Captive R&D Offshoring

The Case of Newly Established Foreign-Invested R&D Units in Emerging Markets

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Captive R&D Offshoring - The Case of Newly Established Foreign-Invested R&D Units in Emerging Markets

(Danish title: Captive R&D Offshoring – Case studier af nyetablerede FoU-enheder i udviklingslande)

PhD thesis by Peder Veng Søberg

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Abstract (English)

This PhD thesis includes four journal papers and one book chapter, which investigate how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates. In particular, the author investigates how the employees of such units acquire R&D home base knowledge, how local talent is made use of, and how local sources of knowledge are engaged. The theoretical framework is primarily based on knowledge management theory, but networking theory is also made use of. The study is a case study, and empirical data have been collected from four MNCs originating from Scandinavia and now operating in Scandinavia, China, and India. The thesis questions an assumption in the Uppsala model, which implies that different business activities can be internationalized in the same way. The findings point to the importance of socialization across the R&D home base and newly established R&D units in order for employees in such units to acquire tacit knowledge in particular. However, documented R&D knowledge at the R&D home base can also nurture the ability of newly established foreign-invested R&D units in emerging markets to carry out their mandates. The findings suggest that the local talent in China and India is particularly suited to improving existing products and processes. However, due to a lack of social initiative, it is more difficult to use this talent to identify and solve entirely new problems. The thesis also investigates how local sources of knowledge are engaged. In particular, interactions with local manufacturing activities and local universities are investigated.

Abstract (Danish)

Denne Ph.D.-afhandling inkluderer fire tidsskriftsartikler samt et bogkapitel. Disse publikationer undersøger hvordan nyetablerede forsknings- og udviklingsenheder (FoU enheder), etableret i udviklingslande, af internationale virksomheder fra andre lande, bliver i stand til at udføre deres mandat. I særdeleshed bliver det undersøgt hvordan de ansatte i disse enheder erhverver viden fra FoU hovedkvartererne i disse virksomheder, hvordan lokal talent bliver gjort brug af, og hvorledes lokale kilder til viden bliver engageret. Den teoretiske ramme er primært baseret på videndeling, men netværksteori er også gjort brug af. Undersøgelsen bygger på casestudier fra fire multinationale selskaber, der stammer fra Skandinavien. Empiri er blevet indsamlet fra Skandinavien, Kina og Indien. Afhandlingen stiller spørgmålstegn ved en antagelse i Uppsala-modellen, der forudsætter at forskellige typer af virksomhedsaktiviteter kan internationaliseres på samme måde. Resultaterne peger på vigtigheden af socialisering på tværs af FoU hovedkvarter og nyetablerede FoU-enheder, for at medarbejderne i sådanne enheder kan erhverve især tavs FoU viden. Dog kan dokumenteret FoU viden fra FoU hovedkvarteret også fremme disse nyetablerede FoU enheders evne til at udføre deres mandat. Resultaterne tyder på, at lokale talenter i Kina og Indien er særligt egnet til at forbedre eksisterende produkter og processer. Men på grund af manglende social-initiativ er det mindre relevant at bruge dette talent til at identificere og løse helt nye problemer. Afhandlingen undersøger også, hvordan lokale kilder til viden er engageret. Især samspil med lokale produktions-aktiviteter, og lokale universiteter undersøges.

ABBREVIATIONS AND SYNONYMS

FoU:	Danish abbreviation for R&D
GDP:	Gross domestic product.
HBA:	Home base augmenting
HBE:	Home base exploiting
ICT:	Information and communication technology
IP:	Intellectual property.
IPR:	Intellectual property right(s).
MNC:	Multinational corporation is a term that is similar to multinational enterprise (MNE). "A multinational enterprise (MNE) is a firm that controls and manages production establishments located in at least two countries" (Teece, 1985; p. 233).
R&D:	Research and development.
R&D unit:	R&D center, R&D subsidiary.
WTO:	World Trade Organization.

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Part 1

1. Research area

The research area of this thesis relates to R&D management in general and international R&D management in particular. Within this topic the five following papers have been included in the thesis:

Paper One:

Søberg, P. V. (2012), "Activity Specific Knowledge Characteristics in the Internationalization Process", Baltic Journal of Management, Vol. 7, No. 3, pp. 251-267. Emerald retains the copyright.

Paper Two:

Søberg, P. V. (2010), "Industrial influences on R&D transfer to China", Chinese Management Studies, Vol. 4, No. 4, pp. 322-338. Emerald retains the copyright.

Paper Three:

Søberg, P. V. (2011), "The transfer and creation of knowledge within foreign invested R&D in emerging markets", Journal of Technology Management in China, Vol. 6, No. 3, pp. 203-215. Emerald retains the copyright.

Paper Four:

Søberg, P. V. & Wæhrens, B. V. (Forthcoming 2013), "Integration of Manufacturing and Development in Emerging Markets", in Slepniov, D., Johansen, J. & Wæhrens, B. V. (Ed.), Global Operations Networks: Exploring New Perspectives and Agendas, Aalborg University Press.

Paper Five:

Harryson, S. J. & Søberg, P. V. (2009), "How transfer of R&D to emerging markets nurtures global innovation performance", International Journal of Technology and Globalisation, Vol. 4, No. 4, pp. 367-391. Inderscience retains the copyright.

As already illustrated in the contents section, this thesis consists of two parts. Part 1 is the thesis cover, and the full versions of the papers are available in Part 2. However, let us first have a look at what R&D is. R&D can be defined as “a complex process of scientific and technological research, the development of new products and processes, manufacturing and marketing support, and the provision of technical services” (Zedtwitz, 2004; 442). Companies must innovate in order to remain legitimate (Johansen and Riis, 2005). As part of these efforts, multinational corporations (MNCs) are increasingly internationalizing their R&D (Blomkvist et al., 2010). Among Danish companies, the tendency to offshore R&D is increasing rapidly. The fact that 10% of Danish companies with more than 50 employees expect to offshore R&D between 2011 and 2013 underlines the importance of this phenomenon. Part of the reason for this R&D offshoring seems to be that other core activities have already been offshored (Junge and Sørensen, 2011), but it also takes place in order to better adapt products to local preferences around the world. Western MNCs offshore R&D not only to other developed countries but also to emerging markets, such as China (Zedtwitz, 2004) and India, which are playing an increasingly important role as innovation hubs (Pillania, 2005). In general, MNC activity in China has increased immensely during the past decade, and recently, these activities have also included R&D (Li, 2010; Lewin et al., 2009). The country has a higher proportion of product development-related offshore implementations than other countries (Lewin et al., 2009). According to Prahalad (2012), the ability to participate and innovate in emerging markets, such as China, will be at the center of the competitiveness agenda for the next ten years.

Emerging markets are nations with social or business activities that are in the process of rapid growth and industrialization (Jain, 2006). Between 1987 and 2003, 98 new R&D labs were set up in China by MNCs (Zedtwitz, 2004). In the years 2003-2005, some 600 foreign R&D centers were established in China (Walsh, 2007). According to the People's Daily Online (2010), approximately 1,200 foreign R&D units are in place in China. This is also the case in India (Asakawa and Som, 2008; Reddy, 2005).

The internationalization of R&D has implications for innovation performance (Nieto and Rodriguez, 2011). However, it might also be an important prerequisite for future innovation performance because it will be needed in order to conduct reverse innovation. If products are developed in emerging markets, such as China and India, introduced in these markets and only subsequently distributed globally, it represents a reverse innovation flow (Govindarajan and Ramamurti, 2011; Immelt et al., 2009). As MNCs increasingly conduct R&D in emerging markets, it becomes more and more important to understand how to improve the performance of foreign-invested R&D centers in emerging markets.

Innovation is difficult to measure (Kline and Rosenberg, 1986; p. 275), but it can be defined as "technological innovation by new or improved products or processes" (Meyer-Krahmer, 1984; p. 176). Innovation output is one way of describing the level of innovation of a firm, and it can be measured in terms of inventions, e.g., patents applied for and granted and new product developments (Meyer-Krahmer, 1984). Although inventions may sometimes provide opportunities for innovation, they can only constitute a part of innovation performance. New products are indications of innovation performance (Zhang et al., 2009; Tsai, 2001). New products can concern totally new products, as well as modifications of or upgrades to existing products or product lines (Zhang et al., 2009; Li and Atuahene-Gima, 2001). Similarly, innovation performance in an R&D unit concerns how the R&D unit contributes to the creation of new products, product lines, and technical processes, as well as platforms, within the company.

R&D is sometimes referred to as local value adding, and local value adding is positive for the performance of foreign subsidiaries (Pehrsson, 2008a; 2008b). The performance of an R&D unit can be described in terms of its ability to carry out its mandate. However, some patience is required when establishing R&D in emerging markets. Zedtwitz (2004) describes how performance measurement in newly established R&D centers of Western MNCs in China is focusing less on the outputs in terms of patents and more on the extent to which R&D skills and the number of employees are built up in the center within certain timeframes, i.e., newly established foreign-invested R&D units in emerging markets should not be expected to be able to carry out their mandates immediately when they are established. Instead, the process of building up R&D skills and the number of employees is necessary before it is possible to carry out the mandate. This process is particularly relevant to investigate because it is important in order to ensure the performance of newly established foreign-invested R&D units in emerging markets and because this, to the best of my knowledge, has not been investigated by others. A mandate is a license to apply distinctive capabilities (Birkinshaw, 1996). Organizational capability can be defined as “a firm's ability to perform repeatedly a productive task which relates either directly or indirectly to a firm's capacity for creating value through effecting the transformation of inputs into outputs” (Grant, 1996; 377).

This study investigates how newly established foreign-invested R&D centers in emerging markets, such as China and India, become able to carry out their mandates. To this end, empirical data collected from leading global MNCs, such as Med Tech, Wind Tech, Mechanic Tech, and Pack Tech (not the real names of the companies), is made use of. Three of the four case companies have

established R&D activities in China. One of the case companies has established R&D activities in India (Wind Tech).

From a very myopic nationalistic perspective, it may sound counterproductive to investigate how R&D is globalized. Some may perceive a high risk of the loss of knowledge intensive jobs in, for example, Denmark. However, the simple need for the numerous technical talents available in emerging markets (Chen, 2006) is likely to make it implausible for any major technically-oriented multinational company to avoid having at least some R&D in these countries (Lewin et al., 2009). Understanding how R&D activities are best transferred to emerging markets and understanding how performance is best nurtured within such globalized R&D organizations is likely to make a large difference in terms of ensuring future competitive advantage.

1.1. International R&D management

The field of international business has particularly focused on differences between locations and pointed to their relevance in relation to firm internationalization. The general notion is that it is beneficial to internationalize into host locations that are similar to the home location so as to avoid the excessive liabilities of foreignness and uncertainty. In terms of assessing the differences between various locations, several frameworks have been developed. Ghemawat (2001) outlines the CAGE framework, which focuses on four general dimensions of distance:

- cultural distance
- administrative and political distance
- geographic distance
- economic distance

Other frameworks focus on only one such dimension of distance, i.e., Hofstede (1984) focuses on the cultural dimension(s), whereas others prefer the similar but broader notions of institutional distance or psychic distance. Institutional distance is the extent of the similarity of or difference between the regulatory, cognitive, and normative institutional dimensions of two countries (Kostova, 1999). Psychic distance is defined as "the sum of factors preventing the flow of information from and to the market. Examples are differences in language, education, business practices, culture, and industrial development" (Johanson and Vahlne, 1977; 24). These notions of distance will often result in differences in consumer preferences internationally, and therefore, products must be adapted according to these different preferences. To the extent that the same research efforts can constitute the basis for products that are subsequently adapted to different consumer preferences around the world, such differences are particularly likely to play out in relation to development activities rather than in relation to research activities. This may be one reason that we have seen many new suggestions regarding how to categorize different types of international R&D activities in the literature, as R&D has become increasingly internationalized.

Several scholars have outlined various dichotomous typologies, which all describe the value adding mandate of foreign subsidiaries, such as R&D units (Schwaag Serger, 2008; for an overview see: Cantwell and Mudambi, 2005; 1110). For example, it is possible to distinguish between home base exploiting R&D activities and home base augmenting R&D activities. Home base exploiting R&D units support local manufacturing and the transfer of prototypes and knowledge from the R&D home base of the company. Home base augmenting R&D units, on the other hand, add to the R&D knowledge base of the company (Kuemmerle, 1999; Kuemmerle, 1997). A more fine-grained

typology is provided by Gammeltoft (2006), who distinguishes between the market-driven, production-driven, technology-driven, innovation-driven, cost-driven, and policy-driven motives for the internationalization of R&D. This typology includes a mix of what Von Zedtwitz and Gassmann (2002) denote as input-, output-, and general performance-oriented factors. In summary, from the existing literature, it is possible to discern three overarching reasons for R&D offshoring, as illustrated in Figure 1:

1. Knowledge seeking
2. Downstream support
3. Upstream support

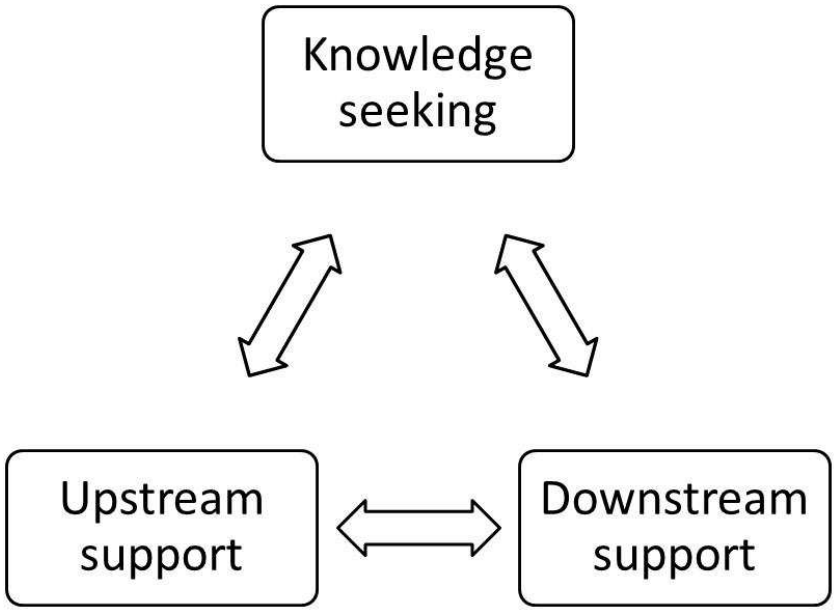

Figure 1: Mandates for offshore R&D units

Companies may sometimes make use of offshoring in order to save costs. However, the cost-saving motive is less important in relation to the offshoring of knowledge-intensive activities, such as R&D (Hutzschenreuter et al., 2011a; Hutzschenreuter et al., 2011b).

Knowledge seeking takes place when companies expand into locations that have different knowledge profiles from the home location so as to use these differences to create new capabilities and bring these back to the home location (Alcacer and Chung, 2011). Time and other costs related to repetitive interactions with knowledge clusters in foreign locations may be substantially lower if they take place in a local context (Sölvell, 2009), and it may therefore be relevant to set up R&D units in geographical locations where R&D has not been conducted by a company before. R&D units that are intended to carry out knowledge seeking can be categorized as home base augmenting to the extent that knowledge seeking is more research oriented than development oriented.

Knowledge profile differences between locations create barriers. Often, companies expand into a location due to its market size rather than in order to take advantage of knowledge profile differences. Such differences in knowledge profiles can then be exploited subsequently if opportunities to do so are identified along the way (Alcacer and Chung, 2011).

Knowledge seeking is similar to home base augmenting R&D. Downstream support and upstream support can both be considered home base exploiting R&D, although the notion of downstream support more clearly incorporates the market-driven elements of R&D internationalization mentioned by Gammeltoft (2006) and the previously mentioned adaptation of products to different consumer preferences than the home base exploiting definition suggests. A benefit of the distinction between downstream support and upstream support is that it better grasps the diversity of roles and mandates for R&D units and advanced manufacturing units when it is important to make a distinction between market and sourcing focuses.

Downstream support concerns local R&D, which is carried out in order to adapt and develop products that are tuned to local demands and preferences. Downstream support also takes place in order to adapt existing products to the rapidly growing emerging markets and in order to develop new products targeting such markets. However, the development of entirely new products targeting emerging markets is less common (Barrett et al., 2011). A wider notion of downstream support is that R&D presence in emerging markets per se often enables better market access not only due to proximity issues and the related better customer understanding but also because local authorities welcome R&D establishments and willingly grant companies better market access if they are willing to expose themselves a bit and contribute to the build-up of local technology skills, i.e., the 'market-for-technology strategy' (Schwaag Serger, 2008; Long, 2005; Håkanson and Nobel, 1993).

Recently, an unprecedented wave of offshoring of production capability has taken place from developed markets into emerging markets, in particular into East Asia (Altenburg et al., 2008). As production and sourcing increasingly take place in emerging markets, it becomes increasingly relevant to have R&D in place locally in order to support these activities, i.e., to have upstream support. China is an important manufacturing base and market for many Western companies (Li et al., 2007). Upstream support, for instance, concerns R&D support in relation to local sourcing and local manufacturing activities. This can operate in terms of optimizing manufacturing processes and thereby increasing efficiency in relation to local manufacturing plants. Local upstream support also makes it easier to make use of sourcing opportunities in emerging markets.

The objectives of gaining access to the current and, in particular, the expected technical and scientific talents available in emerging markets are also gaining momentum (Lewin et al., 2009). Each year, numerous new science candidates are produced in emerging markets, such as India and China (Chen, 2006), but the quality of this talent has been questioned. The percentage of engineering graduates that are suitable for employment in global companies has been reported to be only 10% in China (Farrell and Grant, 2005), 25% in India, and 50% in Central Europe (Farrell et al., 2005).

2. Research problem

Whereas offshoring is already widely explored concerning most business activities, the offshoring of R&D is less explored (Lewin and Peeters, 2006). This is puzzling because many companies invest vast resources and experience challenges of various kinds in relation to this topic. Also, R&D activities are different from other business activities because of the often tacit nature of R&D knowledge (Narula and Dunning, 1998; Cohen and Levinthal, 1990). Tacit knowledge can be defined as knowledge that can only be revealed by its application (Tsoukas, 2003; Polanyi, 1966). Further research is therefore needed concerning the offshoring of R&D, or R&D transfer.

Very little systematic research exists on foreign R&D in emerging markets such as China because this is a relatively new phenomenon (Zedtwitz, 2004). Innovative efforts, such as new product development that takes place within subsidiaries in emerging markets, has largely been overlooked (Zhang et al., 2009). Various problems are often mentioned in relation to R&D transfer to China. These include a lack of creativity and initiative among the Chinese; fear of losing control over strategic IPR (Zedtwitz, 2004); and excessive preference for exploitation as opposed to explorative knowledge creation for the sake of knowledge creation due to a number of historical and cultural factors (Baark, 2007). Experimenting and creating knowledge for the sake of knowledge creation may be important in order to facilitate innovation. Gassmann and Han (2004) identify relevant barriers for managing R&D activities in China and suggest that future research on R&D activities in China should evaluate the best practices for overcoming obstacles in managing foreign R&D in the country.

Concerning offshoring, it is possible to distinguish between captive offshoring on the one hand and offshore outsourcing on the other hand. Captive offshoring concerns offshoring within the company, and offshore outsourcing (e.g. Wendy et al., 2009) concerns the offshoring of activities that are simultaneously outsourced to other companies (Lewin and Peeters, 2006). R&D offshoring concerns the relocation of R&D across borders, which is similar to R&D transfer. Figure 2 illustrates the differences between captive R&D offshoring, offshore R&D outsourcing, domestic in-house R&D, and domestic R&D outsourcing.

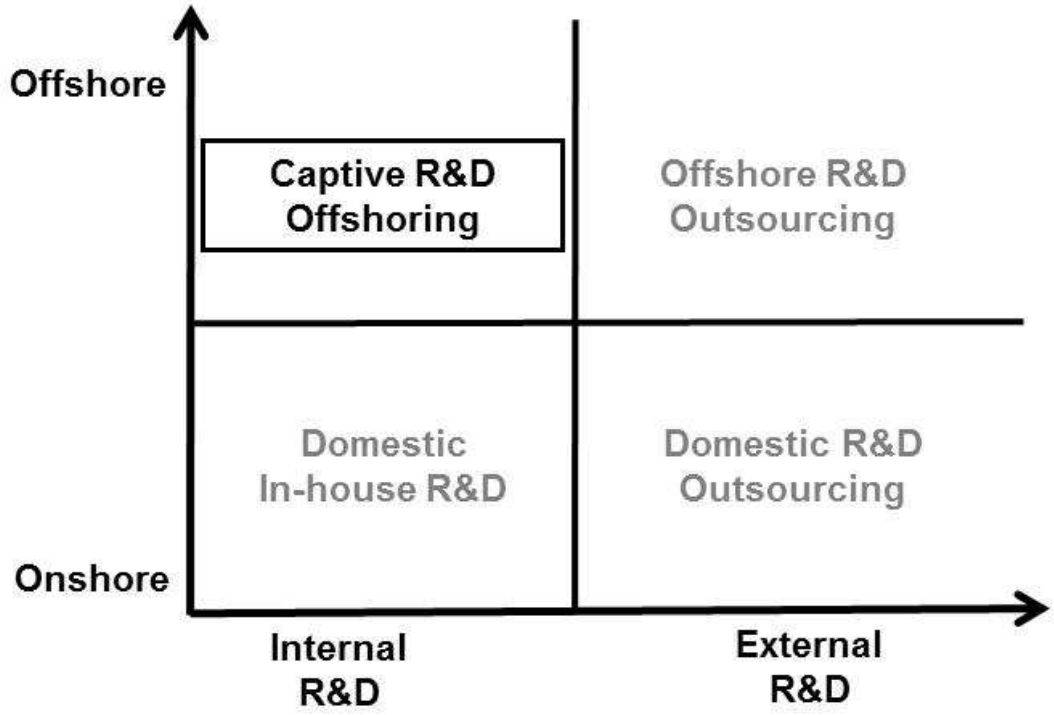

Figure 2: Differences between captive R&D offshoring, offshore R&D outsourcing, domestic in-house R&D, and domestic R&D outsourcing. (Source: Own based on Eppinger and Chitkara (2006; p. 27))

Three of the four parts of Figure 2 are in greyscale because these parts are not the focus of this thesis. The top left part of Figure 2 is bolder than the other parts in order to illustrate that this thesis relates to the subject of captive R&D offshoring, which concerns in-house R&D that takes place abroad. Lewin et al. (2009) propose that the captive approach, meaning that a subsidiary or unit is fully owned, is more often chosen in relation to the offshoring of R&D activities than it is chosen in relation to the offshoring of other business activities. They link this to the need for a strong governance structure, as well as to coordination in relation to R&D. Also, the captive approach may be chosen in order to decrease the leakage of IP and in order to enable a sufficient flow of knowledge within the MNC. If one is to conduct further research concerning knowledge flows within MNCs (as suggested by: Foss and Pedersen, 2002; Gupta and Govindarajan, 2000) in relation to international R&D activities, it therefore seems more relevant to investigate the captive offshoring of R&D rather than the offshore outsourcing of R&D.

