases, lead firms outsource the development and production of core components, such as wind turbine blades, to a few highly specialized first-tier suppliers.

The dominant first-tier supplier of wind turbine blades is the Danish firm LM Wind Power, whose blades are installed in a fifth of all installed wind turbines worldwide (LM Wind Power, 2018) . The company was created in 1940, at which time it mainly produced wooden furniture. From the early 1950s the company started producing various products based on fibreglass materials, such as boats and caravans. In the late 1970s, the experience it had acquired in manufacturing with fibreglass materials and related production techniques laid the foundations for the decision to start producing wind turbine blades. Subsequently, the company gradually focused increasingly on the production of these blades for the emerging wind turbine market. In 2009 the incorporation of previously acquired companies was completed, and in 2010 the LM Wind Power Group was launched, making it a company with a truly global presence. LM Wind Power continuously invests significant resources in R&D to improve the efficiency of its wind-blade technology in order to remain a first-tier supplier and meet the high quality requirements expected from wind turbine suppliers. In 2016, for example, the company's R&D investments amounted in total to 18 million Euros (LM Wind Power, 2016).

LM Wind Power is headquartered in Denmark and has a global presence with established manufacturing capacity and other on-going activities in eight countries spread across four continents: Denmark, India, China, Spain, Poland, Canada, the USA and Brazil. It employs over six thousand people globally across specialised divisions related to R&D, blade manufacturing, local sales offices, services and logistics. Since its inception, it has produced more than 185,000 blades powering an installation capacity of approximately 77 GW and has earned total revenues of 750 million Euros, with a total of 46 million Euros before interest and tax (total profit of 6 million Euros). Recently, LM Wind Power was sold to GE Renewable Energy for a total enterprise value of 1.5 billion Euros.

5. Case study analysis

This section will first describe the development of innovation capabilities in the Indian subsidiary and subsequently the learning mechanisms involved. Direct interviewee quotes are used to illustrate the main findings, while Appendixes B and C can be consulted for further details.

5.1. Innovation capability development in the Indian subsidiary

Initially, blade production and R&D activities were located in Denmark in order to cater for the company's main markets in Europe. However, over time, as LM Wind Power gradually became internationalised, a number of blade production facilities were established in overseas markets (Figure 4). The first of these overseas investments involved the establishment of a local blade-manufacturing plant in 1993 in Hoskote near Bangalore in the state of Karnataka, southern India. One of the motivations for the management of LM Wind Power in establishing a local production facility in India at that time was the increase in local market demand, especially from around 1993 (Mizuno, 2007).

In 2007, LM Wind Power moved the original factory to a larger factory at Dabaspet. At the same time, a decision was made to set up a local R&D unit in Bangalore under the name of Technology Centre India (TCI). Based on previous experience from Denmark, the new TCI unit was located close to the new factory in order to ensure close interaction between R&D and production. Initially, the main strategic reasons for establishing this R&D unit were the needs to increase the global engineering capacity of LM Wind Power and to adapt and modify existing products and designs developed in Denmark to the local conditions. As the Senior Director of Technology and Development in Denmark described it: "*At the time we had our individual units in Holland and Denmark, and we were expanding quite significantly, and we could see the need for having further engineering resources available,* [...] *get the competences on board and* [...] *start the globalization of our R&D facilities because we could see* [...] *a need to support local markets by also having R&D facilities*". The main objective of the local R&D unit at that time was thus to pursue a mainly knowledge exploitation-oriented mandate (Søberg and Wæhrens, 2013).

(insert Figure 4 around here)

Further, increasing the firm's local engineering capacity in India would allow a higher degree of control and more rapid responses to adapting products to local conditions and demand. In this sense, the R&D unit functioned as a 'listening post' to collect market intelligence for sales and marketing purposes. The projected shortage of qualified engineers and technicians in Denmark spurred an interest in reaping the benefits of the availability of a large pool of skilled workers in India, especially in the fields of electrical and mechanical engineering. The relatively lower cost of employing Indian engineers also provided an opportunity to reduce the overall costs of R&D activities. This was confirmed by the TCI Director: "*In 2007, we started mostly with activities that could be carried out from a distance, and what I have heard is that costs were an important element in the decision to open TCI, but then again so was the desire to globalize the company in general*". As such, the establishment of the R&D unit represented a capacity increase for LM Wind Power to cater for growing demand both globally and locally in India, as indicated by the Senior Director of Technology and Development at LM Wind Power: "… *so it was mainly to expand our capacity and also have the competences available on the engineering side because we already saw some bottlenecks on engineering competences those days*".

