The Power of Attention: Examining the Effects of Headquarters Attention to Reverse Knowledge Transfer

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Abstract

My research has aimed to shed light on the role of headquarters (HQ) attention in reverse knowledge transfer (RKT). Subsidiaries in developing economies have been recognised, not only as the recipient of knowledge from their HQs in developed economies, but also as the source of innovation and knowledge for multi-national companies (MNCs). Despite RKT increasingly gaining attention, it is not practised well, in particular from subsidiaries in developing economies to HQs in developed economies. Prior RKT research has highlighted the importance of knowledge characteristics, but has focused on the role of the subsidiary as a 'persuader' in selling its knowledge to the HQ (Yang et al., 2008). The importance of subsidiaries does not lead to a less important role for the HQs in RKT; however, little is understood about the role played by HQ attention in the RKT process. By integrating attention theory, and taking the lenses of process (Ambos & Birkinshaw, 2010; Ocasio, 1997; Yaniv, 2011) and knowledge theory (Grant, 1996; Yang et al., 2008), my thesis has expanded attention theory in the context of RKT. More specifically, I have sought to explore how knowledge characteristics (technical fit and legitimacy), interactional factors and HQ attention combine to influence RKT outcomes, and how MNCs benefit over time from HQ attention to RKT.

My empirical findings show that HQ attention to RKT is not an object that a MNC can obtain, but is a managerial process that centres on the processes of *recognition*, *legitimation* and *exploitation*. Through these processes, I argue that HQs play an active role in RKT; rather than being solely passive knowledge receivers, they can act as *gatekeepers*, *facilitators*, *legitimators* and *learners*. Further, my research indicates that knowledge legitimacy plays a more important role than technical fit for RKT, which implies that HQs should pay attention towards not only the knowledge per se, but also the legitimation process in RKT, by developing an appropriate context for accepting and adopting this knowledge. In addition, my study also highlights that HQs may, over time, increase their ability to leverage their subsidiaries' knowledge, and increase the benefits from doing so through mechanisms such as using expatriate subsidiary heads, co-practice and social interaction between HQs and subsidiaries. Through a single longitudinal case study tracing four RKT events using an 'abductive' approach (Timmermans & Tavory, 2012) and combined process data analysis strategies (narrative, temporal bracketing and visual mapping) (Langley & A., 1999) in an

American multi-national company over 18 years, my study contributes to knowledge management and attention theory and helps practitioners and policy makers in the field of knowledge in the IB context by providing ‘guidance’ to HQs on how to attend to RKTs.

Declaration

I, Jiao Bo, declare that no portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright Statement

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Bo received MBA degree from University of Hong Kong in 2001. During his DBA study, Bo presented his research on reverse knowledge transfer at several international academic conferences, such as, The 8th &9th International Symposium on Management of Technology in China, SASE's 29th annual conference in France and SASE's 30th annual conference in Japan. Bo was also the co-author of a teaching case and teaching note published in IVEY business school (Lin Lu, Bo Jiao, Jiajia Liu and Paul W. Beamish. 2016. "EBS in China" case, IVEY publishing, 9B16M215).

Chapter 1: Introduction

1.1 Research background and rationale

My thesis starts with an empirical problem: how does a multinational corporation (MNC) manage knowledge transfer from its subsidiaries in developing economies to its headquarters (HQ) in a developed economy and thus benefit from the creation and sustaining of a competitive advantage in the international market? With the increasing intensity of global competition, MNCs' advantages in their home countries are no longer sustainable (Immelt et al., 2009). Learning from their dispersed global knowledge networks is strategically important to MNCs. If HQs lack an understanding of how to leverage their subsidiaries' knowledge, they will lose competitiveness as competitors do so and their home markets may be attacked (Govindarajan & Trimble, 2013). When HQs gain a significant amount of knowledge from their subsidiaries, they are able to benefit from gaining a competitive advantage in the global market. With dynamic change in the global economy, an increasing number of MNCs engage in the managerial practices of transferring knowledge from their subsidiaries in developing economies to their HQs in developed economies (Zhu et al., 2016). The case of John Deere, a leading American tractor manufacturer, in the research by Govindarajan & Trimble (2013), is a good example. It illustrates the importance of transferring technology from its subsidiary in India and applying this in its operations at the HQ in the US, allowing John Deere to successfully compete with its Indian start-up competitor in its home market. For more than a decade, the nature of knowledge in MNCs, and hence the nature of knowledge creation, has gone through significant change. The rise of emerging economies like China is challenging the traditional strategy of MNCs that view their subsidiaries in these developing countries either as 'market access' providers or as recipients of knowledge transfer from their HQs (Meyer et al.,

2011). Thus, many MNCs from developed countries have been moving a substantial part of their research and development (R&D) activity to their subsidiaries in developing countries such as China and India (Govindarajan & Ramamurti, 2011). At first, many subsidiaries in the developing countries operated largely as extended R&D arms of the home country, executing pre-defined projects under supervision from their HQs (Jha & Krishnan, 2013). However, the emerging markets are new growth drivers of the global economy, and their unique bundle of opportunities and challenges has become a source of innovation and knowledge for MNCs (Jha et al., 2016). Simultaneously, some subsidiaries of MNCs in the developing countries have been used to accumulate advanced technical capabilities, especially in locations with a large local market, such as China or India. Given these trends, subsidiaries are increasingly acknowledged as knowledge sources for MNCs and as having the position to play an important role in driving knowledge transfer for use at the HQs (Yang et al., 2008).

Despite its strategic importance, knowledge transfer from subsidiaries to their HQs has not been well practised; many MNCs do not seem to achieve global leverage of these advantages but (re-)centralise or completely localise their activities in the hosting countries (Doz et al., 2006; Fors, 1997; Rugman & Verbeke, 2001). On the one hand, managing the knowledge transfer in a reverse direction between the HQ and subsidiary often requires the HQ to leave its 'comfort-zone', which may cause the MNC management to hesitate when evaluating the appropriateness of leveraging its subsidiary's knowledge for wider use at the HQ (Zhu et al., 2016). On the other hand, knowledge transfer from subsidiaries to HQs is conceived of as a process that occurs occasionally, not as frequently as MNCs might expect, and not always to the benefit of MNCs (Ambos et al., 2006). In any case, the economic and institutional gaps between subsidiaries and their home countries makes cross-border knowledge transfer difficult, especially this kind in the reverse direction between HQs

and subsidiaries (Yang et al., 2008), and particularly from subsidiaries in developing economies to HQs located in developed economies (ul Haq et al., 2017). For example, by 2015 foreign MNCs had over 1,000 technology centres in China, but few of them focused on leveraging their Chinese subsidiaries' knowledge for global use (McKinsey, 2015). Another example is the challenge of the early stage of General Electric's innovation in China and India, with very little of the subsidiaries' knowledge being deployed at the HQ because of the HQ's lack of attention and support for the reverse transfer of this knowledge (Immelt et al., 2009). Thus, the question of how an MNC manages knowledge transfer from a subsidiary to the HQ and the means by which the HQ can benefit from that knowledge transfer to enhance its global competitiveness is a theoretically interesting phenomenon of high practical relevance. My research responds to this strong practical need to guide how MNCs effectively manage knowledge transfer from subsidiaries to the HQ in the context of transfer from a developing economy to a developed economy. The dynamic of knowledge transfer between developed economies and developing economies has gained particular traction in recent years (Park & Vertinsky, 2016; Secches & Cotta, 2018; Zhu et al., 2016). This is viewed as a most challenging scenario as it reverses the direction of knowledge transfer between developed economies and developing economies (Beamish & Berdrow, 2003; ul Haq et al., 2017).