This study does not concern R&D transfer or R&D offshoring in general, which would include the offshore outsourcing of advanced services to independent service providers in other countries and joint ventures abroad. Instead, the present study investigates aspects of captive R&D offshoring to emerging markets among Scandinavian MNCs.

China is the home of such inventions as printing, paper, gunpowder, and the compass (Johnson and Weiss, 2008), but it has not since been a technologically leading country. The cultural revolution impacted Chinese innovation output negatively (Simon, 1989), but considering the number of academic publications, China is currently experiencing a rebound (Zhou and Leydesdorff, 2006). Over time, this rebound may make it more interesting to conduct R&D together with local companies and knowledge networks in the country. However, so far, China seems to be catching up

in terms of science rather than technological innovation (Altenburg et al., 2008). Opportunities for foreign-invested R&D to exploit differences in knowledge profiles, as mentioned by (Alcacer and Chung, 2011), are thereby difficult to identify in emerging markets. One reason for this is that emerging markets normally experience a transition period in which the percentage of GDP, which is spent on R&D, takes a great leap forward (Jian and Jefferson, 2007). In other words, emerging markets are most often places in which R&D investments have not been made very much before. Hence, R&D knowledge has had few chances to accumulate. In this sense, it is more difficult for newly established foreign-invested R&D units in emerging markets to perform well and carry out a given mandate than it is in developed markets. In emerging markets, knowledge profile differences relative to the home locations of Western companies are often of a kind that makes foreign-invested R&D establishments less concerned with knowledge seeking. This is why the knowledge seeking box is in greyscale in Figure 3: so as to not emphasize the role of knowledge seeking for newly established foreign-invested R&D units in emerging markets. In other words, MNCs have to play a key role in developing local knowledge clusters in emerging markets if they wish to benefit from these later on, rather than assuming such burgeoning knowledge clusters to be readily available (Manning, 2008; Altenburg et al., 2008).

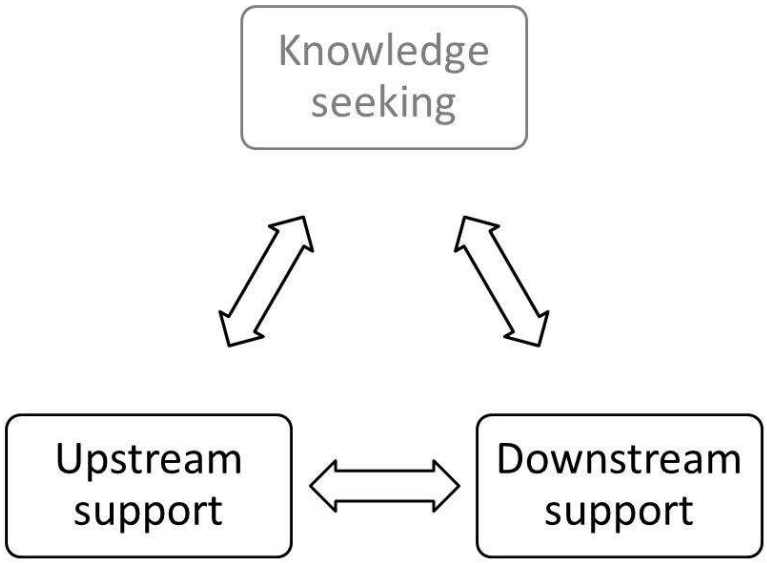

Figure 3: Mandates for offshore R&D units in emerging markets

Newly established foreign-invested R&D units in emerging markets, such as China and India, are therefore more likely to have a mandate that concerns downstream support and/or upstream support than a mandate that concerns knowledge seeking. This is also briefly illustrated in Table 1 in relation to the cases investigated in this thesis.

Case company	Med Tech	Mechanic Tech	Wind Tech	Pack Tech
Mandate of the investigated newly established R&D unit according to the Kuemmerle (1997; 1999) typology	(Aspects of HBA) and HBE upstream support	HBE, upstream support, and downstream support	HBE, upstream support	HBE, upstream support, and downstream support
Examples of Mandates in more specific terms	Support a majority of R&D projects in the company at early stages with capabilities within protein expression and purification etc. Mandate to initiate and manage new R&D projects (happened once so far) Ex-vivo experiments	Local development of application products with support from the R&D home base Support of sourcing and manufacturing	Development of virtual testing systems in collaboration with the R&D home base Responsibility for improvements and validation of repair solutions Support various types of R&D activities and carry out related calculations Support of sourcing and manufacturing	Local packaging material adaptation and validation Development of downstream equipment, with support from the R&D home base Responsibility for improving one existing product category Support of sourcing and manufacturing

Table 1: Mandates within the cases.

Even though all the cases are assessed as HBE in Table 1, it is possible, across the cases, to find examples of activities that can be characterized as HBA, particularly within the Med Tech case. However, the mandates mainly relate to HBE activities. As indicated in Table 1, the mandate of newly established foreign-invested R&D units in emerging markets does not necessarily pertain exclusively to either of the categories of upstream support or downstream support. It is also possible to have a combination of these types. For instance, this is the case within Mechanic Tech, as well as Pack Tech. In Table 1, Med Tech and Wind Tech could also be evaluated as carrying out downstream support in the sense that the mere R&D presence can ease the interaction with local authorities and thereby ease the market access, but mainly, these two cases concern upstream support rather than downstream support.

As knowledge concerning technological innovation is difficult to find, knowledge transfer plays a key role in relation to how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates. It is necessary to transfer knowledge before such R&D units can start to carry out their mandates. Companies struggle to share knowledge effectively in relation to their foreign-invested R&D in emerging markets (Barrett et al., 2011), and there is a need for further research concerning primary and reverse knowledge transfer in relation to offshore

R&D (Demirbag and Glaister, 2010; Manning et al., 2008; Gupta and Govindarajan, 2000). This makes it particularly relevant to investigate the role of R&D knowledge transfer. Knowledge transfer can be defined as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote and Ingram, 2000; p. 151). It takes place when knowledge levels change or when performance, relying on certain knowledge, changes (Argote and Ingram, 2000). *Primary* knowledge transfer occurs when knowledge is transferred from the headquarters to a subsidiary. Knowledge transfer between subsidiaries is called *secondary* knowledge transfer, and *reverse knowledge transfer* is the transfer of new knowledge from a subsidiary back to the headquarters (Buckley et al., 2003). In this study, knowledge transfer is investigated in relation to the process of how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates, as is outlined in the following research question section.

2.1. Research question

In this section, one main research question is outlined, along with three sub questions, which each partially answer the main research question. The research questions are distilled from the research problem discussion above.

As indicated above, the main research question is:

How do newly established foreign-invested R&D units in emerging markets become able to carry out their mandates?

This research question can be broken down in the following three sub-questions:

1. *How do newly established foreign-invested R&D units in emerging markets acquire R&D home base knowledge in order to carry out their mandates?*
2. *How do newly established foreign-invested R&D units in emerging markets make use of local talent in order to carry out their mandates?*
3. *How do newly established foreign-invested R&D units in emerging markets engage local sources of knowledge in order to carry out their mandates?*

Sub-question One can extend the work of Pehrsson (2010), who, in relation to subsidiaries in developed markets, finds that the perceived relatedness of intangible resources between headquarters and foreign subsidiaries contributes to subsidiary performance. However, he does not investigate how such relatedness comes about, particularly not in emerging markets. As outlined previously, a mandate is a license to apply distinctive capabilities (Birkinshaw, 1996). In emerging markets, such distinctive capabilities cannot be assumed to be available, i.e., primary knowledge transfer and the acquisition of knowledge from the R&D home base is important. Sub-question One also implicitly questions the focus on local market knowledge apparent in the Uppsala model of firm internationalization (Johanson and Vahlne, 2009; 1977), which is one of the most influential models of firm internationalization. The focus on acquiring local market knowledge is unlikely to be equally important across different types of business activities. In relation to non-marketing business activities, it is relevant to reconsider which type of knowledge to acquire in the internationalization process (Forsgren in: Forsgren and Johanson, 2010). The investigation of sub-

question One is also likely to reveal differences in the conditions for knowledge transfer across the case companies. It may thereby provide some help in understanding why R&D offshoring differs so much across industries (Lewin et al., 2009; Li and Zhong, 2003).

In particular, Sub-question Two replies to calls for future research on technological and process/service related innovation practices in Asian countries. The skills of local employees are important for the ability to carry out the mandate of a newly established R&D unit, and further research that can reveal the impediments to innovation and knowledge creation in China and India is needed (Johnson and Weiss, 2008).

Sub-question Three relates to calls for further research on how local environments are engaged (Alcacer and Chung, 2011). An important element of the local environment, which it makes particular sense to engage with for newly established R&D units, concerns well-established local manufacturing activities (Quan and Chesbrough, 2010; Zhang et al., 2008; Walsh, 2007; Karandikar and Nidamarthi, 2006). R&D internationalization can decrease the negative impact that physical distance has on knowledge flows (Allen and Henn, 2006; Allen, 1977). Previous research has primarily focused on the interface between R&D and marketing (e.g. Lu and Yang, 2004) rather than on that between R&D and manufacturing, which makes further investigation of the interdependencies and the need for proximity between these two types of activities particularly important (Olausson et al., 2009). Engagement of the local environment in a broader sense needs to take into account key aspects of the institutional frameworks available in emerging markets, such as China and India. In developed countries, much innovation, particularly incremental innovation, takes place in collaboration with suppliers and sometimes with competitors, whereas universities are better collaboration partners concerning radical innovations (Belderbos et al., 2004). However, in the weak IPR regimes available in emerging markets, such as China and India (Keupp et al., 2010), innovation collaboration with competitors and even suppliers is often not feasible. The risks related to collaboration may differ across various types of collaboration partners. For example, through backward or forward integration, suppliers and customers may represent more immediate threats in terms of increased competition than universities do because suppliers and customers are more likely to have the complementary assets (Teece, 1986) needed in order to profit from technological innovation. On the other hand, close links between local universities and local companies may make the knowledge shared by foreign-invested R&D units with local universities available for other local companies and potential competitors sooner or later. However, the advances in science, e.g., in China (Zhou and Leydesdorff, 2006), rather than general technological innovation (Altenburg et al., 2008), make it interesting to focus on local sources of knowledge in terms of local universities rather than on local suppliers. University spinoffs in emerging markets, such as China, have received some research attention (Hu and Mathews, 2008; Kroll and Liefner, 2008; Eun et al., 2006). However, the broader notion of industry university collaboration has received less attention. It is particularly relevant to investigate how foreign-invested R&D and local universities in emerging markets work together (Li, 2010).

2.2. Purpose

The purpose of this thesis is to better understand how R&D knowledge is transferred and created in relation to R&D units established by Scandinavian MNCs in China and India as these R&D units become able to carry out their mandates.

2.3. Delimitations

R&D centers of foreign MNCs in China with a given mission of doing research are primarily located around Beijing, whereas R&D centers of foreign MNCs having a mission focused on development are primarily located around Shanghai (Zedtwitz, 2004). Given the limited number of cases in this study, where MNCs locate R&D in emerging markets will not be investigated.

This study investigates how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates exclusively within Scandinavian MNCs that have established R&D units in China and India. The case companies have generally centralized their R&D in one or two locations in Europe, in particular in Scandinavia, prior to the establishments in China and India.

No attempts are made to study the MNC as a whole. The focus is on the R&D units.

This study does not particularly investigate China or India. Cultural differences are not the focus of this study.

This study does not pertain to international R&D joint ventures.

Secondary knowledge transfer is not investigated in this thesis.

International divestment (Boddewyn, 1979), such as the process of back shoring or relocating already offshored R&D activities, is not investigated.

3. Theoretical framework

In this section, the core conceptual streams applied in the papers of this thesis are briefly presented so as to elucidate why they are relevant.

The wording of the research question implies that it is the capability component of mandates rather than the formal charter component, which is in focus. As capabilities are an essential part of R&D unit mandates, it is natural to make use of a knowledge-based perspective when investigating how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates. Knowledge is non-static, changing, and can be influenced by managerial means. Similar to Plato, Nonaka (1994; p. 15) defines knowledge as *"justified true belief*." Beyond knowledge management theory, this thesis also makes use of in particular networking theory in order to better capture contingent elements that have implications for knowledge transfer, as illustrated in Figure 4.

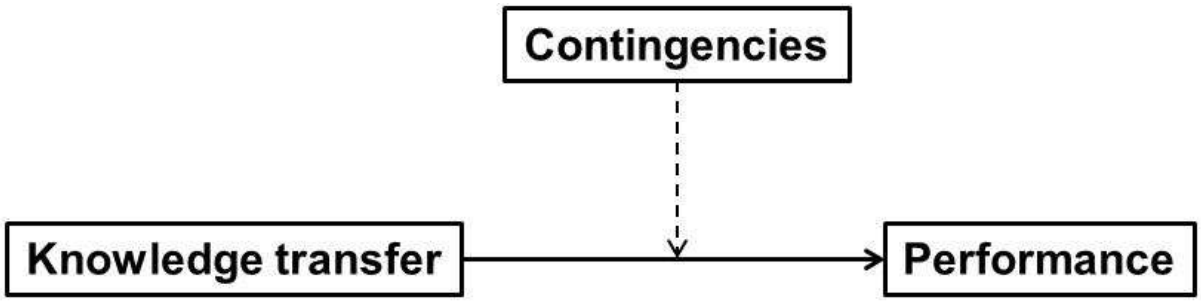

Figure 4: Contingencies that moderate the link between knowledge transfer and performance

Let us return to networking theory later and first focus on knowledge management theory. What is meant by knowledge management theory here is knowledge transfer theory and knowledge creation theory, as well as ambidextrous theory (March, 1991). Knowledge management theory and knowledge transfer theory overlap. The former deals with "the individual and organizational activities by which organizations develop, or leverage their knowledge base" (Kalling, 2003; 116).

3.1. Knowledge transfer

The sharing of knowledge across organizational boundaries is likely to be important for the industrial enterprise of the future (Riis et al., 2007), and it is important when offshoring R&D (Nieto and Rodriguez, 2011). The level of and experience with performing corporate R&D is likely to be lower in emerging markets than in developed markets. The percentage of GDP spent on R&D is often used as a measure of R&D intensity on a national level. In China, it is 1.4%, and in India it has been reported to be 0.8% (Schwaag Serger, 2008). However, these numbers are still below the R&D intensity of most of the Triad countries including "North America (U.S., Canada), Western Europe, and Japan" (Govindarajan and Ramamurti, 2011; 191). Therefore, R&D knowledge transfer to newly established foreign-invested R&D units is likely to be especially important in countries, such as China and India. This is because R&D knowledge has had few opportunities to develop locally. The transfer of R&D knowledge is therefore likely to be a prerequisite in order to carry out the mandate in newly established foreign-invested R&D units in emerging markets, such

as China or India. R&D knowledge pertains to works in progress and therefore tends to be "fluid and embedded in unspecified people, tools, and routines" (Cummings and Teng, 2003; 44).

Different definitions of knowledge transfer can be found. It can be defined as "*a process of systematically organized exchange of information and skills between entities*" (Wang et al., 2004; p. 173) or as "*a process in which an organization recreates and maintains a complex, causally ambiguous set of routines in a new setting*" (Szulanski, 2000; p. 10) or as "*the process through which one unit (e.g., group, department, or division) is affected by the experience of another*" (Argote and Ingram, 2000; p. 151). Wang et al.'s (2004) notion of knowledge transfer as a systematically organized process resonates poorly with the sometimes uncertain nature of R&D. The other knowledge transfer definitions are therefore more relevant for this study. However, the model proposed by Wang et al. (2004) is relevant to consider in relation to this study because it describes the process of knowledge transfer into an emerging market, more specifically China.

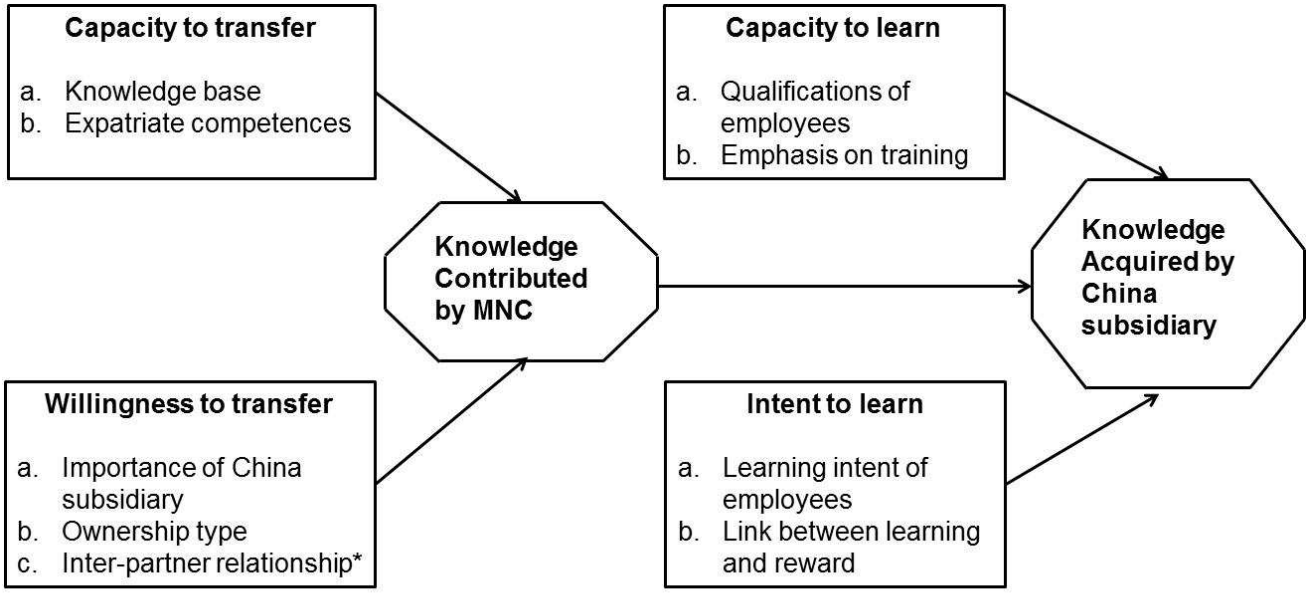

Figure 5: A model for knowledge transfer (Source: Wang et al. (2004))

In Figure 5, knowledge contributed by the foreign MNC is connected with knowledge acquired by the China subsidiary. The figure depicts the capacity to transfer, as well as the willingness to transfer, as being particularly relevant in relation to the knowledge contributed by the MNC. It also depicts the capacity to learn, as well as the intent to learn, as being particularly important in relation to knowledge acquired by the China subsidiary. From Wang et al.'s (2004) work, Liao and Hu (2007) emphasize the effect of trust on knowledge transfer. However, Wang et al. (2004) stress the importance of trust in relation to knowledge transfer when it concerns knowledge transfer to joint venture subsidiaries, not knowledge transfer in general. Trust may thereby be more easily established between an R&D home base and fully owned R&D units than in relation to joint venture subsidiaries.

The empirical data utilized in Wang et al. (2004) were mainly collected at a subsidiary level in China within different foreign-invested subsidiaries of US, European, Hong Kong, Japanese, Korean, and Singaporean firms. Although some interviews took place in Singapore, the focus was

clearly on the subsidiary level in that study. This may be one reason why Wang et al. (2004) only superficially describe the knowledge base of the parent firms. They explain that the richness and sophistication of the parent firms' knowledge bases are positive for the capacity to transfer, but they do not go deeper into other characteristics of the knowledge bases, which have implications regarding whether and how the knowledge base can be transferred to subsidiaries in emerging markets, such as China or India. For example Murray (2005) find that Wang et al. (2004) ignores new product development somewhat. One indication of this is that only one of 83 interviewees interviewed by Wang et al. (2004) was involved in R&D.