In the beginning, the Indian subsidiary mainly fulfilled a supporting role that involved routine-based functions and labour-intensive engineering activities, such as making detailed calculations (such as calculations related to models of computational fluid dynamics), preparing technical drawings, making design modifications and related engineering support (Søberg and Wæhrens, 2013). At that time, only one person was in charge of handling the R&D portfolio in India, which entailed mostly documenting, reviewing and verifying projects. In 2010, however, LM Wind Power implemented a new global strategy with the purpose of establishing a global R&D set-up, which involved a strengthening of the company's presence in both India and China (LM Wind Power, 2010). As part of the strategy, the management's aim was to work toward gradually shifting the mandate of the subsidiary in India from a mainly 'knowledge exploitation' mandate to a 'knowledge augmentation' mandate, which involved engaging increasingly in more strategic and knowledge-intensive engineering tasks. Based on the empirical data collected for this paper, there is compelling evidence that the local subsidiary eventually made this shift.

5.1.1. Movement toward R&D with increasing levels of complexity

Indeed, the overall technical ability of the subsidiary increased significantly after 2010, as reflected in its growing engagement in innovative activities with a high degree of complexity, such as basic and conceptual engineering, as opposed to labour-intensive engineering tasks, such as detailed technical drawings and calculations. As a Senior Director pointed out: "*When interacting, there is a*

lot of knowledge being exchanged, but not only that, also you obtain a better understanding of which capabilities each one contributes with. When you get that understanding, it makes it possible [for TCI] to become involved in more varied tasks". The increasing engagement in these higher value-added R&D activities marks a progression into core and strategic R&D activities previously undertaken predominantly within the headquarters of LM Wind Power in Denmark. Indeed, in certain technical areas in which the Indian subsidiary has become highly specialised, such as the aerodynamic design of wind turbine blades, the company's Indian employees are now able to cooperate on equal terms with their Danish counterparts. According to a Senior Director in Denmark, this mutual cooperation includes full access to and internal sharing of the company's basic intellectual property and databases, such as "*the core tools related to our structural designs and related programming algorithms*". Accordingly, LM Wind Power operates with an internal data classification system according to the sensitivity of technical and customer-related data, according to which the "*Danish and Indian colleagues work together on a daily basis on datasets that are classified as the most sensitive*", as a Senior Director in Denmark expressed it. Nonetheless, as a Senior Manager at TCI explained, most of the core and strategic R&D activities are still conducted in Denmark: "*We started mostly as a support team, but over the years we have developed into being more or less equal, but obviously the lead mostly comes from Denmark*". This understanding is supported by a Senior Director in Denmark, who explained that: "*We actually do more or less the same. I know that my other colleagues are in the process of developing two new methods with our colleagues in India. It is glass-related*". The 'slicing up of R&D activities' (Andersson et al., 2016) within the global organisation of LM Wind Power is therefore not just a question of the offshoring of R&D activities that are non-core and strategic (while core activities are retained 'at home' at the headquarters of the parent MNC). Rather, in this case the establishment of the Indian subsidiary also involves the geographical relocation of core R&D activities to units in emerging economies, which is necessitated by the subsidiary gradually climbing up the ladder to the point that it is able to conduct R&D with the required level of complexity (Amsden and Tschang, 2003). In some cases, reportedly, the organisational slicing up of R&D activities can even go into reverse, with the local Indian subsidiary being responsible for the development of new changes in the basic design features of blades, the details of which are subsequently developed further by engineers at the Danish headquarters. This process was described by a Senior Director in Denmark: "*Consider aerodynamics, for example, which involves several R&D steps. The first step, carried out in India, involves defining the basic building blocks related to the cross section of the blade. The next step, which is undertaken in Denmark, involves further development of a detailed design, based on a selection of a specific type of blade profile*". The process of the local subsidiary in India climbing up the R&D ladder corresponds to a move from 'problem-solving' to 'problem-framing' activities, where the former involves solving well-defined tasks for company headquarters, while the latter involves R&D aimed at reconfiguring the basic architecture of wind turbine blades (Lema, 2014). The local subsidiary has thus transitioned from possessing 'basic innovation capabilities' to 'advanced innovative capabilities' as shown in Figure 1.

5.1.2. Leading role in R&D projects in the global MNC organisation

Furthermore, the Indian subsidiary has become increasingly responsible for leading a number of R&D projects within LM Wind Power's overall global innovation network. For instance, TCI has emerged as a global centre of excellence in the design of new web moulds and related engineering support provided to all of LM Wind Power's manufacturers of web moulds globally (LM Wind Power, 2015). TCI has also been responsible for conceptualising and leading an aerodynamics project that eventually resulted in the development of a blade of 88.4 meters, the longest ever produced by LM Wind Power. This responsibility is part of the increasing specialisation and global leadership of TCI within LM Wind Power in R&D related to blade aerodynamics and aeroacoustics. As the Director of TCI stated: "*The whole aerodynamics design is happening only in India*". The Indian

subsidiary has also taken the lead in relation to R&D in blade reliability based on monitoring the operational performance of plants and feeding this information into LM Wind Power's global R&D activities. "*For example, LEAN projects for operations is something we drive from here and have even been asked to train management in Denmark*", a Senior Manager at TCI explained. TCI has also taken the lead in the testing and qualification of materials: "*In the case of glass and resin we have completely taken over*", said a Manager at TCI, whose words were confirmed by his Senior Manager: "*We have a team called Materials and Processes that is constantly working to optimize materials and processes*". Additionally, the Indian subsidiary has obtained a key role in analysing market and customer trends for LM Wind Power globally: "*Market intelligence is another* [function]*: we have two people here, and they do market intelligence across the whole company of LM and across countries*", the Director of TCI stated.