Theoretically, a stream of studies in international business (IB) has drawn my attention to the phenomenon of knowledge transfer from subsidiaries to their HQs, a process defined as reverse knowledge transfer (RKT), to distinguish it from the traditional HQ-to-subsidiary knowledge flow in MNCs (Ambos et al., 2006; Håkanson & Nobel, 2000). RKT has been recognised as an increasingly important means through which MNCs obtain valuable inputs from their global dispersed subsidiaries to render their unique combinations of knowledge that may represent answers to complex problems (Zenger & Todd, 2004), and increase their performance,

innovativeness and organisational learning (Driffield et al., 2016; Piscitello & Rabbiosi, 2004; Subramaniam & Venkatraman, 2001; Yamin & Otto, 2004). By exploiting their subsidiaries' knowledge, MNCs may benefit by enhancing and expanding existing products and technologies (Ambos et al., 2006) or by generating new technological knowledge to develop new products or technological solutions for their customers (Gonzalez & de Melo, 2018).

Despite the growing interest in the literature in RKT, research on this topic is relatively recent and heavily focused on concept testing versus theory building. Further contributions are therefore propitious. The majority (with a few exceptions, e.g. Napier & Hoang, 2011; McGuinness et al., 2013; Costa et al., 2015) is survey-based large-N hypothesis testing research with various combinations of knowledge and organisational factors (Håkanson & Nobel, 2000; 2001; Mudambi et al., 2014; Rabbiosi, 2011). Whilst these studies generate valauble aggregate insights, they remain limited in adequately addressing and explaining the RKT mechanisms.

One stream of the literature highlights the importance of knowledge characteristics for RKT by recognising that conventional knowledge transfer and RKT are based on different transfer logics (Yang et al., 2008). Conventional knowledge transfer is portrayed as a 'teaching' process whereas RKT is a 'persuading' process (Yang et al., 2008). In the context of RKT, the HQ's commitment to learning from the subsidiary is less than the subsidiary's commitment to learning from the MNC's HQ, and thus knowledge characteristics are more important due to the greater credibility issue with the knowledge source in the context of RKT in comparison to conventional knowledge transfer (Millar & Choi, 2009). Further, the literature (e.g. Gupta & Govindarajan, 2000; Håkanson & Nobel, 2000; Yang et al., 2008) has highlighted that the subsidiary's knowledge must first be relevant and valuable in order to be noticed and recognised by the HQ. However, the existence of valuable knowledge is a necessary but not a sufficient condition for the success of RKT. How to

exploit a subsidiary's knowledge and benefits from it for the HQ are key for an MNC in sustaining its competitive advantage in the international market (Andersson et al., 2016). Another stream of the literature has highlighted the dominant role of subsidiaries in the RKT process through bottom-up processes, such as 'persuading' (Yang et al., 2008) or 'issue-selling' (Dutton et al., 2001) or 'voicing' (Bouquet & Birkinshaw, 2008), in order to influence HQs to notice and recognise the potential and value of their knowledge for wider use globally. These upward influencing techniques have provided us with a good understanding of how a subsidiary in an MNC can trigger and suggest new ideas that may shape the overall agenda of the MNC in terms of knowledge creation and knowledge transfer. However, this does not guarantee that the subsidiary's knowledge can be understood, accepted or even appreciated at the HQ and consequently the exploitation of that knowledge is impeded. Actually, one challenge for a subsidiary in driving RKT through these bottom-up influencing mechanisms is to achieve and maintain high levels of legitimacy within the broader context of HQs' beliefs, norms and practices (Conroy & Collings, 2016). It is argued that some of the existing knowledge at the subsidiary is inevitably undervalued (Chung, 2014) or perceived as 'overselling', resulting in negative attention by the HQ (Conroy & Collings, 2016) and eventually to it not being adopted at the HQ for this reason (Brock & Yaniv, 2007). This knowledge may therefore be lost as a resource for future competitive advantage for the MNC. Hence, available knowledge at the subsidiary does not guarantee the occurrence of RKT or of any benefit for the MNC's competitiveness, even when this knowledge is relevant or valuable to the HQ (Yaniv & Brock, 2008).

Recognising the limitation in the ability of the subsidiary to drive RKT, the literature has highlighted the critical role played by the HQ as an 'attention provider' in the RKT (Ambos et al., 2006; Kumar, 2013). This has also addressed the general concern of the effective use of the

subsidiary's knowledge and the benefit from RKT for a MNC. Specifically, two concerns have been highlighted. On the one hand, not all RKTs will benefit MNCs as the HQ and subsidiary have a mixed-motive relationship (Ambos et al., 2006; Gupta & Govindarajan, 2000); thus HQs should take ownership of the transfer and commit to it (Kostova, 1999). On the other hand, the HQ has a limited capacity to recognise the potential and value of the subsidiary's knowledge, not only because of its absorptive capacity (Cohen & Levinthal, 1990) but also because of its cognitive limitation (Monteiro, 2015), so a lack of HQ attention may result in a 'broken link' between relevant available knowledge and the MNC's competitive advantage (Brock & Yaniv, 2007). Whilst attention theory (Ocasio, 1997; Yaniv, 2011) could provide a new lens to advance an insight into understanding organisational behaviour (Simon, 1950), the application of this notion in knowledge transfer, especially in RKT, is rare. I argue that HQ attention in the context of knowledge transfer remains weakly conceptualised and I challenge some of the underlying assumptions and approaches that impede the extension of the attention-based view in the context of RKT.