3.1.1. Sticky-, codified-, or tacit/explicit knowledge

Different types of knowledge, as well as different characteristics of knowledge, have implications for its transfer. *Sticky information* is information that is costly to acquire, transfer, and use with the purpose of technical problem solving (Von Hippel, 1994). Szulanski (2000; 1996) refers to factors hindering the transfer of knowledge as *internal stickiness*. Internal stickiness can concern motivation-related factors in the relationship between the sender and the receiver. Wang et al. (2004) describe this in terms of "willingness to transfer" and "intent to learn" (see Figure 5). Kalling (2003) emphasizes the importance of motivation in relation to knowledge transfer. He does so based on a single case study that focuses on the implementation of a knowledge transfer program/intranet. In this case, a great deal of competition was instigated between the various parts of the investigated organization. Since competition between different parts of an organization may hamper their motivation to share knowledge that can improve performance, it is not surprising that not all employees in the investigated case company were motivated to share knowledge using the aforementioned knowledge transfer program/intranet. In other words, the reported importance of motivation as a barrier to knowledge transfer may be due to case-specific idiosyncrasies in the single case study. Also, the importance of motivation as a barrier to knowledge transfer has not received much support from other studies so far (Björkman et al., 2004; Minbaeva and Michailova, 2004; Gupta and Govindarajan, 2000; Szulanski, 1996).

Stickiness can also concern the recipient's lack of absorptive capacity (Chen, 2004; Wang et al., 2004; Minbaeva et al., 2003; Lane et al., 2001; Gupta and Govindarajan, 2000; Szulanski, 1996; Cohen and Levinthal, 1990), as well as the tacitness of the knowledge (Polanyi, 1966) to be transferred. The latter is highly important in this research project because R&D knowledge is often tacit to a large extent (Cohen and Levinthal, 1990). What, on the other hand, describes codified knowledge is that it is documented, i.e., expressed in writing (Hansen, 1999). Codification is "the process of conversion of knowledge into messages that can then be processed as information" (Cowan and Foray, 1997). Codified knowledge is easier to transfer than tacit knowledge (Lane et al., 2001; Boisot and Child, 1999; Teece, 1998; Boisot, 1995; Teece, 1986), provided that the recipient can understand the code.

Cultural differences can also make knowledge transfer more difficult. In this regard, Buckley et al. (2006) allude to the importance of having a long-term vision, building personal trust with employees, and building shared mindsets and "guanxi" with partners, specifically in China. However, cultural differences in terms of organizational culture as a barrier for knowledge transfer, has not found much empirical support (Riusala and Smale, 2007; Szulanski, 1996).

3.1.1. Absorptive capacity

Absorptive capacity is defined as "*the ability to recognize the value of new information, assimilate it, and apply it to commercial ends*" (Cohen and Levinthal, 1990; p. 130). R&D creates new knowledge and improves the ability to absorb it (Levinthal and March, 1993). It is similar to Wang et al.'s (2004) notion of the "capacity to learn" (see Figure 5). *Absorptive capacity* is path-dependent (Mowery et al., 1996; Cohen and Levinthal, 1990) and multifaceted. Most research concerning absorptive capacity has framed the concept as a learning process (Lane and Lubatkin, 1998; Cohen and Levinthal, 1990). Zahra and George (2002) frame absorptive capacity as an efficiency process, and they introduce the distinction between potential and realized absorptive capacity. This reconceptualization has since been subject to much criticism. For example, Todorova and Durisin (2007) question the merits of separating potential absorptive capacity from realized absorptive capacity, because it is difficult to operationalize this distinction empirically. Rather than looking at absorptive capacity per se, Lane and Lubatkin (1998) argue in favor of *relative absorptive capacity*. Therefore, they emphasize the external component of absorptive capacity and the importance of similar characteristics, such as shared research communities and knowledge processing systems, between the sender and receiver of information. This may be particularly relevant in relation to knowledge transfer between different companies and possibly less so in relation to knowledge transfer between the R&D home base and a new R&D unit in an emerging market. A reason for this is that knowledge processing systems are likely to be aligned between headquarters and subsidiaries within the same company to a large extent.

The weak appropriability regimes (Teece, 1986) in emerging markets such as India and China (Keupp et al., 2010) are likely to have positive effects in terms of the incentives to invest in absorptive capacity (Cohen and Levinthal, 1990). However, they are likely to have a negative effect on the outcomes of absorptive capacity in terms of competitive advantage (Zahra and George, 2002).

3.1.2. One-shot transfer versus iterative process

Companies that can transfer knowledge at a low cost from the headquarters to their subsidiaries (e.g. Teece, 1981; Teece, 1977) can be considered good at primary knowledge transfer. To a large extent, whether primary knowledge transfer is successful determines whether reverse knowledge transfer is possible (Buckley et al., 2003). This is one example of why it is quite difficult to determine the cost of knowledge transfer and why it is also difficult to investigate knowledge transfer empirically, which may be one reason why it has seldom been done (Foss and Pedersen, 2002). Different indicators of knowledge transfer are used in the literature. Kostova (1999) emphasizes that in terms of an organizational process, knowledge has only been transferred when the process is institutionalized and fully accepted by the recipient. Knowledge transfer takes place when knowledge levels change or when performance, relying on certain knowledge, changes (Argote and Ingram, 2000). Performance improvement may therefore indicate R&D knowledge transfer, and this perspective on knowledge transfer is most relevant for this study. Minbaeva criticizes existing knowledge transfer theory, in particular that of Gupta and Govindarajan (2000), Simonin (1999), and Szulanski (1996), for not capturing "adequately the essential aspects of knowledge senders' behavior" (Minbaeva and Michailova, 2004; 667). In particular, the behavior of expatriates is relevant because they are often used, e.g., in order to ease potential problems from occurring due to the physical distance between the R&D home base and newly established R&D units. A positive correlation between the use of expatriates and successful knowledge transfer has

generally been recognized (Napier, 2006; Minbaeva and Michailova, 2004; Riusala and Suutari, 2004; Wang et al., 2004). The relevance of using expatriates is especially high when it is important to transfer tacit knowledge because such knowledge is difficult to transfer in other ways than via human beings (Swan et al., 2010) socializing with each other (Nonaka and Konno, 1998), whereby tacit-tacit knowledge transfer takes place (Nonaka, 1994). Thus, tacit knowledge can be transferred from person to person and from group to group. In spite of the virtues of expatriation, this knowledge transfer mechanism cannot alleviate situations in which important components of the knowledge are contextually embedded in ways that the expatriate is not aware of, i.e., if a person is unaware of why an organizational process works in a certain context, he or she may face problems when applying the process in another context. This is because part of the reason why the process works in the context may be contingent on the characteristics of that particular context, i.e., it is embedded in the context. This has implications for the relevance of expatriation as a means of knowledge transfer that should be explored further, as done in Paper One. I.e. expatriates may be more relevant in relation to transfer of low location specificity knowledge, such as technological knowledge than marketing knowledge (Fang et al., 2010).

Szulanski (2000; 1996) outlines a knowledge transfer model that is relevant to the transfer of best practices, i.e., organizational routines (the terms *knowledge* and *best practices* are used interchangeably by Szulanski). The model consists of four stages: (1) initiation (identify needs, identify knowledge that meets the needs), (2) implementation (efforts to bridge communication gap between the source and the recipient, efforts to adapt the practice to the recipient's needs), (3) ramp up (the struggle to achieve satisfactory performance), and (4) integration (efforts to achieve and process the routine use of the new knowledge in the recipient, practices become institutionalized/develop ad hoc solutions). Such models poorly reflect the iterations needed in order to transfer R&D knowledge. In particular, in relation to fluid, work-in-progress knowledge it is unlikely that knowledge transfer can take place as a one-shot event. Iterative flows of knowledge between sender and recipient are required for such knowledge transfer (Cummings and Teng, 2003). It is therefore relevant that knowledge transfer processes are studied in this thesis in cases that are followed over time in order to make it possible to capture the iterations that take place.

3.2. Knowledge creation

To merely transfer knowledge is not enough. It is also necessary to do something with the transferred knowledge. It is therefore relevant to utilize knowledge creation theory in order to understand how the knowledge transferred to the investigated R&D units evolves.

When studying a knowledge-intensive and knowledge-creating business activity, such as R&D, it is relevant to consider how knowledge is created. Organizational knowledge creation enables companies to disseminate and embody knowledge in new products and services and thereby create new innovations (Nonaka and Takeuchi, 1995). Knowledge creation theory can enable a better understanding of how knowledge is transferred because knowledge transferred within MNCs tends to be internally created (Foss and Pedersen, 2002). Two important contributions to knowledge creation theory, both somewhat inspired by complexity theory, are the SECI model (Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995), and the Information Space (Boisot and Child, 1999; Boisot, 1995). They will now be briefly introduced and compared.

3.2.1. The SECI model and the Information Space

The SECI model consists of four processes: socialization, externalization, combination, and internalization. The model explains how tacit knowledge and explicit knowledge are exchanged and transformed in a spiraling knowledge process. Knowledge follows a cycle in which tacit knowledge is transformed into explicit knowledge and explicit knowledge is *internalized* into tacit knowledge (Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995). Various criticisms have been put forth in relation to the SECI model, primarily in relation to the definition of knowledge:

- Tacit knowledge cannot be converted into explicit knowledge, because it is inherently ineffable (Tsoukas, 2003), and each type of knowledge (individual explicit knowledge, individual tacit knowledge, collective explicit knowledge, collective tacit knowledge) are distinct and does work the other types of knowledge cannot (Cook and Brown, 1999).
- In its definition of knowledge, the SECI model assumes that knowledge is created by managers. Instead, different types of behavior create different types of knowledge (Gourlay, 2006).

In spite of the criticism, the SECI model has some merits that are relevant to build on further, rather than discarding it entirely.

The Information Space is a three-dimensional model comprising each of the cognitive dimensions *codification* and *abstraction*, as well as the relational dimension *diffusion*. Codification gives data form by assigning them to categories. Abstraction provides structure because it reduces the number of categories to which data need to be assigned before a phenomenon can be understood (Boisot and Child, 1999).

When comparing the SECI-model and the Information Space, a number of points come to mind:

- Both frameworks emphasize the importance of the external environment. Boisot and Child (1999) stress the need for organizations to match the complexity of their environments, thereby paying attention to the external environment. Nonaka and Konno (1998) seem to focus on knowledge within companies, but they also describe the importance of interacting with suppliers and customers, thereby also paying attention to the external environment to some extent.
- The codification of knowledge eases its diffusion (Lane et al., 2001; Teece, 1998; Teece, 1986). In this sense, codification may not only enable the use of knowledge for the organization itself, but may also enable it for competitors. The Information Space seems apt at illustrating knowledge that escapes the organizational context and can spill over from the company and be utilized by competitors. As knowledge is codified and diffused, the use of the knowledge is made easier. It may also be more difficult to appropriate, which is an aspect of knowledge creation which the SECI model seems to neglect by assuming that knowledge is contextually bound and that it therefore sticks to the company. This may be a dangerous assumption, especially in weak IPR regimes, such as many emerging markets.
- Whereas the Information Space jumps rather quickly to the institutional levels in its explanation of knowledge creation, the SECI model is more specific in terms of how knowledge creation takes place. It describes how it evolves from the level of one or few individuals to the group, evolves further to move between groups, and finally returns to the individual level. In this sense, when compared with the SECI model, the Information Space is a model that can be applied in order to illustrate knowledge creation in complex social systems of varying size, be they a firm or China (e.g. Boisot and Child, 1999). The SECI

model primarily focuses on the organizational setting and does not focus as much on different organizational settings and institutions.

In summary, the two models have complementary strengths. It is therefore worthwhile to synthesize them, as is done in Paper Three. In relation to the knowledge creation theory mentioned above, not much empirical work has been carried out (Johnson and Johnston, 2004). This paper diminishes this deficiency in the existing theory by comparing relevant empirical data from Scandinavia, China, and India in relation to knowledge creation-oriented business activities.

3.2.2. Ambidextrous theory

The distinction between exploration and exploitation (Danneels, 2002; Shane and Venkataraman, 2000; Levinthal and March, 1993) is relevant to this research project. Exploration is clearly related to innovation and R&D because it concerns the search for new knowledge in order to develop new organizational capabilities, secure future innovation, and create knowledge. At its core, it concerns experimentation with new alternatives. Exploitation concerns the use of already existing knowledge (March, 1991). Exploitation and exploration are both required for successful innovation to take place, and it has been recognized by many that it is important to perform both activities (Gibson and Birkinshaw, 2004a; Benner and Tushman, 2003; Burgelman, 2002). However, the transition between these two activities is often difficult. This relates to the point at which knowledge is transferred from ideas to manufacturing, marketing, and other complementary skills (Kogut and Zander, 1993). It is possible to distinguish between contextual ambidexterity (Gibson and Birkinshaw, 2004b) and the more traditional notion of structural ambidexterity (Benner and Tushman, 2003). Contextual ambidexterity is nurtured by the implementation of processes and systems that enable individual organization members to balance the needs of alignment (exploitation) and adaptation (exploration). Structural ambidexterity is nurtured by the creation of dual structures in order to harness exploration on the one hand and exploitation on the other hand (Gibson and Birkinshaw, 2004b), i.e., by separating the activities somewhat. Although it may be possible for some companies to be truly ambidextrous, i.e., explore as well as exploit, subsidiaries cannot at be competent at creating and competent at exploiting at the same time (Cantwell and Mudambi, 2005). Hence, ambidexterity is likely to be rare at the subsidiary level, and the notion of structural ambidexterity is most relevant in this thesis.

3.3. International integration and dis-integration

Physical distance exists between an R&D unit and the R&D home base. This constitutes a precondition of physical dis-integration, but in particular, in relation to interaction in the local context, the conditions of integration also exist or can be created. Knowledge transfer theory has so far mainly been studied under conditions of disintegration, i.e., investigations of knowledge transfer between organizational units dis-integrated by physical distance. It is relevant to take into consideration the conditions of integration, as well as dis-integration, in relation to foreign-invested newly established R&D units in emerging markets, in particular when investigating how local sources of knowledge are engaged, as is done in Papers Four and Five of this thesis. It is possible to distinguish between local integration and global integration. For instance, a recurring theme within the international business field pertains to the struggle in MNCs between local responsiveness and global integration (Bartlett and Ghoshal, 1989). Efforts to respond to local demands around the world may often jeopardize global integration, and the risk exists that improved local performance

will come at the cost of decreased global performance of the company. MNCs can influence this equation by defining the way decision mandates, tasks, and resources are distributed between the R&D home base and individual R&D units, in other words by defining the role and mandate of the R&D unit in a way that fits its purpose. This is also relevant to consider in relation to newly established foreign-invested R&D units in emerging markets.

In order to take into consideration conditions of integration as well as disintegration in relation to foreign invested newly-established R&D units in emerging markets, the notion of the double helix (Fine, 2000) is relevant. It explains how supply chains oscillate between integration and dis-integration in terms of "the integral product in the vertical industry and the modular product in the horizontal industry" (Singhal and Singhal, 2012; 249). Such changes are often driven by technological changes.

Knowledge transfer theory and complementary assets theory (Teece, 1986) have gained much inspiration from transaction cost economics, and it is thereby feasible to combine them. Teece (1986) outlines a framework for innovation-related sourcing, which highlights the importance of complementary assets for innovation. It also relates to drivers of integration versus dis-integration.

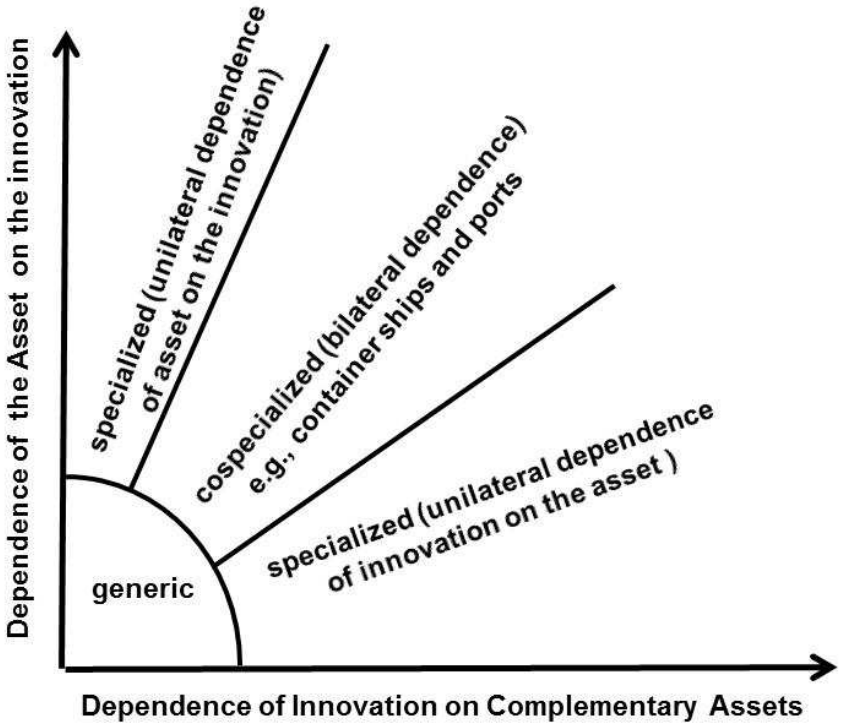

Figure 6*: Complementary assets: Generic, specialized, and co-specialized* (Source: Teece, 1986)

Although both China and India are members of the WTO, the IPR regimes of these countries may still not make it easy to enforce IPR. This is interesting because, especially in contexts characterized by weak appropriation regimes, the control of complementary assets may determine who gets the lion's share of the profits it is possible to extract from new innovations (Teece, 1986).

It is possible to distinguish between generic assets and specialized assets, as is outlined in Figure 6. In contrast to generic assets, either specialized assets depend on an innovation, or the innovation depends upon the specialized asset. Co-specialized assets depend on an innovation, and the innovation depends upon the assets at the same time (Teece, 1986). Although the establishment of R&D in emerging markets may improve the use of certain assets, such as manufacturing plants already present in these countries, a more immediate concern for newly established foreign-invested R&D units in emerging markets may be whether other kinds of complementary assets, which new innovations depend upon, are locally available.

3.4. Networking

The network perspective and the resource-based view of the firm have a great deal in common (Birkinshaw and Hood, 1998). To the extent that knowledge is a resource (Penrose, 1995), the knowledge-based view of the firm and the resource-based view of the firm are also compatible. Hence, combining knowledge management theory and networking theory is feasible. The diffusion dimension of the information space (Boisot and Child, 1999), the socialization and externalization parts of the SECI model (Nonaka and Konno, 1998), and the focus on complex knowledge (Hansen, 1999) can serve as examples of the existing results of such endeavors.

Networking theory is often used to analyze inter-organizational issues and relations between different companies. An R&D unit of a Scandinavian MNC in China can, in many ways, be considered a de-central center, which may be somewhat detached from the R&D home base in Europe. Networking theory is thereby relevant to use in this study. For an R&D home base in Europe, a new R&D center in China or India may seem very distant. Social ties are productive in terms of overcoming the problems caused by physical distance.

Based on the findings of Festinger et al. (1950) and Homan (1950), Burt (1992;, p. 76) states that "*the likelihood of information moving from one person to another is proportional to the strength of their relationship*," where the strength of a relationship is determined by emotional closeness and the frequency of contact. The strength of the relationship also determines whether a tie should be considered weak or strong. Weak ties are non-frequent and transitory social relations (Montgomery, 1994; 1992). Based on Granovetter (1973), Hansen (1999) utilizes a network study to explore how weak inter-unit ties help a new product development team to share knowledge. His findings suggest that while weak ties help the team to find new knowledge located in other units, they are not useful in supporting the actual transfer of complex knowledge. It seems the more complex knowledge is, the stronger the ties required to support its transfer. Since knowledge may flow from strong and weak ties alike, the main benefit of weak ties over strong ties may be that they can provide knowledge access at a lower cost than strong ties can. However, the validity of this claim may depend upon how important it is to gain access to complex knowledge because this is difficult to transfer through weak ties and probably impossible to access through indirect contacts (Hansen, 1999). When foreign-invested R&D units are established in emerging markets, both strong and weak ties are likely to play an important role in terms of connecting the new R&D unit with the rest of the company. However, the complexity of much R&D-related knowledge may require the establishment of strong ties in order to secure good knowledge flows.

Burt (1992) introduces the distinction between primary contacts and secondary contacts. Primary contacts are people you know yourself, and secondary contacts are people you can reach through primary contacts. Burt further defines efficiency in a network as the average number of people reached with a primary contact, whereas effectiveness concerns the total number of people that can

be reached with all primary contacts. In order for a contact to be non-redundant, it needs to have contacts that exclude the contacts of other contacts. According to Burt (1992) *structural holes* connect non-redundant contacts, and seemingly, a positive correlation exists between the number of structural holes spanned by a firm and its innovation output (Ahuja, 2000). However, the best performance at a project group level may come from groups when the group members have strong ties from past joint working experiences and many current weak ties to other groups (Soda et al., 2004). Non-redundant contacts and structural holes are likely to provide access to non-redundant knowledge, which is particularly important for R&D activities. Structural holes act as important bridges for knowledge transfer. This is relevant to keep in mind in relation to newly established foreign-invested R&D units in emerging markets, which are far away and therefore difficult to embed relationally within the rest of a company (Erkelens et al., 2010). For instance, experienced expatriates from the West are likely to have an ability to interconnect a new R&D center with the rest of the R&D activities of a MNC, whereby the new R&D unit can more easily acquire the needed knowledge.