5.1.3. Patenting and R&D personnel in the local subsidiary

As a further indication of its advanced stage of innovative capabilities (see Figure 1), the local subsidiary has reportedly filed over 25 patents since 2007. According to the Senior Manager at TCI, "*There is a team called Aerodynamics, and they have come up with a lot of innovations and patents. In my team we have also come up with new ways of testing materials*". This was corroborated by a Senior Director in Denmark: "*We can see that R&D and new ideas are being driven by our Indian colleagues, which has resulted in a considerable number of patents*". In parallel with the increasing involvement of the subsidiary in LM Wind Power's global innovation activities, TCI expanded from 15 employees when it was established in 2007 to 150 employees in 2016. As a Senior Director in Denmark stated: "*TCI started as an offload organization in 2006 with 15 engineers, but more and more functions have been added to the unit*". In 2018, the total number of employees in TCI, according to a Senior Director in Denmark, increased further to "*around 160*". Based on our interviews, it appears that initially staff qualifications at the local subsidiary mainly consisted of employees with basic education in engineering disciplines at the Bachelor's and Master's levels. Increasingly, however, the employees working there have higher levels of education and specialised engineering expertise.

5.2. Learning mechanisms enabling innovation capability building

Based on Figure 3, we present the learning mechanisms that were found to have significantly influenced the innovation capability development process in the following (see Appendix C).

5.2.1. Learning from hiring skilled managers and workers

The establishment of TCI in 2007 was preceded in late 2006 by a dedicated recruitment process undertaken by key managers of LM Wind Power, which focused on hiring the best possible engineers with expertise in CFD modelling and related engineering skills. The recruitment process involved a test for prospective candidates, which were carried out by Danish colleagues. As a Senior Director in Denmark involved in the process explained, the purpose of the test was to put pressure on the candidates to see "*how they would react to the type of problems we are normally dealing with*. *Prior to having the interviews, we actually called them one hour earlier and gave them a challenge. That would be a problem statement, and we requested them to come up with how they would approach that given problem*". Based on their individual performance in the test, the first batch of fifteen engineers was eventually hired in 2007. This kind of dedicated recruitment continues to be of importance in the ongoing hiring of new employees in the Indian subsidiary, where only engineers with a degree from the top universities in India are considered. However, due to the highly specialised nature of wind turbine blade technology, the management of LM Wind Power

prefers to recruit engineers with some years of experience in a company in a related industry. This recruitment strategy is also aimed at ensuring that employees are accustomed to working in an international environment. Furthermore, in order to maintain and build the internal knowledge base, LM Wind Power has implemented various measures to retain employees in the Indian subsidiary, such as bonus systems. Consequently, attrition rates are evidently around 5% on average, which is very low compared to normal standards according to the HR manager at TCI.

5.2.2. Learning trough training of local workforce by MNC

The emphasis on employee training has been a prominent feature of LM Wind Power's strategy in India from the very beginning, when the first engineers were recruited in 2007. Initially, the training of the first recruited engineers aimed at familiarising them with the specific types of engineering tasks related to the development of wind turbine blades. As a Senior Director in Denmark recalled: "*We brought these fifteen engineers to Denmark for training. They came with a broad engineering background, but none of them had a wind energy background, so we gave them general training courses in wind power and wind-turbine engineering, and understanding the wind-power market*". The Indian engineers were in Denmark for a month, where they received on-the-job training as well as training in Danish working culture and organisational routines (and vice versa for Danish engineers) as a mean to ensure effective cooperation and communication across the units. Such longer-term visits to the Danish headquarters for Indian colleagues has continued to be a central part of LM Wind Power's employee training program in India, which typically involves 70% on-the-job-training, 20% supervising and mentoring and 10% formal training in classrooms. As a manager in India noted: "… *engineers often go for on-the-job training in Denmark in relation to particular projects*". A key element of the program involves in-plant training at the blade factories in both Denmark and India order to ensure that R&D personnel are familiar with blade production processes. These training courses were particularly intensive in the periods 2007-2008 and 2010-2015, when substantial human and financial resources were allocated by LM Wind Power's headquarters to the training of new employees. As a Senior Director in Denmark explained: "*we did a lot of training in the beginning, but have done this continuously, which was particularly intensive in the period from 2010 onwards, when we wanted to build a stronger competence base in India.*"