First, there is an extensive body of research that takes attention to be a scarce 'resource' (Ocasio, 1997) and highlights a 'positive' side of HQ attention in an MNC in terms of the level of recognition and credit given by the HQ to a subsidiary and its initiatives, depending on the 'weight' of the subsidiary (Bouquet & Birkinshaw, 2008) and the strategy of the firm (Bouquet & Birkinshaw, 2008; Buckley et al., 2003; Frost et al., 2002; Gupta & Govindarajan, 2000; Mudambi et al., 2014). I identify the underlying assumption in the literature viewing attention as an 'object' that a MNC can obtain through exchanges related to transaction cost (Teece, 1977) or predefined strategy (Buckley et al., 2003). In contrast, I suggest that the process of HQ attention as a facet of two way exchange between "issue-selling" (Dutton & Ashford, 1993) by the subsidiary and "issue-

buying" by the HQ (Barnett, 2008) of a MNC in the context of RKT. I seek to introduce the legitimation process into this discussion to show how HQ attention influences RKT. I find limited attempts to see attention through a processual lens. My thesis therefore aims to provide a rare processual and emergent perspective of the attention-based view in RKT. I develop a strong process theory (Langley & A., 1999; Langley et al., 2013) based on longitudinal data highlights the socially constructed nature of HQ attention as a process in knowledge transfer (Ocasio, 1997; Yaniv & Brock, 2008).

Second, RKT does not imply a 'full' replication of the subsidiary's knowledge in the HQ. Indeed, transfer of knowledge is typically associated with modification and transformation of the knowledge in the receiving organisation (Argote et al., 2000). I suggest that different forms (tacit and codified) and sources (individual and collective) of knowledge may be changed and transformed through the RKT process (Carlile, 2004). Knowledge transfer across borders often involves people, tasks and tools which are spatially, temporally and relationally intertwined (Argote et al., 2000). Knowledge transfer literature tends to explain "how the knowledge gets from here to there" (Katz, 1999), focusing on knowledge as a thing to store and retrieve, largely disregarding the practical and political mismatches that may occur during the knowledge transfer process (Carlile, 2004). This is regrettable since knowledge, especially its tacit component, is not an object that is transferred physically from one unit to another while being socially constructed between the sender and receiver (Noorderhaven & Harzing, 2009). Therefore, I seek to apply a socio-technical approach (Trist, 1963) for a more holistic view of knowledge transfer by adopting the constructs of technical fit and legitimacy which explicate the difference between the technical and social characteristics of a subsidiary's knowledge. My research aims to build a link between a subsidiary's knowledge characteristics, HQ attention and RKT outcomes.

Third, I further consider the dynamics of RKT through HQ attention at multiple levels, including the individual (micro-) level, the organisational (meso-) level and the macro-level of external institutional environments of MNCs. Recent research that has applied attention theory (Ocasio, 1997) to examining the level of attention as a 'commodity' given by MNC corporate executives to subsidiary units (Bouquet & Birkinshaw, 2008) and its impact on MNCs (Bouquet et al., 2009) or on their subsidiaries' performances (Ambos & Birkinshaw, 2010), has focused more on examining the level of attention given to a subsidiary unit as a whole, rather than to specific knowledge obtained by such a unit. Despite a few recent studies (e.g. Ambos et al., 2006; Ambos et al., 2010; Kumar, 2013) suggesting that the HQ could work as an 'attention provider' in RKT to enable transfer and utilisation of its subsidiary's knowledge, the ambiguity of the exact role and the mechanisms of HQ attention in a specific RKT task does not help in practically guiding the HQ's attention to RKT.

In order to address these deficiencies, I draw on institutional theory (Kostova & Zaheer, 1999; Suchman, 1995) to explain the attention-based view of RKT (Ocasio, 1997) through a processual lens, rather than focusing on the influence of immediate strategic objectives of MNCs. My thesis emphasises the importance of HQ attention mechanisms through the social interaction processes, policies and organisational routines that affect RKT in the firm. The literature has emphasised that a subsidiary's knowledge is a significant potential source of competitive advantage for a MNC (Gupta & Govindarajan, 2000); however, little is understood about the critical role played by HQ attention in the RKT process (Ambos et al., 2006). I argue that attention theory (Ocasio, 1997; Yaniv, 2011) could provide a new lens to advance an insight into understanding the mechanism of RKT, more specifically, to focus on HQ attention as a managerial process for managing knowledge

transfer and even as a capability that the MNC can develop over time for leveraging its subsidiary's knowledge across its global knowledge networks (Ambos & Birkinshaw, 2010).

1.2 Research objective

The aims of the thesis are to explore: 1) how knowledge characteristics, interactional factors and HQ attention combine to influence RKT outcomes, and thus facilitate the theory of HQ attention to RKT, combining and operationalising these through a detailed case study; 2) how a MNC benefits over time from HQ attention to RKT in terms of its global competitive advantages. As mentioned previously, in order to capture knowledge characteristics in the context of RKT, I use the socio-technical framework (Trist, 1963) as a basis to adopt the constructs of *technical fit* and *legitimacy* by explicating the difference between the technical and social characteristics of a subsidiary's knowledge. The socio-technical approach has been widely used in research on knowledge management (e.g. Chai & Kim, 2009; Guzman & Trivelato, 2008; Handzic, 2011; Pan & Scarbrough, 1998; Søndergaard et al., 2007) to emphasise the interrelationship between technical factors and social factors in understanding knowledge management behaviours. Researchers in the knowledge management field have recognised that creation and transfer of knowledge within organisations are as much a social process as a technical one (Bijker, 2011; Spender, 1996). By employing the socio-technical approach, my thesis highlights the influence of the holistic knowledge characteristics of both technical fit and legitimacy on HQ attention to RKT. In sum, building on attention theory (Ocasio, 1997; Yaniv, 2011), my thesis attempts to enhance an important link between an established body of literature on knowledge characteristics and the knowledge transfer mechanism (i.e. the attention-based view) in the IB context. Further, through a longitudinal case study of four RKT events in a leading US firm in industrial safety technology,

my thesis also aims to offer strong guidelines for practitioners and policy makers in the field of knowledge management on how to pay attention to RKT in the IB context.

1.3 Research questions

The research questions that are addressed in this thesis are:

RQ1: How does HQ attention affect RKT?

RQ2: How do knowledge characteristics and interactional factors combine to influence HQ attention to RKT?

RQ3: How does a MNC benefit over time from HQ attention in terms of leveraging the knowledge?

1.4 Research method

HQ attention to RKT is socially constructed in nature (Ocasio, 1997), entailing processual, evolutionary developments and path dependencies which can only be uncovered through longitudinal data. Given that the temporal patterns of HQ attention to RKT remain largely unexplored in the literature, I follow a qualitative approach (Eisenhardt & Graebner, 2007). The aim of my abductive enquiry (Timmermans & Tavory, 2012) that builds on a critical realist perspective is to disentangle the process dynamics of HQ attention to RKT, when the dual effects of technical and social characteristics of knowledge on the process are not yet known, with a particular focus on the interactions between knowledge characteristics, interactional factors and HQ attention, and how they combine to influence RKT. To increase the external validity of my research, I use three strategies in combination: narrative, visual mapping and temporal bracketing (Langley & A., 1999) to facilitate an embedded multiple-event design in a single longitudinal case (Yin, 2013).