3.5. Research model

Now that the research question, purpose, and relevant theory have been presented, it is time to examine the research model that is applied in this study and illustrated in Figure 7. The purpose of the research model is to outline the central conceptual components and to describe in which context they are investigated.

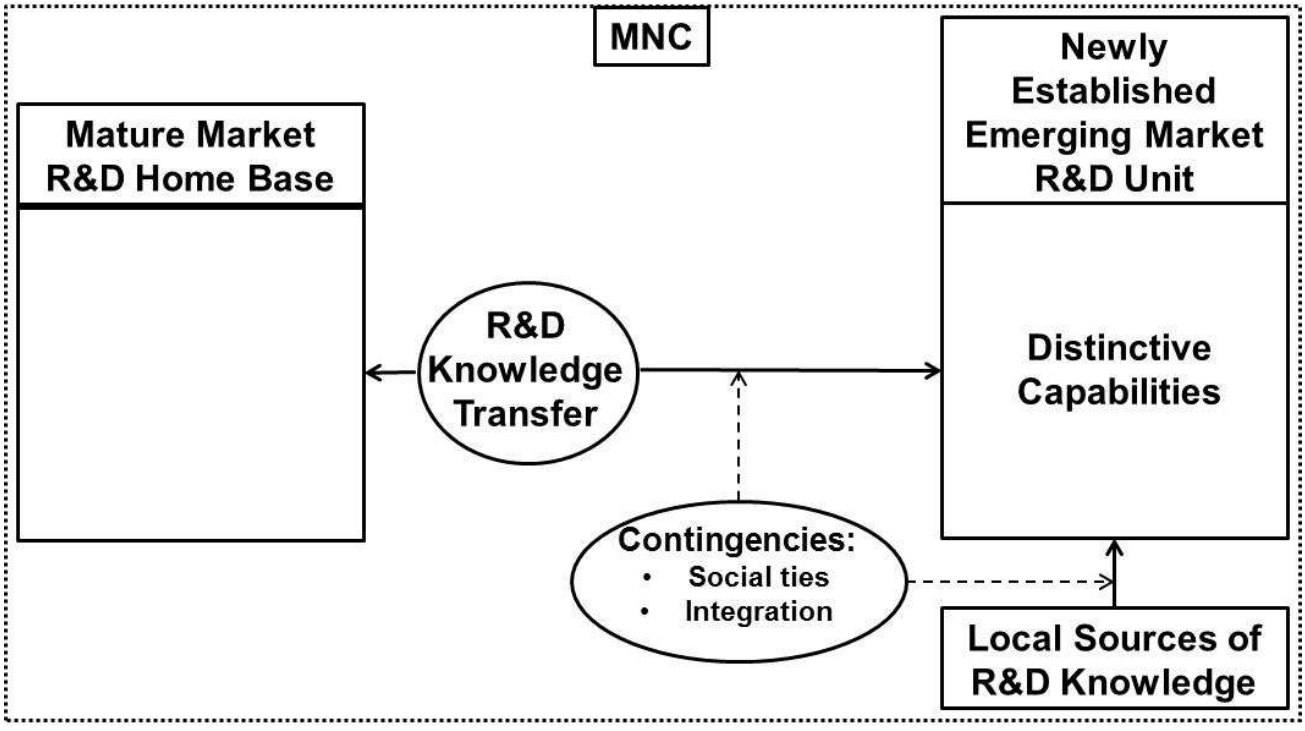

Figure 7: The research model of the thesis

In the left side of Figure 7, an R&D home base in a mature market is illustrated, and in the right side of Figure 7, a newly established foreign-invested R&D unit in an emerging-market is

illustrated. Both these units are within an MNC. As Figure 7 suggests, empirical data have been collected both within mature market R&D home bases and within newly established R&D units in emerging markets. An initial R&D knowledge gap is assumed to exist within newly established R&D units in emerging markets. It is also assumed that R&D knowledge transfer is important in order to nurture the ability to carry out the mandates within newly established foreign-invested R&D units in emerging markets. The model suggests that such knowledge transfer is likely to be contingent on the social ties across sender and recipient units, as well as on the level of integration.

3.6. Theoretical Demarcations

The purpose of this section is to describe the theoretical demarcations of the thesis.

Knowledge management theory constitutes the main theoretical perspective. Other theories, such as networking theory, are only briefly introduced.

Elements of the historical legacies of China and India (Baark, 2007; Yifei et al., 2007; Yang et al., 2006), as well as empirical insights, have given birth to an assumption in this study concerning the existence of initial R&D knowledge gaps within newly established foreign-invested R&D units in emerging markets. Theory concerning culture in a broader sense is, however, not the focus of this study.

Technology and product innovations are mainly knowledge based, whereas in relation to the transfer of strategic capabilities in a broad sense, institutional theory is more relevant (Kostova, 1999). The interviewees have been asked concerning cultural differences and the problems they perceive regarding them. Generally, the interviewees did not emphasize the importance of cultural differences per se. They often replied similarly to the following quote from an interviewee: "*I would find that if a Swede, an Indian guy, and a Chinese guy meet, they will not have large problems in terms of understanding each other. The basic cultural differences are not dominating a technical discussion. I guess that would more be the case if you enter other areas of discussion, like religion and other things. Then, it can be difficult, but as long as you discuss a technical solution, I do not think that you will have any worries at all,"* (Interview, R&D manager 2010-02-09). Possibly, it is more important to leverage culture theory when investigating, e.g., the internationalization of downstream business activities, which tend to be much more location-specific than captive R&D activities within multinational companies tend to be (Anand and Delios, 1997). Other theories applied in this thesis are also able to highlight certain relevant differences between various geographical locations, thereby making it less necessary to leverage culture theory. For instance, Paper Three (Søberg (2011)) includes a discussion that addresses the issue of implications for knowledge transfer based on differences between school systems. It does so, however, through the lens of knowledge management theory.

Theories concerning complementary assets are used in this study to highlight differences between the mature market context (Scandinavia) and the emerging market context (China and India), e.g., in terms of the availability of facilities that are important for R&D knowledge creation.

Theories on human resource management and organizational change are not applied in this thesis.

Agency theory is not applied in this thesis as this has already been done for example by Björkman et al. (2004) in a similar study.

The framework stipulates parameters that are explored and analyzed in each of the cases. The framework is used to assist in creating a better understanding of the research questions. Knowledge

management theory is specifically used in order to better understand how knowledge is transferred, e.g., from local universities to R&D researchers in the newly established R&D unit, and then how this knowledge is transformed from the R&D unit into the overall corporate R&D network, in particular the R&D home base. Knowledge management theory is also made use of in the exploration of how knowledge is transferred from the newly established R&D unit back to the R&D home base in Scandinavia. Networking theory also serves the purpose of enabling a better understanding of how knowledge is transferred, although from a different perspective. No attempts are made at mapping the whole network of the newly established R&D units in emerging markets, which are investigated in this study.

4. Methods

The methods applied in this study have been described to some extent in the papers included in this thesis. However, it is relevant, in this part of the thesis, to elaborate further on the methods and approaches applied in the study. The point here is not to restate what has already been stated in the papers, but to complement the methods description from the papers so as to provide a fuller picture.

4.1. Scientific approach

Two important scientific approaches are induction and deduction, and they differ from each other primarily in terms of the starting point. Induction is a process in which experience is used rather than theory, and deduction, on the other hand, has its starting point in theory (Remenyi et al., 1998). The inductive approach can also be described as the use of data in order to systematically generate theories, and the deductive approach is used to test propositions from theory in the real world. Abduction is a combination between deduction and induction (Dubois and Gadde, 2002; Gummesson, 2000). The abductive approach is intended to reveal underlying structures and relevant patterns (Alvesson and Sköldberg, 2000; 1994). A strength of abduction is that it is useful when the intention is to discover new things, such as new relationships (Dubois and Gadde, 2002). In addition to induction, deduction, and abduction, Dubois and Gadde (2002) present an alternative based on abduction, named *systematic combining*, which is used in this research project.

4.1.1. Systematic combining

This research project follows the systematic combining approach. The basic idea of systematic combining has its origin in the same thoughts as the abductive approach, with a process of *going back and forth* between theory and empirical findings as well as between different research activities. Systematic combining is more suitable for the further development or refinement of existing theories than for generating new ones (Dubois and Gadde, 2002), which is why it is relevant for this research project. Previous research on R&D offshoring largely investigated R&D offshoring between developed countries. In light of the emergent nature of R&D offshoring in emerging markets from developed countries, the abductive approach, rather than the deductive approach, has merit. Systematic combining is based more heavily on theory than induction is, and systematic combining is more focused on the relationship between theory and empirical observations. Systematic combining is a process in which new empirical findings propose that new theoretical influences are added to the research at the same time as new theoretical findings influence the direction of the research work. Furthermore, the framework changes as the interpretation and analysis proceeds. The changed framework in turn influences issues that can be further elaborated on in the research. This idea is founded in the view that in order to be able to understand theory, it is a necessity to compare it with reality and vice versa. This process as a whole means that the theoretical framework can be expanded or changed as the work goes on (Dubois and Gadde, 2002).

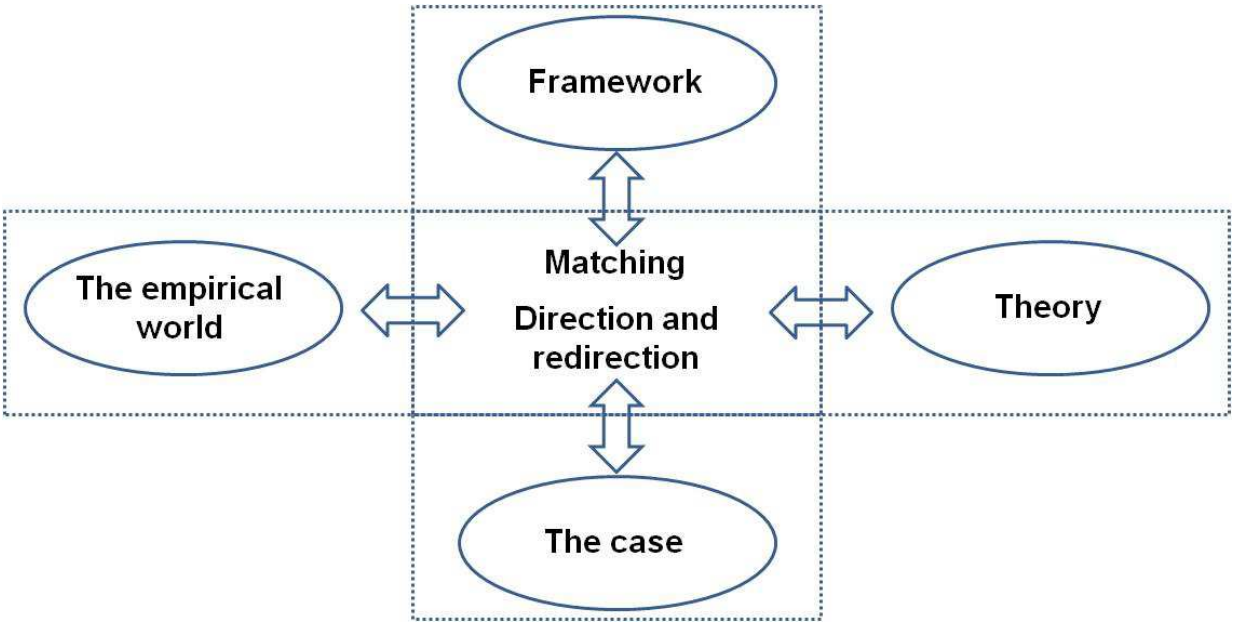

Figure 8: Systematic combining (Source: Dubois and Gadde, (2002; 555))

The key components are the iterative *matching* between theory, the empirical world, and the *direction and redirection* of the research, as outlined in Figure 8. The matching concerns the non-linear process constituting systematic combining by alternating between theory and the empirical world. This matching process does not follow any predetermined or foreseeable routes. Matching can be defined as "*going back and forth between framework, data sources, and analysis*" (Dubois and Gadde, 2002; p. 556). It results in the development of the theoretical framework in parallel with collecting information from the real world and it is thus an approach based on abductive rationales. The abductive approach has the possibility of yielding more than an inductive approach (Dubois and Gadde, 2002). Direction and redirection are the basic features needed to accomplish matching and concerns redirection in this study based upon a broadened understanding of the topic at hand. In terms of the evolution of this research project, an initial focus on the barriers and enablers that exist when transferring R&D to emerging markets has been developed to include how foreign-invested R&D units in emerging markets become able to carry out their mandates.

The role of theory varies depending on the kind of research that is conducted. When generating new theories, the researcher should not be constrained by old theories, but should instead develop theory as the work proceeds. When confirming theories, the theory itself becomes a natural starting point for the research, providing theoretical and conceptual frameworks. In systematic combining, the main approach is not to identify the theory completely beforehand, but instead, to develop the theoretical concept in parallel with the collection of empirical data (Dubois and Gadde, 2002).

It is possible to distinguish between two types of frameworks:

1. tight, pre-structured
2. loose, emergent

The downside of an excessively pre-structured framework is that it might screen off potentially important features, whereas a too-loose framework might lead to a data overload due to the

unrestricted collection of data. Normally, when a scientific approach is based on systematic combining, the framework is tight and evolving. This implies that the framework should be focused at the same time as it should be allowed to change in accordance with the development of the study.

In the initial stages of this research project, the relevant literature was reviewed and the framework was initially focused on knowledge management theory and networking theory to some extent. This has been complemented with theory pertaining to integration and dis-integration.

4.2. Research method

Concerning the investigation of a contemporary phenomenon in its present context, as well as concerning inquiry into complex social phenomena, it is relevant to perform a case study (Eisenhardt and Graebner, 2007; Yin, 2003; Dubois and Gadde, 2002; Remenyi et al., 1998).

Lewin and Peeters (2006) call for industry-contextualized studies in relation to how the various challenges of offshoring are overcome. According to Foss and Pedersen (2004), knowledge characteristics are overemphasized, and the managerial mechanisms by which knowledge transfer is facilitated are disregarded in the literature on the MNC. Case studies are relevant in order to better understand such mechanisms. Case studies have also been mentioned as a relevant approach in carrying out further research on “the mechanisms MNCs employ to integrate knowledge residing in their geographically dispersed subsidiaries" (Li et al., 2007; 246). Li et al. (2007) find such research particularly relevant in relation to subsidiaries in China and India. It is therefore relevant that the case study approach is used in this research project in line with the scientific approach, as outlined above. A case study can be considered similar to a jigsaw puzzle, in which a few pieces fit in the beginning. Patterns become clearer as the putting together of the puzzle proceeds. The difficulty is in choosing the right pieces when pieces from different puzzles appear. This means it is important to choose the most important pieces of information to outline the patterns so that no unclear pieces are left in the study when the project is finalized (Dubois and Gadde, 2002).

4.2.1. Exploratory case study design

The cases studied in this thesis, concern R&D units that have recently been established in China and India by MNCs originating in Scandinavia. It is an advantage to increase the number of observations when studying a few specific variables within case studies. In comparison, to study a number of variables that are independent to one another, the number of cases should be fewer. Consequently, to study many variables, it is an advantage to go in-depth into one case (Dubois and Gadde, 2002). Four cases are made use of in this research project because this will enable a wider scope of comparison and analysis.

4.3. Data collection

4.3.1. Case companies

The case companies are, as outlined in Table 2, Med Tech, Mechanic Tech, Wind Tech, and Pack Tech. As a part of the case selection, a list of companies investing in R&D activities in China was

created in order to provide an overview of the possible case companies (see Harryson and Søberg, 2009; Søberg and Åkerman, 2007).

Good empirical research is often characterized by having good access (Booth et al., 2003), and in the case selection, the fact that it was possible to get good access to these companies was emphasized. Andersson et al. (2001) mentioned that it is difficult to gain access to empirical data concerning subsidiary performance. It may be even more difficult to gain access to empirical data concerning R&D units. Especially when investigating R&D activities that are sensitive to companies, it is important that the case companies are open and willing to participate. It is likely to take time before a newly established foreign-invested R&D unit is able to carry out its mandate. Therefore, it was also important to be able to gain access to the companies over an extended period of time. In terms of the case selection, the fact that the companies are leading high-tech companies who have recently established R&D units in China or India was emphasized. It is difficult to say for how long a time an R&D unit can be considered newly established. In this study, an R&D unit is considered newly established as long as it is still struggling to perform its mandate. In order to carry out a mandate, some level of improvement to the processes or knowledge pertaining to this mandate needs to take place in the R&D unit. This does not necessarily mean major or radical improvements. It means that they are able to challenge the R&D home base knowledge a bit in terms of the activities they are dealing with. This could be in terms of independently improving processes in relation to the mandate of the R&D unit.

In terms of the case selection, it was also a focus that the case companies should come from different industries that are of importance in Scandinavia. Companies are more likely to open up towards researchers who do not interact too much with their competitors. Hence, it has been beneficial in gaining good access to the case companies that each case company is active within a different industry. On the one hand, this makes it slightly more difficult to compare the cases. On the other hand, it makes it possible to make initial comparisons between different industries, and it may also improve the opportunities for making analytical generalizations (Kvale, 1996) based on the findings made in this study. In relation to Paper Two, it is relevant to point out that this study is not a quantitative survey from a cross-industry sample. Instead, cases from various industries are explored in order to illustrate, not validate, the theoretical framework.

Case company	**Med Tech**	**Mechanic Tech**	**Wind Tech**	**Pack Tech**
Industry	Medicine	Automation equipment	Wind turbines	Packaging
Number of conducted semi-structured interviews	27	Nine	Nine	10
Investigated Offshore R&D location	China	China	India	China

Table 2: Case company overview

All the case companies have a focus on in-house R&D instead of having an outsourced R&D model. They rarely collaborate with competitors when performing R&D, and they tend to perform R&D activities in-house rather than having them outsourced.

Collinson and Rugman (2010) find that management research in general is biased towards certain types of companies, which have the characteristics outlined in the left part of Table 3.

Biases	**Med Tech**	**Mechanic Tech**	**Wind Tech**	**Pack Tech**
US firms	No	No	No	No
Large firms	Yes	Yes	Yes	Yes
Manufacturing firms	Yes	Yes	Yes	Yes
Firms that hold dominant positions in important industries	Yes	Yes	Yes	Yes
Firms that have been in existence for a long time	Yes	Yes	Yes	Yes
Firms with a strong recognizable brand	No	No	No	No
Global or bi-regional firms (based on internationalization measures outlined by Rugman and Verbeke (2004))	Yes	Yes	Yes	Yes

Table 3: The case companies evaluated according to case selection biases in management research outlined by Collinson and Rugman (2010).

As outlined in Table 3, the case companies are not US firms. They are all large manufacturing firms that hold dominant positions in important industries and have been in existence for a long time. They do not have particularly recognizable brands, but they are all global or bi-regional firms. Companies that carry out captive R&D offshoring will most likely be global or bi-regional firms. Such companies are also likely to have some of the other characteristics mentioned by Collinson and Rugman (2010). It would therefore be difficult to find companies that do not have the characteristics outlined by Collinson and Rugman (2010) in which it would be possible to investigate captive R&D offshoring into emerging markets.

4.3.2. Qualitative data

In general, quantitative data are primarily used for hypothesis testing, and qualitative data are primarily used for hypothesis creation (Alvesson and Sköldberg, 2000). Quantitative data and qualitative data are complementary (Remenyi et al., 1998), and they can be combined (Andersen, 2003). This can, for instance, take place in a case study (Yin, 2003). For research about processes in a company, informal qualitative interviews and observations offer the best opportunities to obtain the desired information (Gummesson, 2000). It is difficult to investigate R&D quantitatively because the time period between cause and effect is usually long. The empirical data collected in this research project are primarily qualitative primary data from semi-structured interviews. Secondary data from other available sources, such as information about the case companies,

including annual reports and other documents accessed through the Internet or provided by the case companies, have also been investigated. Qualitative data are suitable to this research project due to the complex nature of the investigated topic, because the amount of research investigating this topic has not yet become extensive. Even though this research project is primarily making use of qualitative data, some quantities are included in relation to a small selection of parameters, such as the number of employees working with R&D within the emerging market R&D units or the number of patent applications filed.

As indicated earlier, semi-structured interviews are the most important form of data collection in this research project. The interview is a process in which knowledge is constructed by means of the interaction between the interviewer and the interviewee (Kvale, 1996). In a semi-structured interview, the interviewer has a schedule covering the main topics and issues to be discussed, and the respondent can answer in the way he/she prefers (Fisher, 2004).

Based on a presentation of the research project, the case company would provide a list of suggested interviewees. It was then possible to choose interviewees from this list, and other interviewees could be identified from there. Often, as a consequence of an interview, it would be obvious to talk with certain persons or types of persons, and these people were then identified and approached in order to set up and carry out one or more interviews if possible.

As the cases evolved, more and more time in the interviews was allocated to discussing the issues mentioned by previous interviewees in order to obtain a better view of these issues from the perspective of several interviewees. In follow-up interviews, questions pertaining to previously mentioned issues were also asked in order to see how these issues evolved.

Employees on different management levels, as well as employees without management responsibilities, have been interviewed. This has been done in order to get as close as possible to the important problems, as well as in order to enable triangulation of data across managerial levels. When choosing interviews, gaining access to people who had been involved in the R&D unit establishment from the beginning was emphasized. This was important in order to be able to understand the interaction between the R&D home base and the R&D unit over time.