5.2.3. Internal learning in the Indian subsidiary

It appears that, especially from around 2015 onwards, internal learning in the local subsidiary in India has become increasingly prominent as a source of learning, mainly in relation to knowledge creation in the R&D activities aimed at the patenting of new inventions. In the areas of aerodynamics and aeroacoustics, for example, some of these R&D activities have been carried out independently by specialised teams and task forces working on specific projects. Some of these R&D activities involve learning by experimentation with new designs and materials. Experienced employees within the Indian subsidiary also carry out internal training and supervision of younger and less experienced employees as a form of internal learning and knowledge exchange. Furthermore, it became apparent in several of the interviews that employees at the Indian subsidiary are given a great deal of freedom in their work. The management of LM Wind Power hence encourages its Indian colleagues to take the responsibility for coming up with new ideas and inventions. As the Senior Manager in India remarked: "*We are given a lot of challenges compared to friends I know who work for other companies who only get very simple tasks to perform*". The encouragement of explorative behaviour has provided a strong incentive for internal learning and attaining innovation capabilities in the Indian subsidiary. As the Senior Manager in India noted: "*I think we have been given more responsibility by demonstrating our capabilities rather than through a strategic shift from management in Denmark*".

5.2.4. Learning from pressure to perform according to international standards

As part of the new strategy from 2010 of strengthening the R&D competences in India, the management gradually placed specific R&D tasks there with a higher level of complexity than had been required previously. As has also been observed by Kim (1997), in doing so the management imposed a consecutive number of temporary crises, which forced the local subsidiary to perform at a higher level. Apparently, according to our interviews, the local subsidiary was able to live up to these higher standards of performance in a satisfactory manner. As a Senior Director in Denmark explained, "*when you then observe that it is sensible, well organized and self-driven, you can then continue with the process*". This strategy of continually raising the bar of expectations led to the gradual assignment of new responsibilities and lead roles within various areas of R&D. An interesting interplay can thus be observed between internal learning in the local subsidiary in India and pressure exercised by the company's headquarters to live up to higher performance standards. As a sufficient level of innovation capability had been achieved in the local subsidiary, learning started being a two-way process involving a bidirectional flow of knowledge between the Indian subsidiary and the Danish headquarters. Indeed, as a Senior Director in Denmark explained, "*R&D cooperation started going in both directions, as specific areas of R&D were being driven from India*".

5.2.5. Mutual learning from face-to-face interactions

The management of LM Wind Power has continuously striven toward facilitating close working relationships between employees at the Danish headquarters and at the local subsidiary, either through telecommunication systems or, preferably, face-to-face interactions. This is largely ensured by the structure of the company as a project-based organisation in which functional divisions with specialised departments are spread globally. Specialised teams in these divisions thus work together in relation to specific projects on a global basis, which, according to various interviewees, contributes to cultivating the development of a common company culture and shared modes of operation. A key cultural trait of LM Wind Power that was stressed by all interviewees is the management's emphasis on promoting the company motto of "One LM" in order to induce a sense of being part of one global team (see also LM Wind Power, 2016). In practical terms, this means that the management strongly encourages frequent travel and exchanges of employees and communication on a daily basis to allow close interaction. As a plant manager in India noted: "*We have monthly calls with other LM units around the world where we share what is working and what is not*". Furthermore, various interviewees confirmed that around 10% of the staff are constantly travelling, involving face-to-face collaboration on ongoing projects. A main motivation for encouraging frequent interaction is to enable the crucial exchange of tacit knowledge and accumulated know-how, which is difficult to share in the codified forms of, for example, templates, manuals, blueprints and design specifications. Indeed, as a Senior Director in Denmark noted: "*The exchange of accumulated experience does not happen by writing a book which is then distributed throughout the organisation*"…"*as this requires real interaction in order to increase the knowledge exchange*".

6. Discussion

As highlighted by Joëlle and Ryfish (2015), MNCs can play a key role in facilitating the transfer of knowledge to emerging economies, which may contribute to the catching up of latecomer firms in these countries. Accordingly, devoting attention to studying whether, and how, MNCs operate and influence innovation capability building in their subsidiaries is pertinent. The preceding sections have demonstrated, empirically, the significant development of innovation capabilities in an Indian subsidiary of a Danish MNC, and the main underlying learning mechanisms involved. As argued by Figueiredo (2011), such insights contribute to providing a micro-level

understanding of the dynamics of innovation capability development. Based on the findings presented in this paper, we point to a need to place firm-level learning at the centre of the research on innovation capability building, in the context of MNC subsidiaries in emerging economies.