The case study method is useful for understanding 'how' and 'why' certain events have occurred, examining complex phenomena and processes in order to develop and extend emerging theories (Eisenhardt, 1989). This also answers the repeated calls for more contextual studies within the broad field of knowledge transfer in MNCs (Michailova & Mustaffa, 2012). I trace the four RKT events between 2001 and 2018 at a Chinese subsidiary of a medium-sized American high-tech MNC (EBS), which leads the scientific testing, measurement and research equipment industry. By following multiple events in a single organisation over time, I collected rich process data, which allowed iterations of meaningful patterns of connectivity and new themes to merge to generate theory that is accurate, parsimonious and useful. Focusing on a single organisation with only one subsidiary as a critical case (Flyvbjerg, 2016), I could control for factors beyond the scope of this study, such as rivalry for attention between subsidiaries, to allow key causal links to emerge. By conducting both historical process tracing (RKT events A and B) and research in a real-time context (RKT events C and D) in an organisation over time, I had a rich context in which to investigate the phenomenon of how HQ attention affects the exploitation of the subsidiary's knowledge at the HQ in the broader context of the technical fit and legitimacy of that knowledge as the subsidiary experienced a variety of changes across the different development stages. In addition, different levels of context usually do not develop at the same pace, and thus require not only long term, but different levels of observation which enables me to gain deep insights into this under-explored phenomenon and avoids the danger of observed behaviour (Pettigrew, 1997). I incorporated both the HQ and the subsidiary in my data collection, allowing me to account for the influence of different perspectives of the knowledge transfer across hierarchical and geographical boundaries, and to gain the key factors without losing the discerning elements. I adopted the RKT event as the unit of analysis, enabling me to collect fine-grained data and develop a granular focus to understand

the mechanisms of HQ attention to knowledge (Alexander & Hearld, 2009), which has largely been ignored in previous research on RKT.

1.5 Potential contributions

RKT within MNCs has been increasingly gaining attention. However, little is understood about the critical role played by HQ attention in the RKT process and how it connects with knowledge characteristics and RKT outcomes (Ambos et al., 2006). This thesis focuses on mechanisms of HQ attention to RKT and attempts to build a theoretical link between knowledge characteristics, interactional factors, HQ attention and RKT outcomes through a longitudinal case study that could be operationalised for future empirical study, as well as to explore how MNCs could benefit over time from HQ attention to RKT in terms of their competitive advantages. My thesis potentially contributes to the knowledge transfer literature and to attention theory in the following ways.

Firstly, I further expand attention theory in the context of RKT. This goes beyond previous studies (e.g. Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008; Bouquet et al., 2009) of HQ attention based on the 'structural paradigm', focusing primarily on the quantitative and positive aspects of attention. My thesis emphasises the socially constructed nature of HQ attention (Ocasio, 1997), taking a rare processual and emergent perspective on the attention-based view in RKT. This contributes to Nonaka's knowledge theory (Nonaka, 1991) in terms of knowledge creation and transfer, not only at the individual level but also at the collective level, by showing for every single RKT event in my empirical case study the extent of the connections and social interactions between the HQ and the subsidiary in the RKT process. Furthermore, through the tracing of four RKT events in my empirical case study, I suggest a distinctive role that HQ attention plays in RKT and prove

its viability through empirical application; thus, my thesis offers strong guidance for practitioners and policy makers in the field of knowledge management in the IB context.

Secondly, I integrate technical fit (i.e. technological similarity) and legitimacy (i.e. social acceptance) as two critical dimensions of knowledge characteristics, and discuss how these interact with HQ attention to influence RKT. As such, this builds on previous research on relevance theory (Yang et al., 2008) and absorptive capacity (Cohen & Levinthal, 1990) but explicates the difference between technical and social characteristics of subsidiary knowledge. Knowledge legitimacy has not received much attention in international business research, which has emphasised the transactional cost influencing knowledge transfer (Teece, 1977). My thesis addresses a gap in this regard and argues that knowledge legitimacy is the basis, in the context of RKT, for securing resource flows and maintaining support within an MNC's internal and external knowledge networks.

Thirdly, my thesis supports the argument that the HQ could play the role of "orchestrator" of intra-knowledge transfer in a MNC (Ambos & Mahnke, 2010) beyond the conventional roles, such as resource allocation and decision-right distribution (Ambos & Mahnke, 2010). It also empirically proves, through the detailed case study of a single organisation over 18 years, the active role of the HQ as an attention provider that enables RKT. This complements the existing literature, which takes RKT to be a 'persuading' process (Yang et al., 2008), by suggesting the HQ plays an active role in developing its attentional capability with respect to RKT over time, sustaining its global competitive advantages, rather than being a passive receiver of its subsidiaries' knowledge.

Fourthly, my adoption of a critical realism contributes to theory building in the fields of cross-border knowledge management and international business strategy. This research has utilised

multiple events in a single organisation with a single subsidiary over a period of 18 years. Tracing multiple events has enabled me to conduct close and comparative examination of the intricate and evolving relationships between relevant actors, events and factors. By following an organisation over time, I have collected the rich process data needed to explore the dynamics of HQ attention to RKT as a managerial process and the capability that the MNC develops over time, something which has not been achieved by previous research. Moreover, by collecting the data from both the HQ and the subsidiary, I provide different perspectives on RKT across the hierarchical and locational boundaries.

In the remainder of this thesis, I first review the literature on RKT, as well as the key influencing factors and mechanisms, in Chapter 2. I then put forward my theoretical building blocks and propositions in Chapter 3. In Chapter 4 I introduce the research method, after which I proceed to present my case description and findings in Chapter 5. Lastly, I discuss the theoretical and practical implications of my findings in Chapter 6. I conclude the research and discuss future research opportunities in Chapter 7.

Chapter 2: Literature Review

I start this chapter by reviewing the literature on knowledge and conventional knowledge transfer, along with the extant RKT literature, as well as its relevance in international business (IB) and organisational behaviour (OB) theories. The purpose of this chapter is not to provide a complete and exhaustive literature review on RKT, which is very diverse, but to critically review the key concepts and measures already adopted in existing studies on this subject and the several seminal empirical studies of determinants, as well as the internal mechanisms and external context of RKT, as a basis for developing an explorative theoretical framework in Chapter 3 to guide my empirical case study.