The interviews in this research project (see case-specific overview in Paragraph 4.3.1) were made between the years 2007 and 2011, both in terms of semi-structured in-person interviews and telephone interviews. A benefit of this longitudinal design is that it enables the investigation of the evolution of the cases, without relying extensively on retrospection, which can be problematic (Mcphee, 1990). Interviews have been made with employees from the case companies in Denmark, Sweden, China, and India. Interviews have been conducted with employees from the R&D home bases, as well as the R&D units in China and India, as was recommended by Ambos et al. (2010), Dellestrand (2010), and (Birkinshaw, 1996) in order to be better able to investigate the interactions between headquarter and subsidiaries and how this evolves over time during the captive R&D offshoring process. This back and forth process starting from the R&D home bases took place in order to enable a better understanding of the interaction between the newly established R&D units and the R&D home bases over time. However, the focus has been on the newly established R&D units.

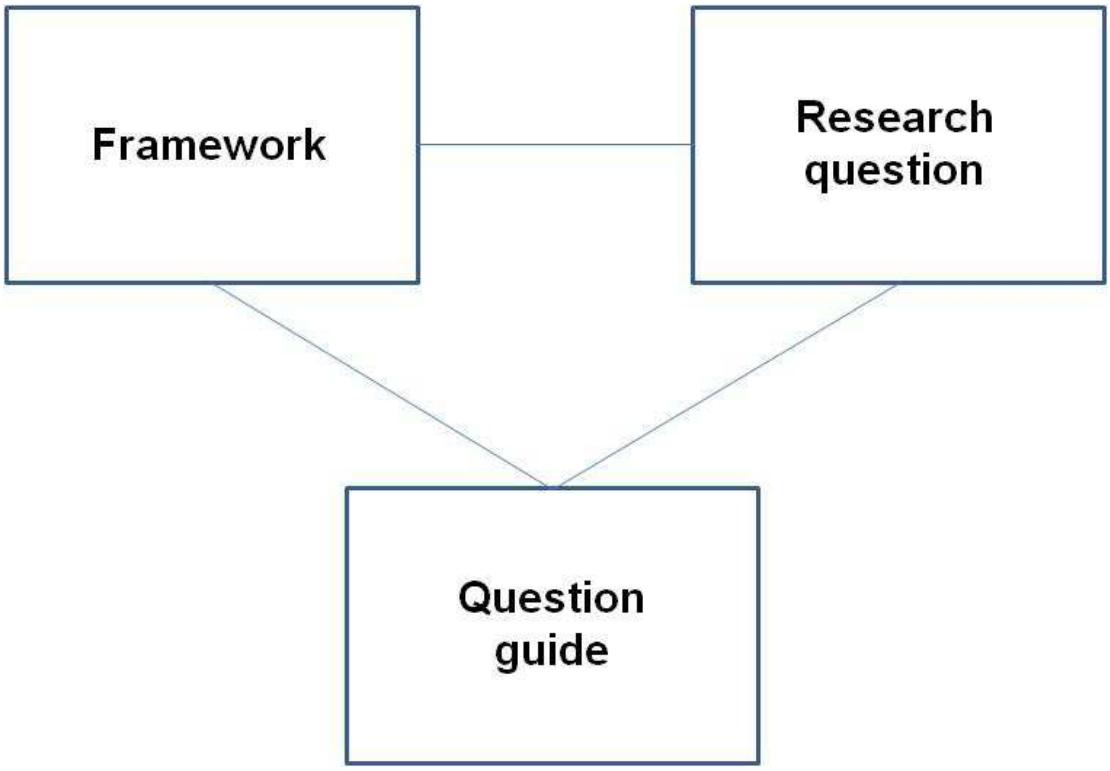

Figure 9: Inspiration for question guide

An interview guide has been used (Kvale, 1996). The question guide included the sequence of the questions, which have been thought through and formulated clearly. This has been done in order to allow the interviewer to redirect the discussion into areas that are of particular interest in terms of the topic studied as the interview proceeds. The content of the question guide was inspired by the evolving framework and the research question, as outlined in Figure 9. Apart from a few exceptions, the interviewees received a question guide prior to the interviews in order to make it possible for the interviewees to study the question guide prior to the interviews. If interviewees study the question guide beforehand, they are likely to be better prepared to answer the questions. On the other hand, it may also give interviewees a chance to train beforehand regarding how not to answer potentially sensitive questions. In general, the author does not perceive this problem to have materialized in relation to the interviews conducted in this research project. The interviewees have generally been informed that if there are questions that they find difficult to answer, they are free to say that they do not wish to answer such questions. This option was not often made use of by the interviewees. The interviewees have generally been open and willing to answer questions and share their views on the topics outlined in the question guide.

A combination of open questions and closed questions were discussed with the interviewees. Open questions in particular were used in order to identify key problems and when discussing possible enablers of such problems. Closed questions were particularly used in order to obtain a factual understanding of the company and the challenges faced by the company.

The interviews usually started with a brief presentation of the research project for the interviewee. This was normally followed by some small talk in which the interviewee got a chance to present him/herself in terms of personal, educational, and professional background, as well as the current title and activities the interviewee would be involved in as a part of his/her work. Otherwise, the

interview questions relate to R&D transfer in particular, as well as broader questions concerning innovation challenges in general for the company, including the role and mandate of the new R&D unit in relation to these innovation challenges. In other words, the study has investigated the ongoing activities of the R&D units and the struggle to become able to carry out such activities. The activities investigated in the cases particularly relate to new product introduction and engineering work, as well as support activities in relation to sourcing and manufacturing. This is especially the case in relation to three cases: Wind Tech, Mechanic Tech, and Pack Tech. Med Tech is different from the other cases in that the investigated activities related less to the support of sourcing and manufacturing. The broad set of questions discussed with the interviewees included themes that relate to networking and interaction within and beyond the company in relation to the ongoing activities of the R&D units. This concerned the interaction between the R&D home base and the R&D unit, as well as the interactions with local sources of knowledge, such as manufacturing units and universities. Related problems, such as intellectual property related issues, have also been covered. Whether and how the internationalization of R&D activities might differ from the internationalization of other business activities was also discussed with the interviewees.

In an investigation of R&D centers owned by foreign companies in China, Zhang et al. (2009) utilize empirical data that they have not collected themselves. They further mention that Luo and Peng (1999), as well as Murray et al. (2005), recommended the commissioning of a Chinese research firm in order to undertake data collection in China. Therefore, this seems to be an accepted practice within the relevant research community. In relation to six of the interviews with local Chinese scientists who are working for Med Tech in China, a native-speaking Chinese PhD student was used as interpreter in order to make it possible for the interviewees to speak in an uninhibited way in their maternal language and in order to limit the risk that the interviewees, out of politeness or for the sake of keeping face (Hofstede, 2001; Hu, 1944), would keep quiet about certain things that could be interpreted as negative comments about Danes when speaking to a Danish researcher. The interpreter is a close friend of the author. Even though the Chinese employees in the R&D center of Med Tech can speak English, it is easier for them to speak Chinese. The question guide was thoroughly discussed with the interpreter prior to the interviews in order to establish the fact that he had a good understanding of the questions and the research project. The empirical data from these interviews are therefore considered to be primary data that have been collected by the use of an interpreter with good research skills who is also a good friend of the author. Even though the use of interpreters seems to be accepted within the research community, it is relevant to consider whether the expected benefits outweigh the drawbacks from case to case. In this study, it seems to have been worthwhile because interesting empirical material has been collected, including some mildly negative remarks about Danes. One can, of course, speculate whether that would have happened to the same extent had the author, as a Danish researcher, conducted all the interviews.

Table 4 lists the interviewees, their locations, the dates of the interviews, the case company synonym, and the total number of interviews that were carried out with the individual interviewees.

	Interviewee	Location of interviewee	Date(s)	Case company	Total no. of interviews
1	Head of development	Scandinavia	31.01.2007	Mechanic Tech	1
2	Vice president	Scandinavia	15.02.2007 08.02.2008	Med Tech	2
3	International Marketing Graduate/ Global Product Manager	Scandinavia, has spent one week in the R&D unit in China	15.02.2007 09.06.2011	Med Tech	2
4	Principal scientist	Scandinavia, expatriate in China for nine months	13.03.2007 08.02.2008 29.01.2009 25.05.2011	Med Tech	4
5	Scientist	Scandinavia, expatriate in China for 15 months	15.03.2007 08.02.2008 23.09.2008 12.05.2011	Med Tech	4
6	President research center	China	19.03.2007	Mechanic Tech	1
7	Patent coordinator	Scandinavia	05.02.2009	Mechanic Tech	1
8	Scientist/ sometimes Project Manager	China	19.05.2009 05.11.2010	Med Tech	2
9	Research associate	China	20.05.2009 26.08.2011	Med Tech	2
10	R&D Department Director	China	20.05.2009 26.05.2009	Med Tech	1 (although the interview took place over two days it is only counted as one interview)
11	Scientist	China	21.05.2009	Med Tech	1
12	Vice president	China	27.05.2009	Med Tech	2

			25.08.2011		
13	Scientist	China	27.05.2009	Med Tech	1
14	IPR manager	Scandinavia	19.06.2009	Wind Tech	1
15	Principal Scientist	China	23.06.2009 13.10.2010	Med Tech	2
16	HR Manager	Scandinavia	15.12.2009	Wind Tech	1
17	Chief Engineer Aerodynamics	Scandinavia	21.12.2009	Wind Tech	1
18	Team manager aerodynamics	India	19.01.2010	Wind Tech	1
19	R&D unit manager	India	27.01.2010	Wind Tech	1
20	Manager	India	28.01.2010	Wind Tech	1
21	IPR employee	Scandinavia	09.02.2010	Mechanic Tech	1
22	Manager R&D processes	Scandinavia	09.02.2010	Mechanic Tech	1
23	R&D unit director	Scandinavian, who is an expatriate in China	31.03.2010 09.02.2011 09.09.2011	Pack Tech	3
24	Team manager	Scandinavian who is an expatriate in China	01.04.2010	Mechanic Tech	1
25	Senior manager design and reliability	Scandinavia	12.05.2010	Wind Tech	1
26	Product Manager	China	21.09.2010	Pack Tech	1
27	Director	China	11.10.2010	Med Tech	1
28	R&D engineer	China	22.02.2011 09.09.2011	Pack Tech	2
29	Industrial PhD	China	12.04.2011 29.10.2011	Pack Tech	2
30	Manager Research Strategy	Scandinavia, has completed several short-term stays in China	30.01.2009 09.02.2010 19.04.2011	Mechanic Tech	3
31	Vice president	China	25.08.2011	Med Tech	1
32	Scientist	China	26.08.2011	Med Tech	1

33	Scientist	China	26.08.2011	Med Tech	1
34	Project Leader without management responsibility	India	30.03.2010 15.08.2011	Wind Tech	2
35	Mechanical Designer	China	09.09.2011	Pack Tech	1
36	Technician	Scandinavian on short term stay in China	09.09.2011	Pack Tech	1
	Total				55

Table 4: List of interviewees

The empirical background for Paper Five also concerns 12 interviews conducted by Associate Professor Sigvald Harryson. These interviews are not listed in Table 4. The author has been given access to the results, and we have jointly analyzed the cases from the perspective of this research project. This approach of the open sharing of research results allows me to base my project on a wider scope of empirical data, which may affect the external validity positively.

Observation has also been utilized to some extent in order to collect empirical data. Within Pack Tech, this did, for instance, take place at a full-day meeting, in which R&D managers from Scandinavia reviewed concepts developed in collaboration with Chinese universities. Notes were taken at the meeting, and the full meeting was recorded in order to make it possible to revisit the material again. Another example is the observation of a coordination meeting in the Chinese R&D unit of Pack Tech, in which all the employees reported on the progress of the projects they were working on. The author has also participated in consulting projects for Pack Tech.

More interviews were carried out with Med Tech than with the other companies. The employees from this company were particularly willing to participate in interviews. Also, in relation to the Med Tech case, the time between R&D unit establishment and data collection initiation was longer than it was in the other cases. This made it relevant to have evidence from more interviewees from Med Tech than from the other cases because retrospection was particularly relied upon in relation to that case. As memory decays with time, it was beneficial to talk with several interviewees within Med Tech who had been involved since the R&D unit establishment or earlier so as to be better able to identify mismatches in the empirical data across different interviewees. It was also relevant to have more interviews within Med Tech due to the considerable size of the R&D organization in this company. For instance, the organization is divided in two divisions, and the R&D unit in China of Med Tech relates to both divisions.

4.3.3. Documentation

It is possible to document interviews in at least two different ways:

1. Document the interviews in their original form, without editing or commenting, giving no kind of other, nonverbal input, or
2. Focus more on nonverbal impressions from the interview situation, providing information on more than what was spoken (Gummesson, 2000).

Transcribed interviews provide a good foundation for making the best analysis (Fisher, 2004). The interviews in this research project have generally been recorded digitally in order to make it possible to focus as much attention as possible on the interaction with the interviewee, including further relevant questions, rather than focusing attention on documenting the interviews. In addition to recording, notes have been taken regarding the most interesting responses. Notes have also been taken based on observation and other non-verbal aspects from in-person interviews and the interviews have been transcribed. In order to ease the transcription process, the speech-to-text program Dragon Naturally Speaking (Professional versions 9-11) has been used. As Dragon Naturally Speaking is not yet a perfect speech-to-text program, the transcriptions have been checked for "typos." The material has been coded into specific themes according to the semi-structured interview guideline in order to make it possible to extract relevant patterns from the empirical material (Yin, 2003). This makes it possible to go back and review the data the analysis is based on. This increases the reliability of the study. In the later stages of the research project, the qualitative data analysis software Nvivo 9 was made use of in order to ease the coding and in order to make it easier to overview the material. When using Nvivo 9, it is highly relevant that the interviews have been transcribed in order to make it possible to make better use of the different analysis tools available in the software.

4.4. Research quality

In order to create a study that it would be possible to evaluate in terms of whether the results represent reality or not, some measurements for this is needed. The measurements commonly used for this are validity and reliability (Yin, 2003; Gummesson, 2000; Merriam, 1998; Kvale, 1996). These aspects are discussed below.

The term validity concerns to what extent the study examines what was sought to be examined (Gummesson, 2000), and a valid study provides a good picture of the object or phenomena at hand. According to Kvale (1996), validity concerns all stages of interview research throughout the process, from thematizing to reporting, with different types of issues in the different stages. Yin (2003) puts forward three different types of validity with different countermeasures to enable a solid study. These are:

- construct validity
- internal validity
- external validity

4.4.1. Construct validity

The term construct validity deals with the concept of making a study that does not have any built-in flaws in the operational procedure. This regards how well the chosen measurements reflect the topic to be studied and how this relation can be demonstrated. In order to address this problem, three countermeasures are relevant:

1. using different sources of evidence
2. establishing a chain of evidence
3. handing the draft of the report to the most important informant for a review (Yin, 2003).

In this research project, the countermeasures mentioned above have been made use of. Different sources of evidence have been utilized, and interviews have been made across different management levels within the case companies. Due to the full transcription of the empirical data from the semi-structured interviews and coding it into different themes, it has been easier to make an overview of the material, establish chains of evidence, and compare different types of empirical material. Key interviewees have reviewed case reports and the documentation of the interviews.

4.4.2. Internal validity

Internal validity concerns the soundness of the proposed cause and effect relationships, and it is therefore especially important in explanatory and causal case studies (Yin, 2003). As mentioned previously, this case study is exploratory rather than explanatory or causal. There is always a risk that the actual causes of events are some other factors that are not included in the study. One method of ensuring internal validity in case studies is the use of triangulation between different sources of information in order to avoid relying on just one (Fisher, 2004; Merriam, 1998). This study is, to a large extent, making use of semi-structured interviews, largely following the same structure. One reason for using a common structure in the interviews is to ensure that information in the various interviews is collected in a uniform way, which is an important factor in case studies (Fisher, 2004). Much like having a common structure in the collection of empirical data is important the analysis of empirical data is likely to influence internal validity. This can be done in a number of ways, and the following list should be considered non-exhaustive:

- Pattern matching
- Explanation building
- Address rival explanations
- Use of logic models

Pattern matching and explanation building are rather similar approaches (Yin, 2003), and in this research project, they have been applied in an iterative manner as part of the matching process, which is integral to systematic combining. Pattern matching can be seen as a somewhat deductive analytic approach in relation to qualitative data. On the one hand, the emergent nature of R&D offshoring within Scandinavian companies into emerging markets, such as China and India, might suggest the use of a more inductive type of analytic technique. However, existing theory may still have some validity in relation to R&D management in emerging markets. Pattern matching is relevant in order to leverage, evaluate, and refine existing theory in relation to the topic at hand and in accordance with the systematic combining approach. In terms of rival explanations, the author has attempted, throughout the research process, to reflect upon and consider different potential relationships between events, outlining the most relevant ones.

4.4.3. External validity/generalizability

External validity concerns the extent to which the findings in a study can be applicable in other situations, the extent to which the results can be regarded as generalizable, and the extent to which it is possible to find the general in the particular (Yin, 2003; Merriam, 1998). Generalizability can be enhanced by using predetermined questions and specific procedures. In order to enhance external validity, theories are relevant in single-case studies, and replication logic is relevant in multiple-

case studies. Case studies can be used to generalize regarding theoretical propositions, but not to generalize about populations or universes (Yin, 2003). All the case companies in this research project originate from Scandinavia, but two of the case companies are now headquartered in other places in Europe. It seems reasonable to say that the findings and propositions in this thesis may be particularly relevant for Scandinavian MNCs that have transferred R&D to countries such as China and India and possibly other emerging markets. To some extent, there are attempts to explain factors underlying events, but there are no intentions to generalize via the extrapolation of the results from the cases in focus in order to apply them to the whole population of MNCs in Scandinavia. When generalizations are made in this thesis, they are in the form of *analytical generalizations* (Kvale, 1996). They are analyzed regarding their applicability in other situations with respect to the similarities and differences of the situations. Consequently, the idea that case studies lack statistical reliability and validity (Gummesson, 2000) does not present an obstacle to this research project. It is not the intention to test a predefined hypothesis, which could have required a different approach in the research project.

The findings of this research project are likely to be generalizable to a wide range of industries active in mechanical engineering and pharmaceuticals and possibly other industries as well. In spite of its focus on globalized R&D in emerging markets, the findings from this research project might also have applicability for more inbound issues concerning how to manage R&D in general. Following Nonaka and Konno (1998), interaction is important for the creation of new knowledge and new ideas, which in one way or another, are important for successful R&D management. The interaction among people in companies is likely to drop dramatically if the distance between them exceeds approximately 30 m (Allen and Henn, 2006; Allen, 1977). Since we may not be interacting that much less with a person who is 6,000 km away from us, instead of 30 m away from us, it is tempting to use this as an argument in favor of the potential generalizability of this study to more traditional R&D management because some challenges may be similar.

The cases concern R&D establishments in both China and India, which is likely to improve external validity because the empirical data are collected from more than one emerging market country. The findings may also have relevance for Scandinavian MNCs establishing R&D activities in a country such as Brazil, which is another large emerging economy.

It may make a difference if R&D is transferred in terms of fully owned R&D units in emerging markets as opposed to joint ventures with local companies. The latter scenario is not included in this thesis. Some caution is likely to be required when considering the findings of this research project in relation to R&D establishments in emerging markets that take place in terms of joint ventures with local companies.

4.4.4. Reliability

Reliability as an expression in research concerns the extent to which the study can be replicated by others, also implying that two parallel studies will come to the same result if the studies are reliable (Yin, 2003; Gummesson, 2000; Merriam, 1998). One difficulty in achieving reliability is that, as stated by Merriam (1998), different people have different interpretations of the same event, which makes it difficult to have one common view to benchmark against. However, as in the case with validity, techniques such as triangulation can be used to ensure reliability.

It is important not only to interview managers but also people at lower hierarchical levels who are on the front line (Johanson, 2004). Unlike previous research on this subject (e.g. Zedtwitz, 2004),

interviews have not been conducted exclusively with R&D directors. Instead, employees at different management levels, as well as engineers and scientists, who are not managers, have been interviewed. This has been done in order to get as close as possible to the important problems, as well as in order to enable the triangulation of data across managerial levels. Similarly, interviews have been conducted with employees of the companies in Scandinavia, as well as in China and India. In addition to qualitative interview material, secondary data, provided by the case companies, as well as press releases, and other sources, have also been investigated. This mitigates the potential problems of informant inaccuracy (Bernard et al., 1984) because it makes it possible to investigate whether inconsistencies exist across different types of data. Since concepts from different theories have been leveraged in this research project, theoretical triangulation has also taken place. Case study protocol and/or case study databases, which enable the later repetition of procedures by enabling the later review of the findings, can also be used in order to ensure reliability (Yin, 2003). In this research project, a case study database has been used. Key informants have reviewed the case reports and the transcriptions of the interviews.

5. Summary of the papers

Now, it is time to examine the content of the articles included in this thesis. The abstracts of the papers are therefore included here.

5.1. Abstract for Paper One

Paper One:

Søberg, P. V. (2012), "Activity Specific Knowledge Characteristics in the Internationalization Process", Baltic Journal of Management, Vol. 7, No. 3, pp. 251-267. Emerald retains the copyright.

Abstract

Purpose - The purpose of this paper is to investigate differences in the characteristics of knowledge, which is very important for the internationalization of different business activities. In particular, the focus is on internationalization in emerging markets such as China and India.

Design/methodology/approach – The paper presents a framework primarily based on knowledge management theory, which is illustrated in relation to interesting cases of four companies that are global leaders.