While this paper focuses on intra-corporate learning and innovation capability development specifically related to MNC parent-subsidiary relationships, other inter-firm arrangements through which the transfer of knowledge to latecomer firms can take place may be of equal importance, including license agreements, joint ventures and buyer-supplier arrangements (Qiu et al., 2013). In any case, as pointed out by Mathews (2002), the catching up of latecomer firms depends critically on their linking up with foreign actors in industrialised countries, to leverage the resources needed to strengthen their innovative capabilities (see also Hansen and Lema, 2019).

As shown in this paper, it cannot be assumed that the key role of the MNC's headquarters in providing financial and human resources devoted specifically to developing the innovative capabilities of the local subsidiary will proceed automatically or inevitably. In fact, MNCs typically prevent the development of innovative capabilities beyond a certain level, in order to prevent their subsidiaries from taking over the core competences of the parent firm (Navas-Alemán, 2010). In this case, however, the process clearly proceeded much further into core and strategic R&D activities, which was even encouraged and enabled by the strategic interests and motives of the parent MNC. Therefore, it appears evident that a strategic interest is required on the part of the MNC, as well as their investment of significant resources, which could contribute to gradually building up the level of innovation capability in the local subsidiary (see also Lema et al., 2015). This finding corroborates insights from the literature on MNC subsidiary capability evolution, which has repeatedly stressed the importance of the strategic intent of the parent MNC in relation to the development of innovative capabilities in their subsidiaries (Birkinshaw and Hood, 1998; Cantwell and Mudambi, 2005).

While the MNC's headquarters was an important provider of learning in the innovation capability building process – for example, by providing training and knowledge transfer – other learning mechanisms also played a role. In particular, internal learning undertaken within the local subsidiary provided a strong impetus for the development of its innovation capabilities. Parts of these internal learning efforts were undertaken independently of the headquarters, while others were closely related to the internal learning efforts aimed at fulfilling the specific performance standards set by the parent MNC. The MNC management considered such performance standards to be part of the initiatives undertaken to strengthen the R&D competences of the subsidiary. Therefore, as noted by Blomkvist et al. (2016), the development of innovative capabilities unfolds as a complex interplay between evolutionary change in the subsidiary and the strategic choice of the MNC. These observations draw attention to the role of the MNC subsidiary acting not as a passive recipient of knowledge transfer from the parent MNC, but as an active agent in the process. Indeed, as pointed out by Ariffin (2010), innovation capability building in MNC subsidiaries seem to be contingent on the level of engagement to leverage learning from the parent MNC (see also Ariffin and Figueiredo, 2004). This confirms the longstanding argument in the literature that latecomer firms will only advance to higher levels of innovative capabilities to the extent to which they deliberately devote resources to learn (Bell, 2007; Hansen and Lema, 2019).

The key role of the parent MNC in MNC subsidiary innovation capability building should not be surprising, based on the literature. However, the main focus is often on the unidirectional flow of knowledge from the headquarters to the subsidiary (Fu et al., 2018). In this paper, we uncovered the existence of a bidirectional flow of knowledge as the innovation capabilities gradually deepened, which allowed the subsidiary to develop more knowledge-intensive linkages with the global MNC network (see also Figueiredo, 2011; Giuliani et al., 2014). This paper, therefore, suggests that the role of knowledge flows from parent MNCs to subsidiaries should be treated as part of a multitude of possible flows of knowledge, some of which involve mutual and reciprocal forms of learning (see also Rabbiosi and Santangelo, 2013). Interestingly, in this case the relative importance of various types of learning mechanisms seem to have changed dynamically over time, as the subsidiary built

increasingly higher levels of innovative capabilities. Whereas initial innovation capability building relied mainly on training undertaken by the MNC, the significance of internal learning and mutual learning from R&D cooperation became more prominent at a later stage (see also Ariffin, 2000).

Finally, while sources of external learning in the local environment were found to have been insignificant in this case, other studies have pointed at the importance of such learning mechanisms (see e.g. Figueiredo, 2011; Figueiredo and Brito, 2011). A possible explanation for the insignificance of local sources of learning could be related to the highly specialised skills needed in relation to wind turbine blade technology. As shown above, training and supervision undertaken by experienced colleagues from the parent MNC are an essential element of acquiring such specialised skills, as opposed to acquiring them from other sources (Li et al., 2013).

7. Conclusion

This paper began by highlighting the lack of studies focusing specifically on the development of innovation capabilities in MNC subsidiaries operating in emerging economies. To help overcome this knowledge gap, this paper analysed the development of innovation capabilities in the context of an Indian subsidiary of a leading Danish supplier of wind turbine blades. The micro-level and longitudinal perspective adopted in this paper aimed at moving beyond the prevailing focus in previous studies on a highly aggregated level of analyses using statistical evidence. By pursuing a case study approach relying on qualitative data, we were able to analyse in-depth the learning processes enabling the development of innovative capabilities over time.