2.1 Knowledge and its classification

Knowledge has long been recognised as one of the most strategically important resources (Kogut & Zander, 1993; Nonaka, 1991; Spender & Grant, 1996), among other resources for MNCs. A fundamental challenge for MNCs is to identify and leverage knowledge within their global dispersed networks of subsidiaries (Cantwell & Mudambi, 2005; Frost et al., 2002), while the ability of MNCs to transfer and apply knowledge across organisational units has become essential for achieving and sustaining competitive advantage (Gupta & Govindarajan, 1991; 2000; Mudambi, 2002; Yang et al., 2008). Knowledge has been classified and defined in a variety of ways (Kogut & Zander, 1993; Nonaka, 1991). For the purpose of this research, knowledge is defined as a mix of framed experience, technology and expert insight that adds value for MNCs (Davenport & Prusak, 1998). My thesis focuses on the technological knowledge related to the products, production and engineering know-how in a MNC, which often becomes embedded not only in

documents or repositories, but also in organisational routines, practices and norms (Winter & Nelson, 1982). Technology involves the accumulated skills or expertise that allows things to be done efficiently and effectively (Kaufmann & Roessing, 2005). Among various types of knowledge, technological knowledge has been found to be the most frequently transferred type in a MNC (Yang et al., 2008).

Technology transfer often involves people, tasks and tools, so it is important to understand the nature of technological knowledge before discussing how it is created and transferred. In my thesis, I categorise technological knowledge by two dimensions epistemologically and ontologically. This considers both the experiential and cognitive aspects of knowledge as well as the social context within which the knowledge is presented (Ibrahim et al., 2009).

One dimension of technological knowledge is based on the 'epistemological' category, tacit or codified (Håkanson & Nobel, 2000; Polanyi, 1967), while another dimension of technological knowledge is defined according to an 'ontological' perspective in which knowledge is classified as individual or collective (Cook & Brown, 1999; Nonaka & Takeuchi, 1995). Depending on the form (tacit or codified) and on the source of technological knowledge (individual or collective), I have developed a classification of four different types of knowledge in the context of my thesis: individual tacit technological knowledge, individual codified technological knowledge, collective tacit technological knowledge, and collective codified technological knowledge.

Individual tacit technological knowledge refers to the 'uncodified' knowledge embedded at the individual level in the subsidiary or HQ, for example engineering know-how or manufacturing expertise in the subsidiary. Capturing the tacit knowledge carried by people involves socialisation processes such as face to face contact and informal meetings (Nonaka, 1991).

Once the technological knowledge possessed by people becomes codifiable and has a relatively stable meaning, I term it individual codified technological knowledge. This category of knowledge includes the draft notes, documents and prototypes that can be articulated individually, as opposed to individual tacit knowledge, but that are still not collectively accessible to each member of the organisation.

Technological knowledge at the collective level can also be tacit in nature in a MNC – that is, embedded in its sociocultural environment (Ibrahim et al., 2009) rather than being captured in a document or other codified source (i.e. collective codified technological knowledge). The contexts of knowledge are likely to differ between the HQ and the subsidiary in an MNC, both culturally and geographically, which makes the transfer of tacit knowledge even more challenging (Nair et al., 2017; Szulanski, 1996).

Technology transfer within MNCs draws attention from the top management as it requires a specific form of resource commitment and also involves potential conflicts of interest due to geographical, cultural and task distance between the HQ and the subsidiary (Kaufmann & Roessing, 2005). Knowledge transfer in MNCs is not 'movement' of knowledge from one place to another place (Szulanski, 1996), but a process "to reconcile discrepancies in meaning" (Nonaka & Takeuchi, 1995) and a process of "negotiating interests and making trade-offs" between the sender and the receiver (Brown & Duguid, 1991). I argue that different forms (tacit and codified) and sources (individual and collective) of knowledge may be transformed through the RKT process (Carlile, 2004). In the context of MNCs, an important task is how to convert this individual level knowledge, especially tacit knowledge, into collective knowledge through organisational attention so the firm can benefit from the knowledge transfer in terms of its competitive advantages (Nonaka, 1991).

2.2 Conventional knowledge transfer within MNCs

The early stages of research on MNCs views knowledge as "public goods", which are easily transferred and hard to protect (Buckley & Casson, 1976), so MNCs have to develop an internal market in response to external imperfect markets in order to protect their possession of superior knowledge (Hymer, 1976). Rugman (1980) argued that, in his internalisation as a general theory on FDI, MNCs arise due to the internationalisation of the failure of the market for information. As Vernon (1966) pointed out in his international product life cycle model, technology is first developed and commercialised in developed economies, and then transferred to less developed economies as required, through the export of products and delocalisation of production at later stages of the product life cycle. These early stages of study on MNCs and knowledge transfer include both theoretical and empirical examination. The basic assumptions are that knowledge is "public goods" and the market for trading knowledge is imperfect. The primary advantage of MNCs lies in the control and transfer of knowledge because it economises information exchange against external markets.

With the explosion of knowledge-based views and theories, scholars changed their minds on MNCs. Kogut & Zander (1993) pointed out that MNCs arise, not out of the failure of the external market for trading knowledge, but out of their superior efficiency as organisations, by which they transfer knowledge across borders, while the less codifiable and harder to teach the technology is, the more likely the transfer will be to wholly owned operations. This point has also been confirmed through empirical examination by other scholars. For example, Subramaniam & Venkatraman (2001) revealed that the product development capabilities of MNCs significantly depend upon their ability to transfer and deploy tacit knowledge concerning oversea markets through the empirical study of ninety transnational product introductions from American, European and Japanese MNCs. The

study of MNCs, as they had evolved at this stage, did not assume knowledge as public goods. MNCs arise, not from the failure of markets for the buying and selling of knowledge, but out of their superior efficiency in managing knowledge transfer, especially the transfer of tacit knowledge across borders. However, empirical examinations primarily focused on the study of knowledge transfer from HQs to subsidiaries (Björkman et al., 2004; Inkpen and Tsang, 2005; Mudambi, 2002; Gupta and Govindarajan, 1991; Ghoshal and Bartlett, 1990; Zander and Kougut, 1995).

As the research and theories on knowledge management and MNCs evolved, MNCs were portrayed as a network for transactions in knowledge. Gupta & Govindarajan (1991) defined MNCs as a network for transactions in knowledge transfer in their knowledge flows-based framework, with each node in the network playing a different role according to the intensity and direction of knowledge flow: global innovator, integrated player, implementer and local innovator. Based on that, different control mechanisms are recommended for HQs according to differences in subsidiary contexts in terms of the extent to which they play the roles of users or providers of knowledge between themselves and the rest of the corporation. Mudambi (2002) argued that MNCs by nature are network firms that are therefore able to leverage their networks to effectively manage dispersed knowledge globally. Abou-Zeid (2002) showed three key elements in describing the knowledge transfer process within MNCs in his theory on inter-organisational knowledge transfer, which was developed based on Gupta and Govindarajan's model, using an ontology-based approach: outflow of knowledge from source subsidiary, mediated by a transfer mechanism; inflow of knowledge into target subsidiary. This is influenced by different factors at different stages.