Findings – An R&D knowledge gap still exists in China and India. Differences across business activities exist in terms of the characteristics of the knowledge, which is most important for the internationalization in emerging markets within multinational corporations (MNCs). The most important knowledge for the internationalization of R&D activities is more tacit than it is for manufacturing activities and international purchasing activities. The source of the most important knowledge for the internationalization of R&D activities, as well as manufacturing activities, is more likely to be the MNC itself, than when marketing activities or purchasing activities are internationalized to emerging markets.

Originality/value – A model is developed that illustrates differences between the most important knowledge for the internationalization of key business activities within MNCs. It is proposed that the technical dimension of tacit knowledge is more easily codified than the cognitive dimension of tacit knowledge. The cognitive dimension of local tacit knowledge is crucial for the internationalization of marketing activities, whereas the technical dimension of tacit R&D knowledge from the home base is crucial for the internationalization of R&D activities.

Keywords – Knowledge transfer, Knowledge characteristics, Internationalization, Business activities, Tacit knowledge, China, India, Knowledge management, Emerging markets

Paper type - Research paper

5.2. Abstract for Paper Two

Paper Two:

Søberg, P. V. (2010), "Industrial influences on R&D transfer to China", Chinese Management Studies, Vol. 4, No. 4, pp. 322-338.

Abstract

Purpose – The purpose of this paper is to open a new research frontier concerning industry factors influencing R&D transfer to emerging markets within Western multinational companies (MNCs).

Design/methodology/approach – The paper presents a framework based on knowledge transfer, knowledge creation, and innovation theory, which is illustrated in two cases from globally leading MNCs from different industries and technological fields which have established R&D units in China. It addresses the issue of industrial influences on R&D transfer to emerging markets, and the importance of complementary assets for innovation performance.

Findings – The framework and empirical research suggest that R&D transfer to new R&D units in emerging markets is less challenging for companies within industries characterized by slow technological development. This is due to dynamics, which result in codification and diffusion of technical knowledge, whereby it is easier to transfer and absorb. When the transformation from exploration to exploitation of knowledge is simple rather than complex within an industry, R&D transfer is less challenging. Leverage of local complementary assets nurtures reverse R&D knowledge transfer – positively impacting innovation performance.

Originality/value – The paper addresses the gap in knowledge transfer theory concerning industrial R&D transfer differences. The paper provides a framework for innovation related industrial contingencies on R&D transfer concerning emerging markets, and it advances the argument that complementary assets are important for R&D in emerging markets. Implications for management in China are outlined. The term captive knowledge transfer is coined.

Keywords – Innovation, China, Research and development, Knowledge transfer, Emerging markets

Paper type – Research paper

5.3. Abstract for Paper Three

Paper Three:

Søberg, P. V. (2011), "The transfer and creation of knowledge within foreign invested R&D in emerging markets", Journal of Technology Management in China, Vol. 6, No. 3, pp. 203-215.

Abstract

Purpose – The purpose of this paper is to investigate important impediments to knowledge creation within newly-established foreign invested R&D centers in China and India.

Design/methodology/approach – The paper presents a framework based on knowledge creation theory in order to understand the barriers for transfer and the creation of innovation-related knowledge within newly-established foreign invested R&D units in China and India. The paper utilizes extensive empirical data collected from a case study in three Scandinavian multinational companies (MNCs).

Findings – Examples of innovations in China and India within Scandinavian MNCs are presented. Impediments to these innovations are identified with regard to socialization and knowledge creation. Particular skills of R&D employees in China and India are relevant for process innovations, e.g. competencies in codification of knowledge.

Originality/value – A synthesis of existing knowledge creation theory is applied to compare R&D knowledge creation skills of Chinese, Indian, and Scandinavian engineers, within MNCs. The new framework explains knowledge creation in China and India, and can be used in other foreign invested R&D units in these countries. Implications for managers working with newly established foreign invested R&D units in emerging markets are offered.

Keywords – China, India, Scandinavia, Multinational companies, Knowledge creation, Knowledge transfer, Foreign invested R&D, Innovation performance

Paper type - Research paper

5.4. Abstract for Paper Four

Paper/Chapter Four:

Søberg, P. V. & Wæhrens, B. V. (Forthcoming 2013), "Integration of Manufacturing and Development in Emerging Markets", in Slepniov, D., Johansen, J. & Wæhrens, B. V. (Ed.), Global Operations Networks: Exploring New Perspectives and Agendas, Aalborg University Press.

Abstract

The chapter investigates the problems related to functional integration between manufacturing activities and R&D activities in emerging markets within multinational companies. A framework to this end is developed and illustrated through four case studies from multinational companies, which have established R&D and manufacturing in China or India. The findings point to the importance of adopting cross functions colocation drivers and contingencies, such as clock speed, technological complexity, as well as the extent to which local adaptation is needed, as an integral part of corporate relocation decisions.

5.5. Abstract for Paper Five

Paper Five:

Harryson, S. J. & Søberg, P. V. (2009), "How transfer of R&D to emerging markets nurtures global innovation performance", International Journal of Technology and Globalisation, Vol. 4, No. 4, pp. 367-391. Inderscience retains the copyright.

Abstract

In the context of global R&D, we connect literature on knowledge management to a network-based theoretical framework helpful to explain the impact of R&D globalisation on innovation performance. This framework is applied to two case companies, both global leaders within their respective industries, in order to analyse the extent to which their strategic globalisation of R&D activities, from Scandinavia to China, has contributed to increased innovation performance. Our findings suggest that close interaction and cross-fertilisation with local knowledge networks are of eminent importance for newly established R&D offsprings to improve overall innovation

performance. Pack Tech illustrates this through a collaboration-intensive approach to university competitions in China.

Keywords: innovation performance; R&D transfers; networking; ambidexterity; sources of exploration; university collaboration in emerging markets.

6. Discussion and Conclusions

6.1. Summary of the findings

In this section, the findings from the various papers will be briefly outlined. In order to do so, it is relevant to restate the research questions with the summary of the findings.

As outlined previously, the main research question is:

How do newly established foreign-invested R&D units in emerging markets become able to carry out their mandate?

This research question was divided in three sub-questions, each focusing on a different aspect of the research question. These questions will now be treated one by one based on the findings in the individual papers.

Focus	R&D Home Base Knowledge Acquisition		Utilization of Local Talent	Engagement of Local Environment	
Topic	Differences between different business activities	Different points of departure for captive R&D offshoring	Impediments to knowledge creation in offshored R&D in emerging markets	Local interaction between R&D and Manufactu-ring	Local Industry-University collaboration
Paper titles	Paper one: Activity specific knowledge characteristics in the internationali-zation Process	Paper two: Industrial influences on R&D transfer to China	Paper three: The transfer - and creation of knowledge within foreign Invested R&D in emerging markets	Paper four: Integration of Manufactu-ring and Development in Emerging Markets	Paper five: How transfer of R&D to emerging markets nurtures global innovation performance
Captive R&D Offshoring Process					

Table 5: Progression of the papers included in the thesis in relation to the captive R&D offshoring process

The purpose of Table 5 is not to outline a stage gate model, but to illustrate that each of the five papers included in this thesis particularly highlights a different part of the same offshoring process.

Papers One and Two particularly deal with earlier stages of the offshoring process and are particularly relevant in relation to Sub-question One. Papers Three, Four, and Five highlight the challenges and benefits that can be reaped in later stages of the captive R&D offshoring process. Paper Three is particularly relevant in relation to Sub-question Two, whereas Papers Four and Five are particularly relevant in relation to Sub-question Three. Iterations between the investigated processes do take place, and they are likely to take place simultaneously to some extent, as will be elaborated on later in the managerial implications section. Table 5 merely presents the logic of the progression of the papers included in this thesis.

In contrast to much research that has exclusively investigated individual parts of the internationalization process, this thesis investigates the captive R&D offshoring process longitudinally. Internationalization theory in general has advanced to a rather sophisticated level within the realm of its assumptions. This thesis contributes to internationalization theory by questioning an assumption in the Uppsala model of firm internationalization: that various business activities can be internationalized in the same way. As proposed in Paper One, it is important to pay attention to the differences between various business activities because these differences have implications for the offshoring process.

Paper Two outlines how documentation processes within a company have implications regarding how easily the knowledge levels of newly recruited R&D employees can be elevated so that the MNC can make best use of these R&D employees. This is a topic that is further elaborated on in Paper Three. As this takes place, the R&D unit becomes better able to leverage local sources of knowledge networks in order to carry out its mandate. In order to facilitate good interaction with local manufacturing units already established locally, it is important to pay attention to contingencies, such as clock speed, technological complexity and the need for local adaptation, in order to obtain efficient knowledge flows between R&D and manufacturing in emerging markets, as described in Paper Four. Paper Five explores how local universities can be leveraged by newly established foreign-invested R&D units. In this sense, there is a progression in terms of the level of maturity or how far the offshoring process has evolved in relation to the focus of the different papers, as initially outlined in Table 5. This thesis therefore goes beyond the contributions of each individual paper by advancing our understanding of the R&D offshoring process, as a whole but let us first revisit Sub-question One.

Sub-question One: How do newly established foreign-invested R&D units in emerging markets acquire R&D home base knowledge in order to carry out their mandates?

As illustrated in Figure 10, the transfer of R&D activities to emerging markets differs from the transfer of other business activities in the sense that the knowledge that is the most important in the internationalization process is likely to be tacit rather than explicit and located within the MNC itself rather than the new local context.

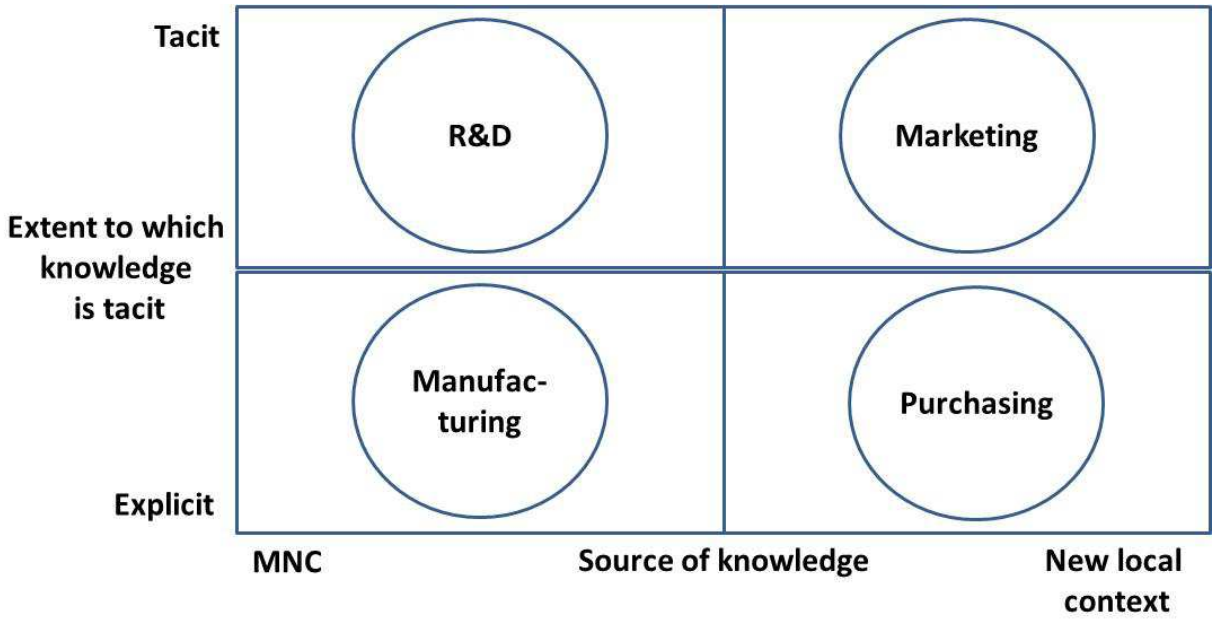

Figure 10: Propositional model outlining characteristics of the knowledge that is the most important for the internationalization of different business activities, from developed markets to emerging markets

As an empirical illustration of the relationships outlined in Figure 10 (from Paper One), it can be mentioned that Pack Tech experienced that newly employed R&D personnel did not have anyone to learn from within the R&D unit in China. Although new employees spent a great deal of time in Scandinavia receiving training lectures, it was difficult for them to make use of this training before they were given opportunities to develop their experiential knowledge in real projects. This may point to the tacit nature of the knowledge needed to carry out these activities. The importance of receiving training at the R&D home base or from experienced people within the company was emphasized across the investigated cases of R&D establishments in China and India. This supports the notion that the knowledge that is most important for the internationalization of R&D to emerging markets is likely to reside within the MNC and that it is likely to be tacit, as outlined in Figure 10. This knowledge is therefore dissimilar to the knowledge that is most important for the internationalization of marketing activities. Within the case companies, it was emphasized that when internationalizing marketing activities, it is important to hire local people who have a great deal of local experience. This may also point to the tacit component of this type of knowledge, but the source of this knowledge seems to be the new local context rather than the MNC. From a managerial point of view, these differences translate into important implications for the internationalization processes of various business activities because different knowledge transfer mechanisms are more or less relevant depending on the business activity in focus. Expatriates have often been mentioned as relevant for the transfer of tacit knowledge, and they are thus highly important to utilize in relation to captive R&D offshoring into emerging markets in order to enable the acquisition of R&D home base knowledge in newly established units. Previous research has suggested that expatriates are particularly relevant to knowledge transfer regarding low location specificity business activities, which tend to be technically oriented (Fang et al., 2010; Anand and Delios, 1997). Paper One enriches our understanding and illustrates why this is the case empirically.

Admittedly, in certain situations, expatriates are less relevant to use. This can be in situations in which the tasks that need to be carried out in a foreign location can easily be specified and are quite straightforward. In emerging markets, there is often a need for scaled-down products containing less functionality, and perhaps also a lower level of quality than in more developed markets. A risk with expatriates may be that in such cases, it can be costly if expatriates rigidly adhere to the same quality standards and suppliers they are used to. This can be one way in which the price tag on products can become too high for customers in emerging markets. Hence, rather than simply assuming that expatriates are always important in relation to R&D offshoring, it is of course also important to keep in mind that regardless of function, if a task is straightforward and more in need of local insights than skills and knowledge that have been accumulated elsewhere, expatriates are likely to be less relevant, or their skills should be combined with people who have needed local insight.

Similarly to Dunning (2001), Paper One also questions the relevance of the Uppsala Model beyond market seeking. This being said, it is important to keep in mind that Figure 10 concerns the internationalization of various business activities from developed markets to emerging markets, i.e., the differences between developed and emerging markets play a role in the relationships outlined in the figure. For instance, it is likely that manufacturing activities that are offshored from developed markets into emerging markets are off a less sophisticated character, in which the production processes are well understood and under control because such manufacturing is more easily offshored than other types of manufacturing are. Also, knowledge from the new local context is likely to be more important when offshoring R&D activities to other developed countries, where opportunities for knowledge seeking may be more abundant. Another point is that regardless of which kind of business activity a company wishes to offshore to emerging markets, such as China and India, some level of interaction with local authorities is necessary. As R&D activities are usually offshored subsequently to other types of business activities, it is usually possible to leverage the experiences made in relation to the offshoring of other types of activities when R&D offshoring is initiated. On top of this, Med Tech hired a local expert specifically to take care of the interaction with local authorities in relation to getting new facilities up and running. Hence, this type of local skills can be sourced locally with relative ease.

The findings presented in Paper Two suggest that industrial characteristics influence the extent to which captive R&D offshoring is challenging to perform, particularly in terms of how difficult it is for newly established R&D units to acquire R&D home base knowledge, i.e., how difficult it is to carry out primary knowledge transfer. For instance, how complex the transformation from exploration to exploitation is differs across companies (Kogut and Zander, 1993). The transformation between exploration and exploitation refers to when knowledge is transferred from ideas to manufacturing, marketing, and other complementary skills. For Med Tech, the transformation from exploration to exploitation was eased in China by the availability of complementary assets: large test populations. For Mechanic Tech, the transformation from exploration to exploitation seems more difficult, and many problems are experienced in the company in terms of coordinating various local suppliers in China.

What may have stronger implications for the ability of newly established R&D units to acquire R&D home base knowledge is that different companies are not equally forced to document R&D knowledge. Med Tech is forced to document, i.e., codify, a great deal of R&D knowledge in order to adhere to the strict and lengthy test requirements related to pharmaceutical products. For Mechanic Tech, these requirements are not nearly as intensive. Because Med Tech is forced to codify R&D knowledge, it is easier to transfer R&D knowledge in terms of primary knowledge transfer for Med Tech than it may be for Mechanic Tech. An important reason for this is that

codified knowledge is more easily transferred than tacit knowledge (Lane et al., 2001; Teece, 1998; Teece, 1986). Also, for Med Tech, the technological development within the industry seems to be slow among other things because of the extensive external test requirements. This may, on the other hand, encourage the use of IPR (Boisot, 1995b), whereby much R&D knowledge is made accessible, e.g., in patent databases. Newly established foreign-invested R&D units can use this knowledge. This was seen within Med Tech. The technological development within the industry where Mechanic Tech is active appears to be faster, and the use of IPR seems to be less intense. This represents one example of differences across companies in terms of the pressure to codify R&D knowledge. These differences, in turn, create differences in terms of how easily newly established R&D units can acquire R&D home base knowledge as a means of becoming able to carry out their mandates. In the case of Med Tech, this seems to be more easily done than in the case of Mechanic Tech, as illustrated in Paper Two. Whereas previous research (Lewin et al., 2009; Li and Zhong, 2003) has outlined dramatic differences in terms of which industries tend to offshore R&D, Paper Two provides and illustrates a framework that aids our understanding of why this is the case. This framework is also relevant in terms of understanding how easily R&D homebase knowledge can be acquired by newly established foreign-invested R&D.

In summary, it is relevant to make use of expatriation in order to facilitate the primary knowledge transfer of tacit R&D knowledge from the R&D home base so that it can be acquired by newly established foreign-invested R&D units in emerging markets. It is also relevant to leverage, to whatever extent possible, already codified R&D home base knowledge when acquiring R&D home base knowledge. Hence, beyond human knowledge transfers, documentation processes and ICT systems are also important because they can enable newly established foreign-invested R&D units in emerging markets to acquire codified R&D home base knowledge.

Sub-question Two: *How do newly established foreign-invested R&D units in emerging markets make use of local talent in order to carry out their mandates?*

The findings suggest that sometimes, superior codification skills, but weaker socialization skills, in relation to knowledge transfer and knowledge creation can be found within newly established foreign-invested R&D units in emerging markets as compared with the R&D home bases of the investigated companies. Indications of good codification skills within the newly established R&D units exist in terms of good theoretical understanding, as well as proven abilities to come up with process innovations, which may require good codification skills, as outlined in Table 6. Within the newly established R&D units in emerging markets, a problem seems to exist in terms of a lack of social initiative. Many engineers and scientists seem to prefer to work on their own, which does not nurture socialization, and thereby, the transfer of tacit knowledge is not nurtured (Nonaka and Konno, 1998).

Type of skill	Codification	Socialization
Type of problem where the skill may be particularly relevant	How to solve existing problems better	How to find new problems to solve
Type of innovation where the skill may be particularly relevant	Process innovations	New product or service

Table 6: Relevance of codification, and socialization in relation to different types of innovation-related activities

A barrier to the transfer of tacit knowledge is that work-related socialization does not take place as much. Innovations, which have their initial life within the investigated cases of newly established foreign-invested R&D units in China and India, generally concern technical process innovations or optimizations. In other words these are innovations, which are created largely based on the further development of existing codified knowledge within the company, as well as application of good codification skills within the newly established R&D units. Activities that require these skills seem to be particularly well suited for the investigated cases of newly established foreign-invested R&D units in emerging markets.

Paper Three outlines similar findings as those found by Han and Froese (2010) among local recruits within newly established foreign-invested R&D units in China. However, Paper Three goes beyond these findings and outlines implications in terms of which activities are particularly relevant to carry out within foreign-invested R&D units in emerging markets. Also, the paper provides a reinterpretation of the SECI model, focusing on the differences between various types of tacit knowledge, i.e., the technical dimension and the cognitive dimension of tacit knowledge. The application of the technical dimension of tacit knowledge, i.e., know-how, is often restricted by the cognitive dimension of tacit knowledge. When know-how is exposed to new mental models and beliefs, it often becomes possible to apply know-how to new ends. An implication of this is that there is a point to mixing people with a lot of know-how with people with less know-how within a specific area because people with less know-how can bring new perspectives and new mental models, which can improve the applicability of existing know-how. R&D employees within newly established foreign-invested R&D units in emerging markets will often initially have less know-how than experienced R&D employees from the R&D home base, but they are able to review the R&D knowledge of the company in new ways. An example of this could be the "good enough" mindset of the local R&D employees within Mechanic Tech. In this sense, the reinterpretation of the SECI model is instrumental in terms of further elucidating the commonplace notion that diversity nurtures creativity. It is not only the combination of different types of know-how that can nurture creativity. Also, different levels of know-how can provide a benefit, particularly when combined with different types of mental models and beliefs, i.e., the cognitive dimension of tacit knowledge.

Paper Three also adds to the discussion concerning differences between various types of innovations, particularly the differences between process and product innovations. Boer and During (2001) find that few differences exist between product, process, and organizational innovations; however, these types of innovation differ in terms of the required internal diffusion. Organizational innovation requires more internal diffusion than process innovation, and product innovation requires the least internal diffusion. Rather than focusing on the extent to which internal diffusion is

required as the point of distinction between various types of innovations, Paper Three outlines differences between product and process innovations in terms of the different antecedent skills required to carry out such innovations, as outlined in Table 6.