The paper finds that the local Indian subsidiary progressed significantly in terms of the development of innovation capabilities since its establishment. The paper provides a detailed account of the specific learning mechanisms that have enabled this progression to take place, pointing at the key role of the parent MNC in providing resources specifically aimed at strengthening the innovation capabilities of the local subsidiary. The paper also points to the importance of internal learning, as the local subsidiary gradually progressed in terms of its innovation capabilities, eventually leading to a bidirectional flow of knowledge in the subsidiary–parent MNC relationship. This paper shows that learning and innovation capability building does not trickle down automatically from the parent MNC to its local subsidiaries in emerging economies. Rather, innovation capability building in MNC subsidiaries depends on the strategic interest and resources the parent MNC is prepared to devote to this purpose. The paper, thereby, highlights the intentionality of the parent MNC, and the independent efforts undertaken by the subsidiary as key elements in MNC subsidiary innovation capability building (Ariffin, 2000).

As learning and innovation capability building appear highly firm-specific, further research could compare similarities and differences in the specific learning mechanisms, and the nature of the innovation capability development process. Such research could proceed on a case-by-case basis involving in-depth qualitative research on specific MNCs and their subsidiaries. Theoretically, it would be beneficial if subsequent research could unravel the mechanisms of change with regard to the underlying learning mechanisms in the innovation capability development process. Indeed, while learning from engaging with local universities and customers was not found to be important in this paper, the case could be different elsewhere. To provide a basis for comparison, the empirical context could be expanded to include other industries and MNCs in other emerging and developed economies. Ideally, further empirical research would not only include MNC subsidiaries that have made significant progress in terms of the level of innovation capabilities achieved, but also include others that have progressed to a lesser extent.

Finally, from the perspective of the MNC subsidiary, the paper gives rise to reflections on managerial aspects of innovation capability building. The paper confirms the understanding of MNC subsidiaries as independent enterprises, while shaped fundamentally by their parent MNCs. As agents potentially capable of shaping their own technological development paths, the management in MNC subsidiaries are encouraged to actively pursue learning from the relationship with the parent

MNC (Li et al., 2013). As shown in this paper, developing innovation capabilities by engaging with the parent MNC may function as a basis for enhancing the autonomy of the subsidiary to engage independently in innovation activities at a later stage.

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Tables

Table 1. Learning mechanisms within and outside of the parent MNC-subsidiary relationship.

Learning mechanisms within the parent MNC-subsidiary relationship	
• Mutual learning from face-to-face interactions • Training of local workforce by parent MNC • Knowledge transfer from parent MNC confined to a narrow range of tasks • Pressure from parent MNC to adopt international standards	
Learning mechanisms outside of the parent MNC-subsidiary relationship	
Firm level	• Internal R&D effort • Hiring of skilled managers and workers • Learning through firms' acquisitions, joint ventures and licensing
Collective level	• Learning within firms at the local (cluster or regional) level
Other external	• Learning from suppliers, universities, service providers • Imitation from competitors

Modified from: Ariffin (2000); Figueiredo (2011); Pietrobelli and Rabellotti (2011); Rabbiosi and Santangelo (2013); Michailova and Zhan (2015); De Marchi et al. (2017).

Table 2. Interviews conducted for this paper.

Date of Interview	**Location**	**Interviewee**
27 June 2016 18 April, 2018	Denmark	Senior Director
14 June, 2016	Denmark	Senior Engineer
8 August, 2016	The Netherlands	Global HR Manager
20 June, 2016 18 July, 2016	India	Director, TCI
21 June, 2016	India	Finance Manager, TCI
21 June, 2016	India	HR Manager, TCI
18 July, 2016	India	Senior Manager, TCI
19 July, 2016	India	Manager, TCI
19 July, 2016	India	Plant Manager