So far, research on conventional knowledge transfer within MNCs has been mainly focused in one direction, from HQs to subsidiaries (Michailova & Mustaffa, 2012). MNCs have been conceptualised as efficient producers, exploiters and transferors of knowledge (Eden, 2009). Once

knowledge has been produced, MNCs exploit that knowledge and earn rents from their knowledge-based assets created at home, which is a primary motivation for foreign direct investment (FDI) (Dunning, 2000; Vernon, 1966). This is in line with the traditional hierarchical structure of MNCs, suggesting one-way knowledge transfer from the HQ in the home country to the subsidiaries in host countries. More recently, researchers (including Gupta and Govindarajan, and Ram Mudambi) have combined network theory and the knowledge-based view of the firm to study other intra-MNC knowledge transfer mechanisms, including subsidiary-to-subsidiary transfers (Frost et al., 2002), but only a few studies (e.g. Ambos et al., 2006; Frost, 2001; Håkanson & Nobel, 2000; Yang et al., 2008) have addressed knowledge transfer from foreign subsidiaries to HQs.

Why this shift? I suggest two possible explanations considering the fact that, apart from the nature of theory development both on knowledge management and MNCs, the nature of knowledge in MNCs, and hence the nature of knowledge creation and transfer, has also gone through significant changes over the last few decades. First, there has been a shift in the role of HQs with regard to how knowledge is created and distributed as MNCs change from more traditional hierarchical structures to network-based and less hierarchical configurations (Michailova & Mustaffa, 2012). Increasingly, HQs have been acting as receivers and coordinators of knowledge from their internationally dispersed subsidiaries, given their access to the existing knowledge pool in the local environment through both internal and external networks (Frost, 1998), which can directly enhance MNCs' strategic competitive advantages (Ambos et al., 2005; Bartlett and Ghoshal, 1989; Cantwell, 1995). Subsidiaries, playing the roles of global innovator and integrated player (Gupta & Govindarajan, 2000), centre of excellence (Andersson & Forsgren, 2000) and world mandate (Birkinshaw, 1996), are increasingly acknowledged as sources of knowledge for MNCs as a whole. Second, dynamic change in the global economy, especially with the rise of emerging economies,

is challenging the traditional MNC innovation strategy, and hence knowledge transfer and utilisation between subsidiaries and HQs. MNC subsidiaries in the emerging economies of China and India have been viewed not only as either 'market access' tools or recipients of knowledge transfer, but also as sources of innovation and knowledge for MNCs (Govindarajan & Trimble, 2013). As a result of the significantly different characteristics of emerging economies versus developed economies in terms of preference, infrastructure and sustainability, as well as in regulatory terms (Govindarajan and Trimble, 2013), MNCs are challenged both to create revolutionary new technologies and solutions in order to be better suited for the requirements of these emerging local markets, and to generate the opportunities to export these innovations and new knowledge created in emerging economies back to the developed world by leveraging their local resources, such as local talent pools, government support and manufacturing ecosystems (Govindarajan and Trimble, 2013; Govindarajan and Ramamurti, 2011).

2.3 Reverse knowledge transfer

2.3.1 RKT and its relevance in IB and OB theories

Recently, the study of RKT has been given attention in the literature (Ambos et al., 2006; Håkanson & Nobel, 2000; Najafi-Tavani et al., 2012; Yang et al., 2008). The evolution of RKT research shows its relevance in both IB and OB theories. Figure 1 provides an overview of IB and OB theories as a foundation for RKT literature.

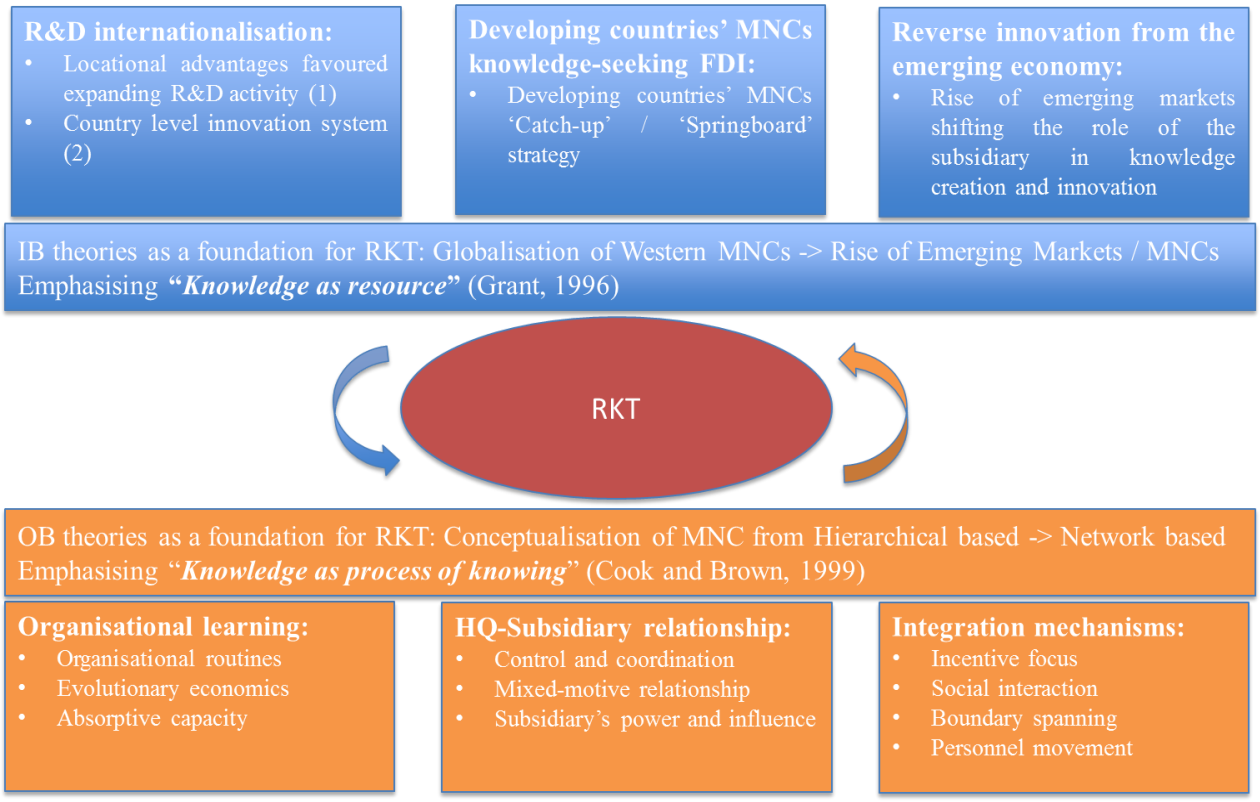


Figure 1: RKT's relevance in IB and OB theories

References for Figure 1: (1) (Andersson & Forsgren, 2000; Cantwell & Mudambi, 2005; Castellani, 2002; Dunning, 1995; Feinberg & Gupta, 2004; Rugman & Verbeke, 2001; Sanna-Randaccio & Veugelers, 2007); (2) (Criscuolo, 2009; Dunning & Lundan, 2009; Narula & Michel, 2009).