In summary, it is relevant to assign tasks and projects to newly established R&D units, which makes it possible for the local R&D employees to make use of their good codification skills in order to make good use of the local talent. This may relate to the optimization of technical processes.

Sub-Question Three: How do newly established foreign-invested R&D units in emerging markets engage local sources of knowledge in order to carry out their mandates?

Whereas Paper Four focuses on interaction with local manufacturing units, Paper Five focuses on interaction with local universities. There are, of course, other sources of knowledge, the interaction with which could also be relevant to explore further. As mentioned previously, emerging markets do not always catch up equally within science and broader technological innovation. For example, in China, the catch-up process within science seems to be faster than the catch-up process concerning technological innovation. Local suppliers are more likely to be relevant as local sources of knowledge in emerging markets that are catching up in terms of technological innovation and in terms of science. Hence, in the near future, it may become more relevant to investigate how local suppliers are engaged as sources of knowledge than it has been so far.

A problem with the existing research on industry-university relationships is that it has generally made use of readily available quantitative data only, and it has mainly contributed in terms of describing the problems of industry-university collaboration, rather than dealing with how such problems can be solved. One such problem concerns the gap between discovery and development (Jelinek and Markham, 2007). This problem can be expressed in terms of bridging exploration and exploitation, and Paper Five contributes examples of how this is done. According to Li (2010), such contributions are much needed, particularly in relation to collaboration between foreign-invested R&D and local universities in emerging markets. Whereas Li (2010) investigates R&D alliance partner selection, specifically in China, spanning both companies and universities, Paper Five contributes by exploring how partner selection and local collaboration is actually carried out. An additional contribution of Paper Five is that whereas Paper Four focuses on knowledge transfer within the local emerging market context, Paper Five also explores how knowledge created in collaboration with local sources of knowledge is transferred back to the R&D home base.

In relation to the answer to Sub-question Three, it is relevant to pay attention to the notion that whether different organizational units are co-located or physically distant from each other has important implications for knowledge transfer between them (Allen and Henn, 2006; Allen, 1977). Beyond the need for local adaptation, Figure 11 outlines clock speed and technological complexity as relevant determinants of the need for the co-location of R&D and manufacturing in emerging markets. Mechanic Tech illustrates a situation characterized by high levels of all three dimensions, seemingly with a high need for co-location and largely contrary to the situation experienced by Med Tech. Perhaps more interestingly, Wind Tech seems to experience a need for the co-location of R&D and manufacturing that is similar to Pack Tech's. This is the case even though the situation of Pack Tech is characterized by higher levels of both technological complexity and need for local adaptation than Wind Tech. This may indicate that clock speed somehow dominates the other two dimensions in Figure 11. Lower levels of clock speed provide more time and opportunities to apply traveling expert teams and other mechanisms, which may help to alleviate high levels of technological complexity and the need for local adaptation.

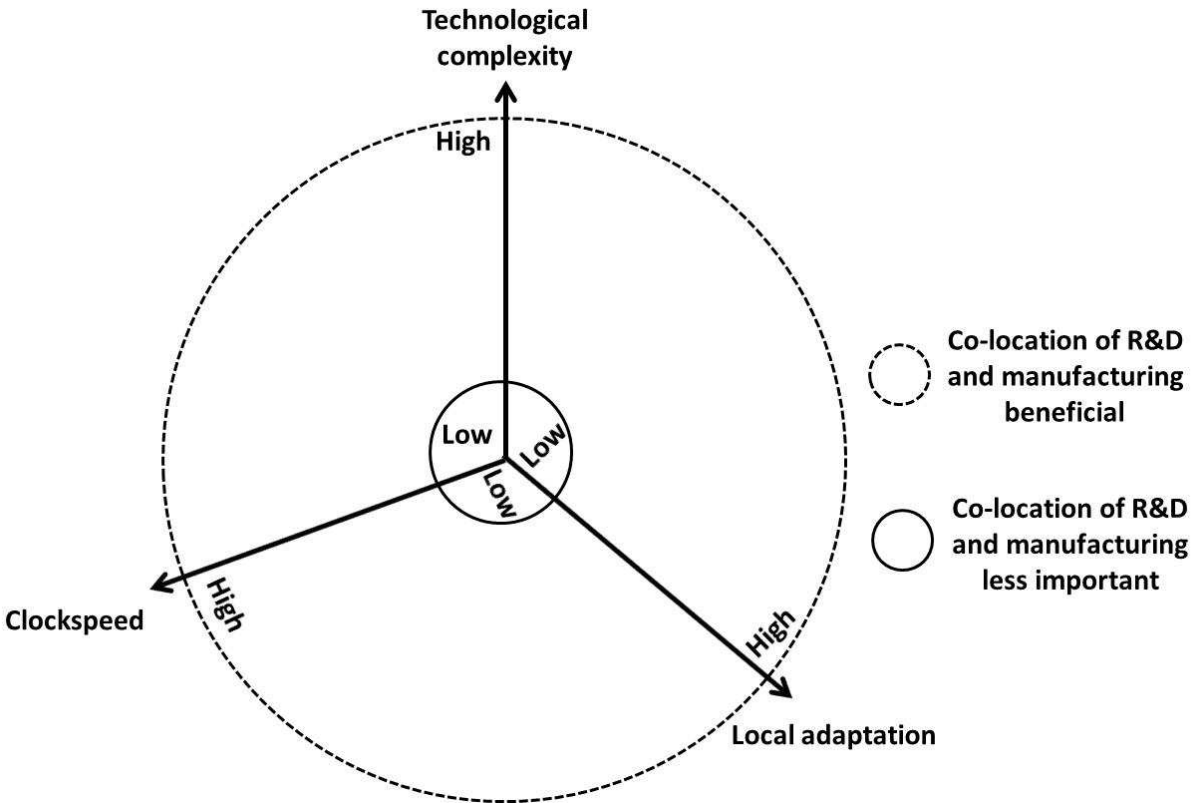

Figure 11: Characteristics affecting the importance of co-location of R&D and manufacturing in emerging markets

None of the cases investigated in this thesis experienced a situation characterized by a high need for local adaptation in combination with low levels of the other two dimensions in Figure 11. Maybe, in such a situation, it would suffice to merely have a local R&D presence. However, co-location with local manufacturing activities would not be necessary. The argument here is that in such a situation, local R&D would enable the needed understanding of the local needs in relation to the R&D activities. However, the low level of clock speed and technological complexity could possibly allow time enough to interact efficiently with manufacturing, even from a distance.

Whereas previous research (Quan and Chesbrough, 2010; Zhang et al., 2008; Walsh, 2007; Karandikar and Nidamarthi, 2006) has mentioned the opportunities to co-locate R&D and already-offshored local manufacturing as important drivers of R&D offshoring, Paper Four outlines and illustrates a framework that explains when co-location as a means of knowledge transfer between offshoring R&D and manufacturing in emerging markets is particularly relevant.

It may seem highly intuitive to engage closely with already established manufacturing units when establishing R&D units in emerging markets. What is perhaps less intuitive is to engage closely with local universities. Managers within the case companies Med Tech and Pack Tech did not initially think of local Chinese universities as obvious sources of knowledge. The reason for this is that the universities did not have much experience with collaboration with companies from the industries in which the case companies are active. In spite of this, Pack Tech initiated a close collaboration with three selected local Chinese universities in order to develop distribution equipment solutions. Pack Tech did not only interact with local universities in order to get the universities to develop new concepts. The company also included selected university students and

professors in the further development of the most promising concept at the company premises in China and in Scandinavia.

Whereas Pack Tech interacted with local universities in the early explorative phases of innovation, as well as later in the exploitative phases of innovation, Med Tech did not interact closely with the local Chinese universities in relation to the development of new concepts. Instead, the company interacted with the local universities in order to understand how to source special medical equipment locally in order to gain access to good recruits and leverage the good opportunities for conducting medical tests in the country to some extent.

Whereas both companies benefited from their interactions with local universities, Pack Tech seems to have benefited the most, e.g., in terms of new concepts for products relevant for global implementation. Also, two patents were filed by Pack Tech regarding inventions created by researchers from the local universities. Since Pack Tech collaborated with local universities in the exploration phase of innovation, whereas Med Tech collaborated with local universities in the exploitation phase of innovation, it is tempting to draw the conclusion that local industry-university collaboration in China should take place in the exploration phase of innovation. This is, however, likely to be only a partial conclusion because it should be noted that Pack Tech also integrated selected researchers and students from the universities in the further development of the most promising concept in Scandinavia and in China. Thus, it was made easier for the researchers and students to explain and illustrate the best concept in front of R&D employees within Pack Tech in more detail. The knowledge transfer process from the exploration phase of innovation to the exploitation phase of innovation seems to have benefited from this human knowledge transfer and made it easier to overcome, e.g., language problems. The findings therefore suggest that it may be beneficial to collaborate with local universities in emerging markets such as China not only in the exploration phase of innovation but also in the exploitation phase of innovation, as outlined in Figure 12. For the sake of simplicity, this is called ambidextrous industry-university collaboration.

Main strategy of I-U interaction	Captured I-U benefits
Exploitation oriented strategy:	Med Tech: Lower-cost and lower-risk test of medicine for wider exploitation across China and other emerging markets Brand building by marketing the R&D investment Improved recruitment opportunities - also for exploration focused functions
Exploration and Exploitation oriented strategy:	Pack Tech : New implementable concepts for the distribution equipment R&D pipeline Goodwill and brand building without marketing local R&D investment Reduced time-to-market of higher performance lower cost equipment by interconnecting creativity and process networks through transfer of researchers

Figure 12: Industry-university interaction across exploitation and exploration

Turning a critical eye to these findings suggests that it may be difficult to integrate researchers and students from local universities in the company in order to allow them to further develop concepts generated as a result of industry-university collaboration. What Pack Tech did to mitigate such problems was to be selective in terms of which people to integrate in the company from the local universities. Pack Tech established strong ties with only some of the individuals from the universities in the later stages of product development. Only the people behind the most promising concept were invited to be integrated in the company for a period of time when the innovation process shifted from the exploration phase of innovation to the exploitation phase of innovation. In this sense, the transformation from exploration to exploitation in relation to the local industry-university collaborations of Pack Tech marked a shift in tie strength from many weak ties to fewer strong ties with relevant local universities.

The findings of this thesis that particularly pertain to the engagement of the local sources of knowledge as a means for a newly established foreign-invested R&D unit to become able to carry out its mandate can be briefly summarized in the following way. It is relevant to pay attention to clock speed, technological complexity, and the need for local adaptation when determining the need for co-location with local manufacturing units. Also, it is relevant to progress from many weak ties to few strong ties in order to bridge exploration and exploitation when collaborating with local universities and progressing in the engagement of local sources of knowledge.

6.2. Towards a revised knowledge transfer model

Some of the theoretical implications of the individual papers have been outlined above. Here, the author will attempt to visually carve out the theoretical contributions of the thesis as a whole. Knowledge transfer within the MNC is important for newly established foreign-invested R&D units in emerging markets to become able to carry out their mandates. Knowledge transfer is also the core theoretical perspective applied in this thesis. Hence, in order to clarify the theoretical contribution of this thesis, it is relevant to synthesize the findings of this thesis with existing knowledge transfer theory. To this end, it is particularly relevant to revisit Figure 13, which was also introduced in the theoretical framework.

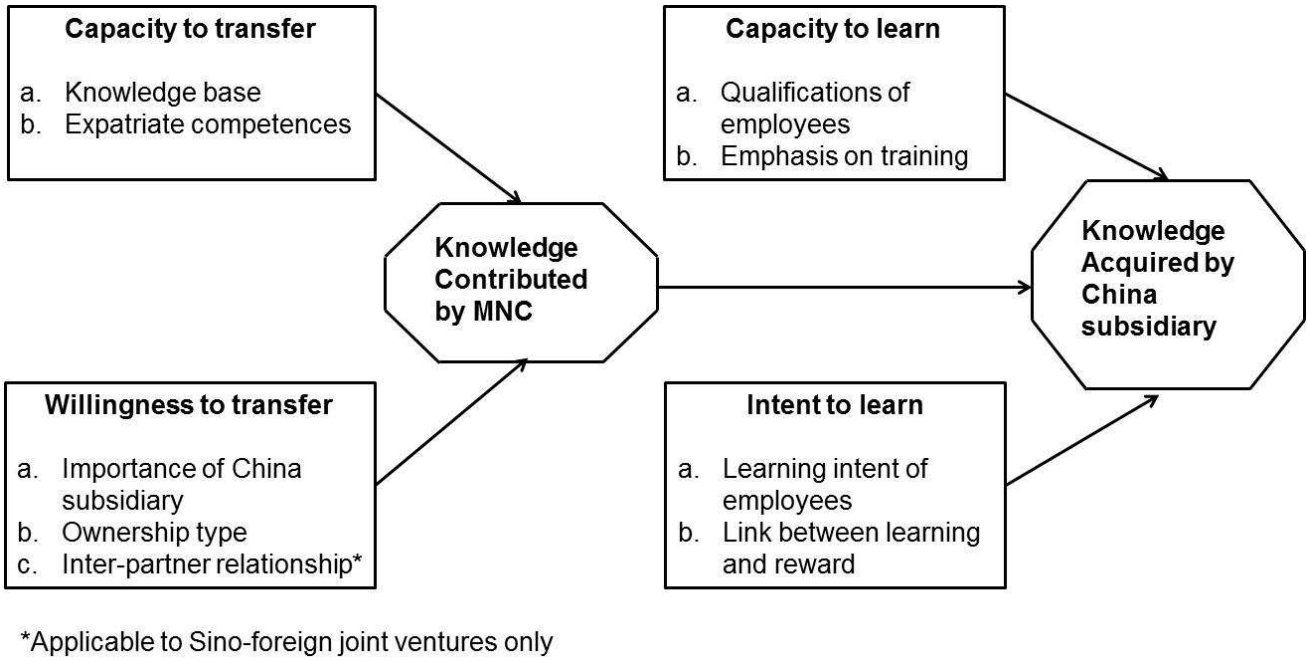

Figure 13: A model for knowledge transfer (Source: Wang et al. (2004))

Figure 13 depicts the knowledge transfer process from a foreign MNC to a Chinese subsidiary. It has many similarities to for example "Figure 1. Determinants of intra-corporate knowledge outflows from and inflows to foreign subsidiaries: An overarching theoretical framework" by Gupta and Govindarajan (2000), but due to the emerging market focus in this study Figure 13 can be considered particularly relevant here. Admittedly, Figure 13 focuses on China specifically, not on emerging markets in general. Also, Figure 13 relates to knowledge transfer across different offshoring business models, i.e., fully owned subsidiaries and ventures, but it is still relevant as a starting point for the synthesis exercise described above.

6.2.1. The papers of this thesis in relation to the figure

Of the four square boxes in Figure 13, Papers One and Two included in this thesis relate particularly to the box "capacity to transfer," whereas Paper Three discusses the skills of the employees in the investigated newly established R&D units, as well as their R&D home base colleagues, and it thereby pertains particularly to the point "qualifications of employees" in the box named "capacity to learn" in Figure 13. Papers Four and Five relate particularly to the box "Capacity to engage local knowledge sources," which will later be integrated into Figure 14, but let us first deal with Figure 13 as it is and try to prune away a few elements in the model that seem to be redundant based on the findings of this thesis and the findings of other researchers, as outlined in the theoretical framework. "Willingness to transfer" is a similar construct to "motivation to transfer," which has been mentioned by many knowledge transfer researchers, but has received limited empirical support. In relation to the box "willingness to transfer," Wang et al. (2004) mentions the following three points:

1. importance of China subsidiary
2. ownership type
3. inter-partner relationship, which is only applicable to Sino-foreign joint ventures.

Wang et al. (2004) mention that willingness to transfer is likely to be higher in relation to wholly-owned subsidiaries rather than foreign joint ventures. The findings of this thesis do not provide much evidence to disagree with this suggestion. At the same time, since the investigated cases in this study only concern wholly-owned subsidiaries the empirical data do not allow sufficient opportunities to discriminate between knowledge transfer in relation to wholly-owned subsidiaries and joint ventures. Therefore, of the three points mentioned above, the latter two have particularly limited relevance in relation to the findings of this thesis. In general, willingness to transfer seemed to be present in the investigated cases, and the focus of the papers included in this thesis has therefore been targeted elsewhere. Similarly, the intent to learn from the R&D home bases in the respective companies seemed to be high among the employees in the investigated newly established foreign-invested R&D subsidiaries. This makes one question whether the boxes "willingness to transfer" and "intent to learn" are relevant to include in a model of knowledge transfer to fully owned subsidiaries in emerging markets, such as China and India. It seems relevant to assume that indeed, willingness to transfer and intent to learn are present. Hence, for the sake of parsimony, it is possible to exclude these two constructs from such a figure altogether. In Figure 14, Wang et al.'s (2004) original model has been changed in the sense that the boxes "willingness to transfer" and "intent to learn" have been removed. In doing so, one needs to keep in mind that the constructs are not as much removed from the figure as they are integrated as underlying assumptions in the same figure. In Paper One, it is mentioned that sometimes, the Chinese R&D employees within Med Tech have to wait for input from the R&D home base before they can proceed. To some extent, this may be due to a lack of willingness to transfer. However, although such examples can be found, this seems to be the exception rather than the rule. In other words, based on the investigated cases, it seems safe to assume that the parent is willing to transfer knowledge and the recipient is motivated to receive and apply that knowledge.

In relation to the remaining constructs in Figure 14, Wang et al. (2004) reduce "capacity to transfer" to simply the quality of the knowledge base of the parent and expatriate competences. Their notion of knowledge base does not include any characteristics of this knowledge base beyond its mere quality. It does not consider characteristics of the knowledge base that are likely to have implications for whether and how the knowledge base can be transferred to the recipient. They thereby seem to suggest that as long as the knowledge base is good and expatriates are competent, there is high capacity to transfer the knowledge. However, expatriates may not always be equally relevant as a means for knowledge transfer, and contextual characteristics of the knowledge base in terms of how and where it is stored are not considered by Wang et al. (2004). They do not clearly distinguish between knowledge pertaining to different types of functions either. Papers One and Two help to outline such contingencies in relation to the home knowledge base and their implications for the knowledge transfer process. These papers thereby help to further describe the knowledge base and the implications the characteristics of the knowledge base have in relation to the capacity to transfer knowledge.

Wang et al. (2004) mention that "capacity to learn" in Figure 13 is similar to absorptive capacity, which as previously mentioned, can be defined as "*the ability to recognize the value of new information, assimilate it, and apply it to commercial ends*" (Cohen and Levinthal, 1990; p. 130). Cohen and Leventhal (1990) stress the importance of prior related knowledge in relation to absorptive capacity, and this is also where Wang et al. (2004) focused their efforts in their explication of the construct "capacity to learn," regarding which they provide evidence suggesting that Chinese employees are more likely to recognize the value of parent technological skills over management skills. However, they do not spend much effort in the paper on the discussion and

exploration of which *commercial ends* are then likely to be relevant when making use of the local talent – an issue further developed in Paper Three.

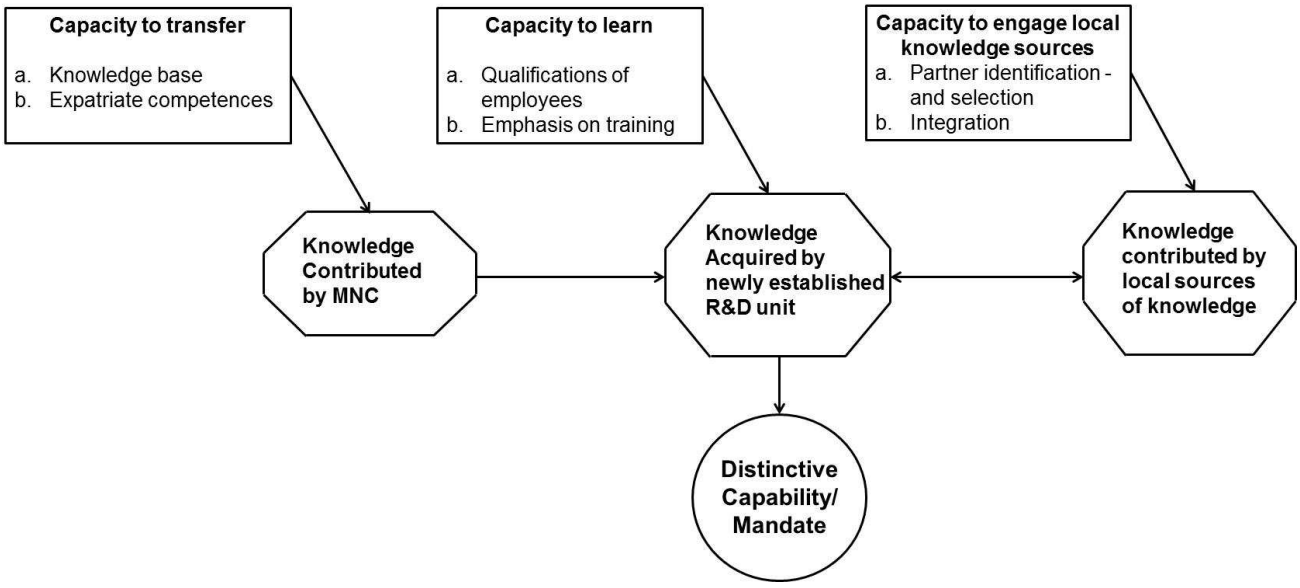

Figure 14: A revised model of knowledge transfer to newly established foreign-invested R&D units in emerging markets

The boxes "capacity to engage local knowledge sources," "knowledge contributed by local knowledge sources," and the circle "distinctive capability/mandate" have been added in Figure 14. The arrow between the box "knowledge acquired by newly established R&D unit" and the circle "distinctive capability/mandate" describes how the former enables such newly established foreign-invested R&D units to develop and carry out distinctive capabilities, i.e., their mandate. The arrow between "knowledge acquired by newly established R&D unit" and "knowledge contributed by local sources of knowledge" points in both directions in order to illustrate that knowledge is also shared with local sources of knowledge when these are engaged in collaboration. Kalling (2003) defines knowledge transfer as something that takes place within the organization. The relevance of integrating extramural elements, such as local sources of knowledge, in a knowledge transfer model, such as Figure 14, can therefore be questioned. On the other hand, the notion of making use of extramural actors in the knowledge processes of firms is by no means new. For example, Nonaka and Konno (1998) mention the relevance of socializing with suppliers and customers. In Figure 14, local sources of knowledge have a different role than other parts of the MNC, particularly the R&D home base. Rather than acting as knowledge contributors per se, local sources of knowledge are more likely to act merely as catalysts that directly or indirectly catalyze the creation of distinctive capabilities within an R&D unit.