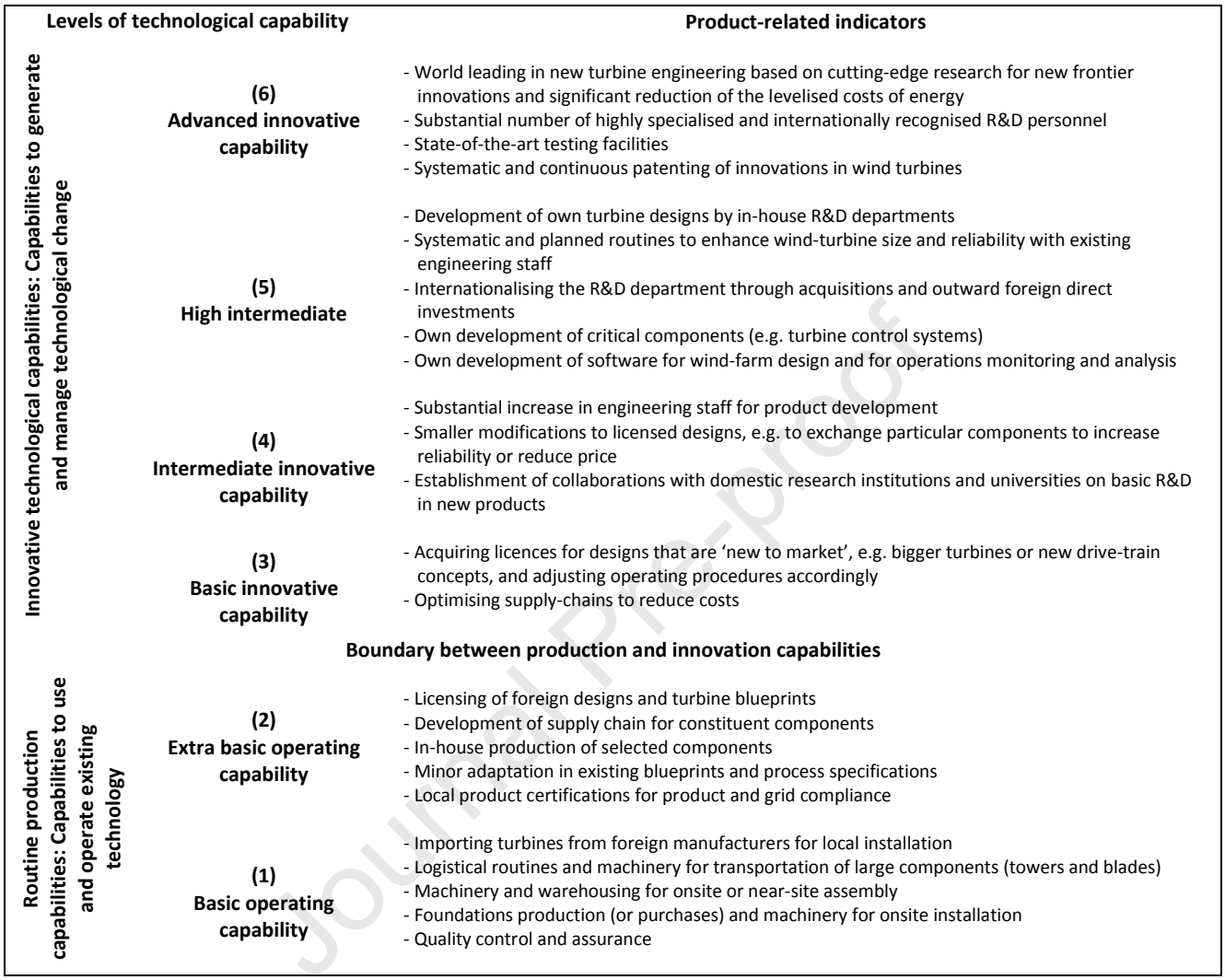
Table 3. Illustration of the coding procedures used to analyse the data collected from interviewees.

Indicators of innovation capability	**Direct interviewee quotes**	**Interpretation**	**Overall finding**
1. Movement from detailed engineering tasks to basic/conceptual engineering	• …… • …… • ……	• …… • ……	• ……
2. Lead role in R&D projects in the global MNC organisation			
3. Number and qualification of R&D personnel in the local subsidiary			
4.			
5.			
Learning mechanisms in innovation capability development			
1. Mutual learning from face-to-face interactions	• …… • …… • ……	• …… • ……	• ……
2. Training of local workforce			