The early studies of RKT in the context of IB mainly focused on the developed economies where good locational advantages favoured expanding R&D activities by MNCs and their subsidiaries, so that RKT was concentrated almost entirely in the group of developed countries (Dunning, 2000; Yang et al., 2008). A considerable portion of the literature on the internationalisation of Western MNCs' R&D (see the references for Figure 1) engages with firm-specific advantages in the home country and location-bound advantages in the hosting countries that have evolved together to create value for MNCs (Andersson et al., 2016), underpinned by a resource augmentation logic (Dunning,

2000; Johanson & Vahlne, 2009). Two new trends have drawn attention in recent years. The first relates to new RKT from developed economies to developing economies from the 'springboard' and 'catch-up' perspectives (Luo & Tung, 2007; Mathews, 2006). MNCs in developing economies rapidly catch up and aggressively overcome their latecomer disadvantages, which are often lack of knowledge or expertise (Mathews, 2006). In this sense, the subsidiary's knowledge is essential and strategic for the HQ, underpinned by a resource seeking logic (Kalnins & Chung, 2004). The second trend consists of RKT which is directed towards the developed economies from developing, mostly BRIC, economies (Govindarajan & Trimble, 2013). Historically, developed economies have often been considered as the lead markets influencing the transfer of new technologies or products to the developing economies, whereas emerging markets have generally been seen as laggard markets with little influence on the adoption of new technology innovations compared to their developed counterparts (Vernon, 1966). For RKT from a subsidiary in a developing economy to its HQ in a developed economy, this essentially tests the idea of the emerging market being the lead market (Zhu et al., 2016), which may cause the HQ to hesitate when evaluating the value and appropriateness of such reverse-transferred knowledge. In contrast to the resource seeking motive of the emerging countries' MNCs investing in developed economies, and the sense of developed countries' MNCs investing in other developed economies with a resource augmentation logic, I contend that blends of both resource seeking and augmenting may be evident at different points in time. As such, I challenge the assumption (i.e. the either/or dichotomy) of uni-directionality of knowledge transfer in the literature and suggest that both forward and reverse knowledge transfer may be apparent in different phases, or may occur simultaneously, while not necessarily following a linear pattern in the context of knowledge transfer from developing economies to developed economies (Park & Vertinsky, 2016). This scenario, transfer from developing countries to

developed countries, has also been viewed as a most challenging scenario for RKT (Beamish & Berdrow, 2003; ul Haq et al., 2017).

RKT research in the context of IB focuses on outcomes at the organisational level of analysis, such as technological capability (Belderbos et al., 2008; Zorska, 2013), productivity (Castellani & Pieri, 2013) and country level innovation systems (Criscuolo, 2009; Dunning & Lundan, 2009). MNCs that are effective in transferring knowledge internally while preventing the spill over of knowledge to external competitors, are theorised to be more successful than those MNCs that lack effective knowledge management (Zander & Kogut, 1995). Although effective knowledge transfer is generally viewed as central for MNCs' success in the international markets, knowledge treated as a "resource" (Grant, 1996) in the context of IB weakly specifies and tests the processes or underlying mechanisms through which knowledge transfer occurs in organisations (Argote et al., 2000).

By contrast, RKT research in the context of OB focuses on organisational learning, the HQ-subsidiary relationship and integration mechanisms by treating knowledge as a "process of knowing" (Cook & Brown, 1999). Organisational learning is part of the foundation that underlies knowledge-based thinking (Eisenhardt & Santos, 2002). The concept of organisational routines forms the basis of collective learning in organisations and represents a manifestation of organisational memory (Cyert & March, 1963). Winter & Nelson (1982) integrated organisational knowledge and routines with the notion of dynamic competitive environments. In their approach to evolutionary economics, the firm is viewed as a repository of knowledge, which is represented by routines that guide organisational action. Cohen & Levinthal (1990) related organisational learning and innovation to the evolving knowledge base of the firm and defined the absorptive capacity of a firm as its ability to recognise, assimilate and apply external knowledge.

In addition, the study of knowledge transfer from the HQ-subsidiary relationship perspective is another important area in the OB literature. This literature focuses on how MNCs coordinate and control their geographically dispersed knowledge networks. Some scholars have focused on the control and power aspects in RKT that reflect the hierarchical nature of HQ-subsidiary relationships (Mudambi & Navarra, 2004; Najafi-Tavani et al., 2015). Others have emphasised the integrative and value creating nature of HQ-subsidiary interactions by examining, for example, knowledge flow between the units in MNCs for the purposes of creativity and innovation (Gupta & Govindarajan, 2000; Rabbiosi, 2011). As great emphasis has been placed on the critical roles of foreign subsidiaries and their unique contributions in knowledge creation and innovation, MNCs have shifted their attention from HQ-driven hierarchical design towards an increasing recognition of bottom-up mechanisms in global MNC knowledge networks (Gupta & Govindarajan, 2000).

Another stream within the literature on RKT in the context of OB focuses on a variety of mechanisms of knowledge transfer in organisations. These mechanisms include incentive focus (Gupta & Govindarajan, 2000; Szulanski, 2000), social interaction (Inkpen & Tsang, 2005; Noorderhaven & Harzing, 2009), boundary spanning (Beamish & Berdrow, 2003; Carlile, 2002), and personnel movement (Argote et al., 2000). This OB literature provides a theoretical framework of mechanisms for transferring knowledge within organisations.

The transfer of technology from subsidiaries to HQs represents a crucial capability for worldwide learning for MNCs across multinational networks of foreign subsidiaries (Håkanson & Nobel, 2000; 2001). In my thesis, technology transfer from a subsidiary to its HQ involves production and supply chain know-how as well as product technology know-how. This implies, in the context of RKT, that subsidiaries in developing countries not only need to raise quality and lower costs but must

also endeavour to introduce new technologies to their HQs in developed countries that may complement their global product portfolios (Zhu et al., 2016).

Under some circumstances, RKT is far from solely being an absorptive capacity problem of the HQ (Monteiro, 2015), but can be one of negotiating interests and making trade-offs between the HQ and the subsidiary (Carlile, 2004), a problem which is addressed in my thesis. With different interests arising, RKT is a political process of negotiating these interests and legitimising the subsidiary's knowledge at the HQ (Kostova & Zaheer, 1999; Suchman, 1995).

My thesis is positioned to bridge the literature on knowledge management and organisational attention building in the associated theories of IB and OB, as stated above. It not only focuses on the strategic value of the subsidiary's knowledge per se, but also on the process and mechanism by which the subsidiary's knowledge is actually appropriated by the HQ of the MNC in order to create and maintain competitive advantages in the international market. In the following subsection, I examine the definitions and measures of knowledge and RKT that are adopted in the extant literature.