In order for newly established foreign-invested R&D units in emerging markets to be able to obtain such catalyzing effects, local sources of knowledge need to be engaged. To this end, it is relevant to consider how to identify and select collaboration partners among the local candidates. It is also relevant to consider what level of integration is needed with such local collaboration partners and how it can be obtained. Partner identification and selection are therefore mentioned along with "integration" in the box "capacity to engage local knowledge sources," as illustrated in Figure 14.

Paper Four focuses on the collaboration with local manufacturing units in emerging markets, and hence, it does not explicitly pertain to collaboration with extramural actors outside of the MNC. However, the paper outlines contingencies that influence whether physical integration is needed in

order to facilitate knowledge flows in relation to newly established R&D units in emerging markets. The paper therefore relates mainly to the point "integration" in the box "capacity to engage local knowledge sources." In Paper Five, how Pack Tech used a competition to identify and select which local partners (among local universities) to collaborate and establish strong ties with is described. In the paper, how the selected team was integrated into the R&D unit, as well as the R&D home base, was also described. In this sense, Paper Five spans both topics mentioned in the box "capacity to engage local knowledge sources" in Figure 14. Whereas Paper Four outlines contingencies for whether integration is needed, Paper Five illustrates an example of how this takes place.

To sum up, the research efforts presented in this thesis have provided a rare look into the processes of how knowledge is transferred into foreign emerging market locations, integrated and combined with local knowledge, and potentially transferred back again. A benefit of Figure 14 is that it takes Figure 13 beyond its focus on primary knowledge transfer. As Figure 14 also incorporates "knowledge contributed by local sources of knowledge," it provides a more firm conceptual basis from which to implement managerial practices that are more likely to result in reverse knowledge transfer than Figure 13 was in its original design.

6.3. Managerial implications

In the following, an attempt will be made to extract and synthesize some managerial implications from the findings of this thesis. The results of the thesis can help Scandinavian MNCs that offshore R&D into emerging markets such as China and India to nurture the ability of newly established foreign-invested R&D units in emerging markets to carry out their mandate. Zedtwitz (2004) describes various ways in which the performance of foreign-invested R&D units are evaluated. Figure 15 is relevant as a means of evaluating R&D unit performance at the initial stages of captive offshore R&D establishments in emerging markets. This is an area in which the existing literature has been rather vague.

It is beneficial to consider emerging markets as places in which knowledge gaps are likely to exist, but good codification skills can be found. Knowledge gaps can be decreased by encouraging social interaction and knowledge sharing within and beyond the emerging market R&D unit. Collaborative R&D projects with the R&D home base and local universities can enable R&D units in emerging markets to carry out their mandates. The captive offshoring of R&D to emerging markets has implications for internal processes in a company at large. It is important to ensure a common IT platform and information communications technology where project files and documentation can easily be shared across the R&D unit and R&D home base. Increased geographical distance may suggest a strong emphasis on the codification of knowledge in order to ease its transfer. However, due to the often tacit nature of R&D knowledge, knowledge codification should not necessarily be considered the answer to all problems, because tacit knowledge may be more efficiently transferred and created by means of socialization within and beyond the walls of the company. However, the often-good codification skills that can be found in emerging markets, may nurture process innovations, particularly the further refinement of existing technical processes.

As previously outlined, the journey newly established foreign-invested R&D units in emerging markets travel in order to become able to carry out their mandates can be divided into the following three sub-processes:

1. acquire R&D home base knowledge
2. make use of local talent

3. engage local sources of knowledge

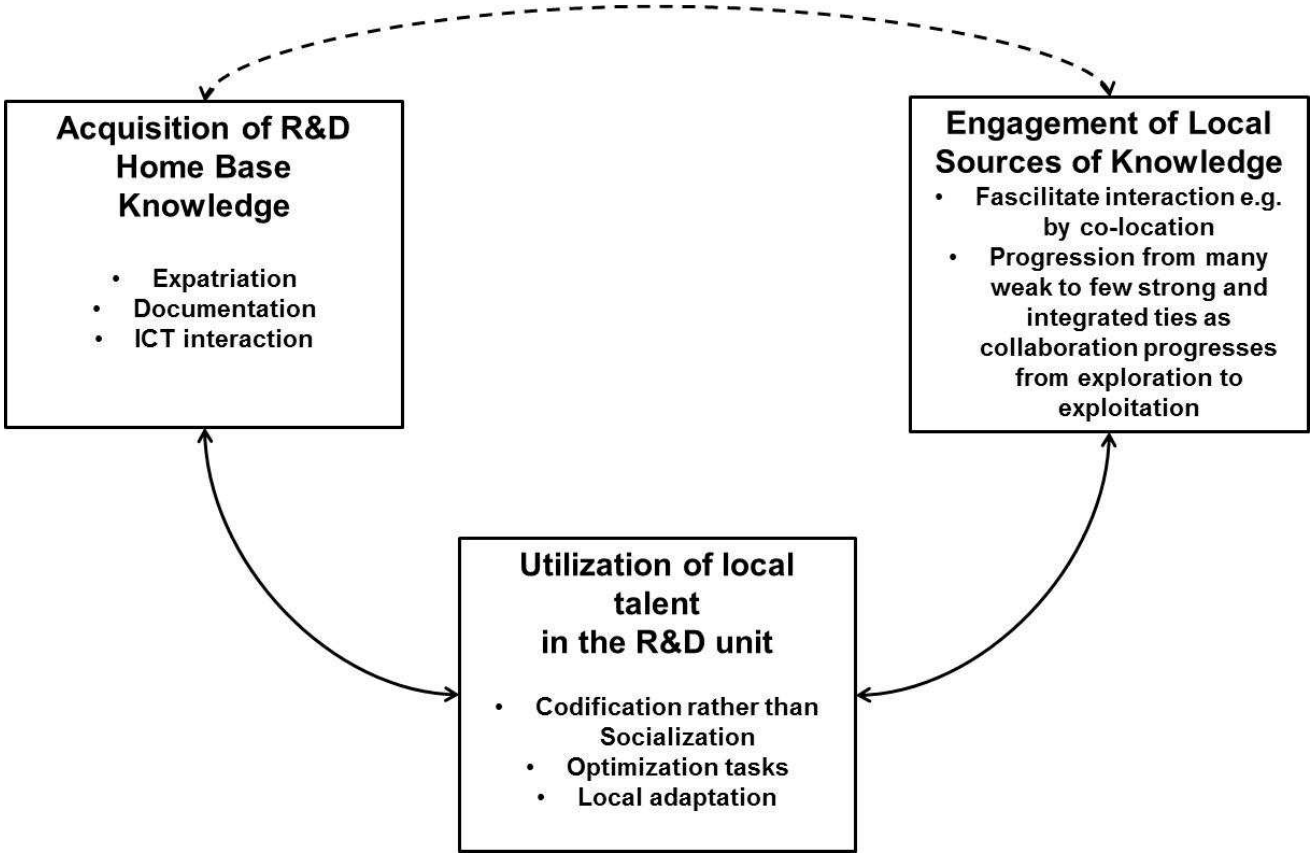

Figure 15: Propositional model of how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates

These three sub-processes are illustrated with square boxes in Figure 15.

In the left part of Figure 15, how expatriation is important in order to acquire R&D home base knowledge, particularly as it pertains to tacit R&D home base knowledge, is illustrated.

Although expatriation and mutual visits between an R&D home base and a newly established R&D unit are important, this does not mean that efforts to ensure that a common IT platform and ICT are in place should be neglected. Such efforts make it easier to exchange information. For a newly established R&D unit, it is easier to acquire and integrate already-documented R&D knowledge from the R&D home base in this way. The box in the bottom of Figure 15 illustrates the relevance of making use of local talent in ways that make it possible to exploit the often-good codification skills of R&D employees in emerging markets, such as China and India. As indicated in the bottom of Figure 15 and outlined in Paper Three, one way to do this is to specify tasks that pertain to the optimization of existing technical processes. Over time, it may be possible to assign more complicated tasks that require more social initiative to carry out, but somewhat simpler tasks can serve as a starting point. It is also relevant that the local adaptation of products takes place locally. Hence, in relation to such activities, it can also be important to make use of local talent, as illustrated in the bottom of Figure 15. Local adaptation does not necessarily require good codification skills, but the local presence makes it important to carry out such adaptation locally to

whatever extent possible. This does not mean that local adaptation is easily carried out by newly established foreign-invested R&D units in emerging markets. For example, Med Tech and Pack Tech have experienced that a lot of support from the R&D home base can be required.

In the right part of Figure 15, the importance of facilitating interaction, e.g., by co-location in order to engage local sources of knowledge is illustrated. It is also illustrated that it is important to progress from many weak ties to fewer strong ties as the collaboration progresses from exploration to exploitation.

6.3.1. The interrelations between the sub processes

The interface and interplay between the three sub-processes in Figure 15 is particularly important. Dashed and non-dashed lines have been used to connect the boxes in Figure 15. This has been done in order to illustrate the importance of creating a good balance and synergy between the different sub-processes. This means that when carrying out any of the sub-processes outlined in Figure 15, it is also relevant to pay attention to the other sub processes, particularly the boxes that are connected with non-dashed lines.

The top line in Figure 15 between the boxes “acquisition of R&D home base knowledge” and “engagement of local sources of knowledge” is made dashed because it is important not to jeopardize R&D home base knowledge, which the company does not want to share in the local environment. On the other hand, the biggest potential for the creation of reverse knowledge transfer and reverse innovation from foreign R&D units is likely to reside in the interaction with local sources of knowledge. Still, particularly in emerging markets, where knowledge seeking, as previously outlined, is less likely to be possible upfront, the potential for such reverse knowledge transfer cannot be reaped without first sharing knowledge locally. In weak appropriability regimes, trust has to substitute for legal contracts. A local R&D unit therefore has a key role to play in terms of managing the local relations around the unit and in terms of choosing who to collaborate with. Pack Tech experienced a competitor teaming up with a local university in order to copy some equipment that was originally developed by Pack Tech. It is interesting to note that the university in question was a university with which Pack Tech had not collaborated. One can speculate regarding whether some level of collaboration with the university in question could have preempted such questionable behavior.

The left non-dashed line in Figure 15 points to the particular importance of acquiring R&D home base knowledge, keeping in mind the nature and level of local talent, as well as the tasks they are anticipated to carry out, i.e., keeping in mind the sub-process “utilization of local talent in the R&D unit.” When establishing a new R&D unit in emerging markets, it is not always possible to evaluate the opportunities to engage the local environment upfront. Hence, it makes more sense to focus on acquiring R&D home base knowledge in order to be able to make good use of local talent in the R&D unit. If the role of the R&D unit is clear, it makes it much easier for the employees to know what knowledge they need to absorb from the R&D home base and how they are supposed to contribute. One problem experienced across the cases was an initial lack of clarity of the role of the newly established R&D units. Within the cases, this seems to have had negative implications for primary knowledge transfer. If R&D employees in the newly established R&D units do not know how they are going to apply their received training, it is difficult to know where to focus attention. As a step toward aligning the activities of newly established R&D units with R&D home base activities and in order to ensure good primary knowledge transfer, it is important that newly established R&D units depend on their R&D home bases initially. If newly established R&D units

have to clear their activities with the R&D home base, it decreases the risk that newly established R&D units will invest excessive resources in the re-creation of knowledge that has already been accumulated at the R&D home base, i.e., resources invested in knowledge duplication. If the activities of a newly established R&D unit relates to whatever it independently feels like doing, the risk is high that the R&D unit will simply mind its own business, without realizing opportunities to learn from and improve knowledge already accumulated elsewhere in the company.

There is also an element of consistency that is relevant to consider in relation to the capacity to transfer knowledge and the related implications for the opportunities for newly established R&D units to acquire knowledge. In times of crisis, the traveling budget is cut down, e.g., within Wind Tech and Mechanic Tech, and socialization across the R&D home base and the newly established unit suffer from this. R&D home base personnel can also easily become a bottleneck. They are needed in order to train people in the newly established R&D unit, but particularly when business is good, they are already busy carrying out their own tasks. Then, they need to train people at the new unit, and on top of this, these people may also start to send back requests for changes in products and processes, which may need approval from the R&D home base in order to be implemented. Then, the home base is easily drowned in such requests in their everyday life.

The right non-dashed line in Figure 15 points to the importance of considering the skills of local employees and the activities they carry out in the R&D unit when engaging the local environment. As the employees in newly established R&D units in emerging markets become more capable and knowledgeable, it becomes important to grant more autonomy in order to make it possible to reap local opportunities. On the other hand, too much industry-university collaboration to soon may not necessarily contribute to the ability of newly established R&D units in emerging markets to carry out a mandate, or it may do so at an excessive cost. Pack Tech initiated industry-university collaboration very early in the captive R&D offshoring process. However, for Pack Tech, although promising concepts were developed in the first round of industry university collaboration, subsequent collaboration in China has so far been more successful than the first round. One reason is that Pack Tech now focuses on smaller, less ambitious projects when collaborating with local universities in China. Another reason is that the employees in the R&D unit are more knowledgeable of advanced packaging technology and are therefore better able to interact with local sources of knowledge and, for instance, coach local university students during projects. When an R&D unit has just been established, such activities may be difficult to carry out. Newly employed local recruits may have knowledge about which professors and students are relevant to approach. However, at the same time, they lack sufficient industry-specific knowledge to engage them in a relevant way. Expatriates from the R&D home base may have relevant industry-specific knowledge, but they may be less knowledgeable about which professors and students to approach. Of course, they can consult their local colleagues concerning these matters; however, R&D home base expatriates seem to spend their time better if they prioritize interaction and the sharing of knowledge with their new colleagues rather than local universities from the get-go. On the other hand, if a newly established R&D unit begins to interact and collaborate with local universities from the get-go, they start to get experience with this type of activity, which they can benefit from later on. The point here is not to say that newly established foreign-invested R&D units in emerging markets should avoid collaboration with local sources of knowledge from the point of inception. It simply seems to be important to start small.

6.4. Conclusions

The main findings constituting answers to the research questions and the purpose of this work have been outlined above. It may, however, be worthwhile to sketch a few additional conclusions of a more general character resulting from this research project:

- An initial knowledge gap existed within the investigated cases of foreign-invested R&D units in emerging markets. Such knowledge gaps may also exist when R&D is transferred from a mature market to another mature market, but they are more likely to exist within emerging markets, although this greatly depends upon the specific field of R&D because different kinds of expertise are likely to be available in different locations (Sölvell, 2003). The character of knowledge gaps in emerging markets seems not to be due to a lack of theoretical understanding per se. On the contrary, based on the investigated cases, a good theoretical understanding seems to be available in emerging markets. However, few opportunities may have been available to train the ability to apply it. The notion of knowledge being easier to transfer if it is codified (Lane et al., 2001; Teece, 1998; Teece, 1986) depends on the assumption that sufficient codification skills are possessed by the receiver, in order to enable the receiver to understand the knowledge being transferred (Hansen, 1999). The findings suggest that this assumption holds true in terms of the codification skills of the R&D engineers and scientists working for the case companies in emerging markets within the investigated R&D units.

- The implied notion that knowledge recreation needs to take place in order for knowledge transfer to occur (Szulanski, 2000) may depend upon the extent to which knowledge has already been codified in a relevant way that is applicable for the recipient. If knowledge has been codified, but still cannot be understood by the receiver, it is more likely that relevant codification schemes need to be internalized by the recipient in order to make it possible to understand the knowledge rather than that the knowledge needs to be re-created per se.

- The present study adds to previous research on exploration and exploitation (Kogut and Zander, 1993; March, 1991) by providing empirical evidence, as seen in the Med Tech case, which indicates that the codification of R&D knowledge, as well as the availability of relevant complementary assets, eases the transformation from exploration to exploitation.

- Several of the newly established foreign-invested R&D units investigated in this study went beyond their stipulated mandates. For instance, Pack Tech experienced how the R&D unit in China, in collaboration with local universities, turned out to develop test equipment that is now being implemented on a global scale within the company. This example illustrates the benefits that can be reaped when the local environment is successfully engaged (as requested by: Zaheer and Nachum, 2011). It also supports the theory suggesting that subsidiary mandates are likely to evolve dynamically over time (Birkinshaw and Hood, 1998; Birkinshaw, 1996).

- Manufacturing activities are often described as low value adding (e.g. Mudambi, 2008) and hence implicitly less important for society. However, manufacturing activities indirectly generate value, because it is important to carry out higher value adding activities, such as R&D, in proximity to manufacturing activities. Such benefits were reaped by R&D units in China and India within three of the four cases investigated in this thesis. Teece (1986) would probably agree that such indications make it relevant to reconsider the importance of manufacturing activities.

- The Uppsala model of firm internationalization (Johanson and Vahlne, 2009; Johanson and Vahlne, 1977) is relevant for the internationalization of marketing activities (Forsgren in: Forsgren and Johanson, 2010). However, due to its focus on local market knowledge, it is less relevant in relation to captive R&D offshoring into emerging markets.
- In the international business literature, different notions of distance are described as crucial barriers to firm internationalization. However, in relation to R&D offshoring and the internationalization of other knowledge creation-oriented activities, certain types of distance may also constitute potential benefits, not only barriers. To this end, it is interesting to consider the distinction between the technical dimension of tacit knowledge and the cognitive dimension of tacit knowledge, as described by Nonaka and Konno (1998). The technical dimension of tacit knowledge can largely be described as know-how, whereas the cognitive dimension of tacit knowledge concerns "beliefs, ideals, values, schemata, and mental models which are deeply ingrained in us and which we often take for granted" (Nonaka and Konno, 1998; 42). The application of know-how, i.e., the application of the technical dimension of tacit knowledge, is often restricted by the cognitive dimension of tacit knowledge. In relation to R&D offshoring, R&D home base knowledge and know-how is exposed to different mental models, i.e., cognitive dimensions of tacit knowledge, which have the potential to change the knowledge into something new. New applications for know-how thereby come into existence, and knowledge is created. In this sense, differences in the cognitive dimension of tacit knowledge represent knowledge creation potential in terms of new perspectives and potential new applications of existing know-how. In other words, those types of distance that are likely to result in differences in the cognitive dimension of tacit knowledge, i.e., beliefs, ideals, values, schemata, and mental models, should not only be considered as barriers to firm internationalization. For instance, in relation to R&D offshoring, where knowledge creation at some level is important, such types of distance also represent a potential benefit to be reaped during the internationalization process in terms of new perspectives. For example, Med Tech mentioned how surprising new perspectives were applied when the scientists in the Chinese R&D unit analyzed material that had already been analyzed at the R&D home base. For instance, aspects of institutional distance (e.g. Xu and Shenkar, 2002), i.e., regulatory, normative, and cognitive distance, may create such positive potentials.

6.5. Limitations

Cases from various industries have been investigated in this thesis. This was necessary in order to investigate differences across industries in relation to foreign-invested R&D units in emerging markets. However, comparisons across industries may bring along certain biases (Mcphee, 1990) because the conditions for innovative activity tend to differ across industries. The case study approach applied in this research project has facilitated a good understanding of these conditions within the individual companies and their respective industries. This minimizes such biases.

6.6. Further research

The findings of this thesis can inform further studies, and hopefully, such studies will set out to test the propositions outlined in this thesis. In particular, when performing an exploratory case study, it is difficult to predict the outcome of the research efforts beforehand. In a sense, the final result largely constitutes a basis for further studies, and it is therefore also important to give some

attention to these aspects here. Some suggestions for further research have already been made in the individual papers, and these will not be restated here. Rather, further research suggestions resulting from the overall research project will be outlined briefly.

6.6.1. Influences from culture/context

The Wind Tech case made it possible to include empirical material from India, not only China, thereby enabling some comparisons between empirical data from both countries. Further research may help us understand if and how cultural and contextual factors influence how newly established foreign-invested R&D units in emerging markets become able to carry out their mandates. Søberg and Åkerman (2010) provide an initial attempt to this end, but further research may improve our understanding in this specific area.

6.6.2. Industry-specific investigations

The case study presented in this thesis included cases from various industries. Further research may attempt similar investigations within the same industry.

6.6.3. Back-shoring and reconfiguration

Companies that are able to dynamically reconfigure their global footprint may have much to gain. This thesis has investigated newly established R&D units in emerging markets. Sometimes, it may be relevant to relocate such R&D units. This process is not investigated in this thesis, but is instead left for further research.

7. References

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