3. Internal R&D efforts			
4.			
5.			

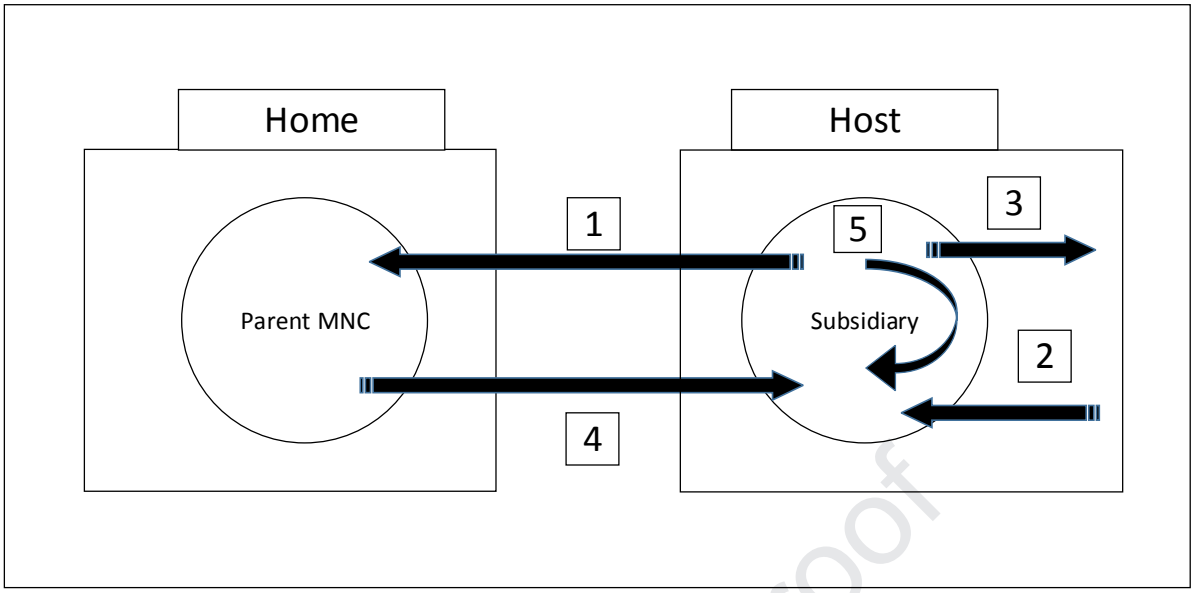
Figures

Figure 1. Typology of levels of innovation capabilities in wind turbine supplier firms.



Source: Hansen and Lema (2019).

Figure 2. Learning and knowledge creation in MNC subsidiaries.

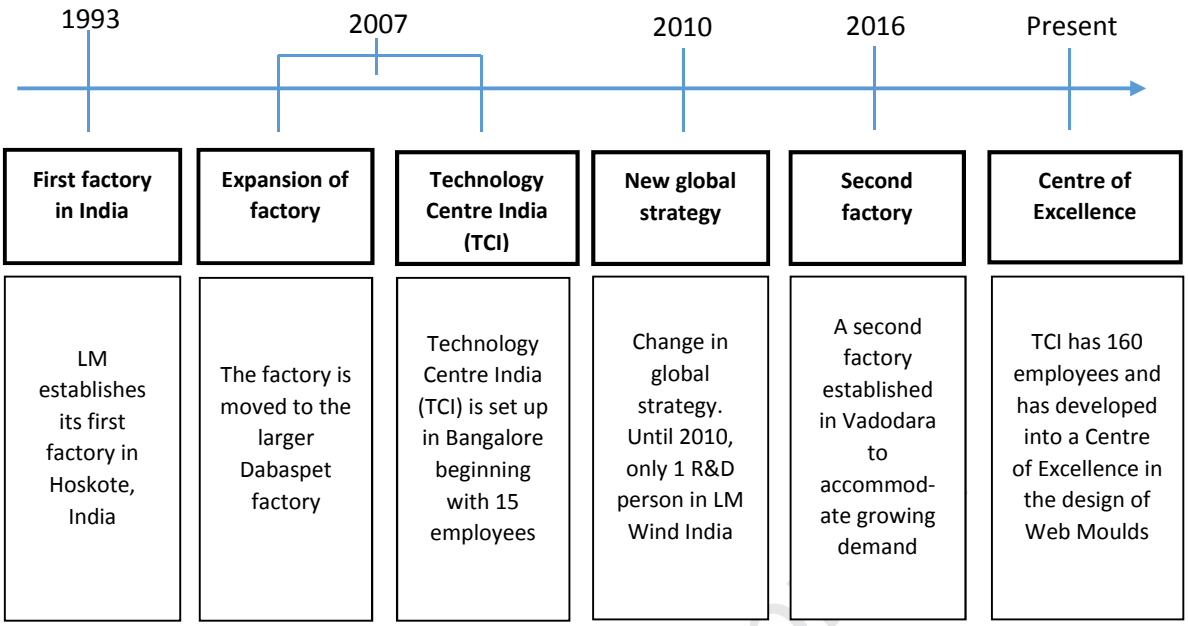


Source: Modified from Mudambi and Navarra (2004). (1)=Knowledge flows from subsidiary to parent MNC; (2) Knowledge flows from location to subsidiary; (3) Knowledge flows from subsidiary to location; (4) knowledge flows from parent to subsidiary; (5) Internal learning in subsidiary.

Figure 3: Learning mechanisms analysed in this paper.

- Learning from hiring skilled managers and workers
- Learning trough training of local workforce by parent MNC
- Internal learning in the Indian subsidiary (Flow 5 in Figure 2)
- Learning from pressure exercised by parent MNC to perform according to international standards
- Mutual learning from face-to-face interactions (Flow 4 in Figure 2)
- Learning within firms at the local (cluster or regional) level (Flow 2 in Figure 2)

Figure 4. Key timeline and milestones of the local subsidiary of LM Wind Power in India.



Source: Authors own elaboration.

Highlights

- Limited research on innovation capability building in MNC subsidiaries
- Paper adopts a micro-level perspective on innovation capability building
- Case study of an Indian subsidiary of a first-tier supplier of wind turbines
- Learning through intra-corporate knowledge transfer, and internal learning
- Bidirectional knowledge flows as innovation capability building progressed