2.3.2 The definitions and measures of RKT

RKT is defined, in contrast to conventional 'forward' knowledge transfer (from the HQ to the subsidiary) and the less conventional 'lateral' knowledge transfer (from subsidiary to subsidiary), as knowledge transfer from a subsidiary to the HQ (Ambos et al., 2006; Buckley et al., 2003; Mudambi & Navarra, 2004; Yang et al., 2008). Other terms have also been coined by different scholars, such as reverse technology transfer (Håkanson & Nobel, 2000; Song & Shin, 2008), reverse capability transfer (Bontis et al., 2009) and reverse diffusion of knowledge (Dobosz-Bourne, 2006), highlighting not just the directionality of flows, but the context of such flows. RKT takes

place in a reverse direction in terms of both the locational context (Yang et al., 2008) and relational context (Ambos et al., 2010; Mudambi & Navarra, 2004; Najafi-Tavani et al., 2014) between the HQ and subsidiary. Both of these dimensions have important implications for a deep understanding of RKT. Put another way, RKT literature attempts to explain knowledge transfer in a context of asymmetries in cognition, power, resources and capabilities between the HQ and subsidiaries in a MNC (Millar & Choi, 2009; Mudambi et al., 2014). I argue that RKT provides a unique asymmetry through which HQ attention plays an important role.

The literature on RKT is still limited in spite of its growing importance for knowledge creation and MNCs' competitive advantages (Michailova & Mustaffa, 2012). Existing literature has measured RKT in a couple of ways by highlighting: (a) its efficiency, such as the number of transfers / occasions (Håkanson & Nobel, 2000; 2001), patent citations (Mudambi & Navarra, 2004; Phene & Almeida, 2003; Song et al., 2011), and the intensity of the transfers (Ambos et al., 2006; Gupta & Govindarajan, 2000; Najafi-Tavani et al., 2015); (b) its effectiveness, such as productivity (Castellani, 2002), innovativeness performance (Piscitello & Rabbiosi, 2006; Yamin & Otto, 2004) and perceived value of the knowledge (Kumar, 2013; Rabbiosi, 2011; Rabbiosi & Santangelo, 2013). RKT does not imply a replication of the subsidiary's knowledge at the HQ but an adaptation or transformation of the existing knowledge for specific contexts (Foss & Pedersen, 2002). In my thesis, I measure RKT through changes in the knowledge at the HQ (Argote & Ingram, 2000). By doing so, I focus on how HQs exploit their subsidiaries' technological knowledge in enhancing and expanding their existing products or developing new products or technological solutions for customers through learning from their subsidiaries.

2.3.3 The challenges of RKT compared with conventional knowledge transfer

With the shift in the locational context, subsidiaries become the source of knowledge that may potentially be used at their HQs. Whilst subsidiaries are embedded in a MNC's knowledge network, they are also embedded in the host country's external knowledge network (Almeida & Phene, 2004). Such dual embeddedness means that knowledge created in subsidiaries is often tacit and context-specific in nature, which challenges HQs in recognising its value and the potential for its application depending on their absorptive capacity (Cohen & Levinthal, 1990). Further, in contrast to conventional knowledge transfer, the shift of relational context in RKT, with the reverse hierarchical order in knowledge transfer between HQs and subsidiaries, incurs additional barriers (Teece et al., 1997). Yang et al. (2008) argued that RKT and conventional knowledge transfer have distinctive transfer logics. While conventional knowledge transfer is a 'teaching process' (i.e. HQs transfer knowledge to subsidiaries through a mentoring relationship), RKT tends to be a 'persuading process' (i.e. subsidiaries need to make HQs understand the value of the knowledge they have developed) (Hsu & Iriyama, 2016). The 'principal-agent' relationship between HQs and subsidiaries implies that the conventional 'top-down' transfer is legitimate and necessary (Chung, 2014), particularly in knowledge-exploiting foreign direct investment (Dunning, 2000). RKT has to go through a legitimation process in order for the subsidiary's knowledge to win acceptance at the HQ (Markard et al., 2016). Conventional knowledge transfer is by no means easy, but RKT faces additional difficulties and barriers, especially when the knowledge originates from subsidiaries located in developing economies (Kumar, 2013; Yang et al., 2008). This is because of significant cultural and geographical distances between the HQs and the subsidiaries (Ambos & Ambos, 2009), HQ resistance based on a sense of superiority (they think they 'know best') (Chung, 2014) and the belief that a subsidiary's knowledge is indeed hard to 'absorb' (Cohen & Levinthal,

1990) even when other factors favour the transfer. Therefore, it has been argued in the literature that knowledge characteristics (e.g. relevance) are an important factor for RKT that can help HQs to pay attention to the new knowledge and recognise its potential value (Yang et al., 2008). In summary, with the shift of both locational and relational contexts, not only does technological similarity of knowledge between HQ and subsidiary make a difference for RKT, but so too does social acceptance by the HQ based on its beliefs, norms and practices. Both dimensions (i.e. technical and social) of knowledge characteristics need to be considered simultaneously, which is largely overlooked in the existing literature on RKT. I elaborate on this in Chapter 3.

2.4 Critical review of the key influencing factors for RKT

Researchers have investigated and identified a number of factors that either facilitate or inhibit RKT, arching over a wide range of factors such as the characteristics of knowledge, subsidiaries and HQs. For a complete list of which papers focus on which part of the characteristics of knowledge, subsidiaries and HQs, please refer to Appendix 1.

2.4.1 Characteristics of knowledge

Knowledge is identified in the literature as one of the most important resources for a MNC by virtue of its characteristics such as tacitness, inimitability and immobility, and as a major source of competitive advantage (Grant, 1996). Knowledge characteristics have been by far the most extensively examined aspect in studies of conventional knowledge transfer (Michailova & Mustaffa, 2012). In the context of RKT, Håkanson & Nobel (2000) argued that characteristics of technological knowledge affect both the costs of RKT and the propensity to engage in such RKT. For instance, low articulability and high complexity may discourage imitation but also increase the cost of RKT (Håkanson & Nobel, 2000; Nair et al., 2015; Piscitello & Rabbiosi, 2004). Despite the

term knowledge characteristics being relabelled in various ways, such as articulability or observability (Håkanson & Nobel, 2000), all of these refer to the extent that knowledge can be transformed into an explicit form to be articulated, codified and observed by the knowledge recipients by addressing the single aspect of knowledge transfer based on the resource-based view (Barney, 1991). Apart from the epistemological tacit-codified dimension, knowledge is also categorised according to an 'ontological' dimension in which the knowledge can be classified as individual or collective (Nonaka & Takeuchi, 1995). Knowledge exists everywhere, within individuals and within companies. It is important to look at both experiential and cognitive aspects of knowledge and at the social context within which it is presented when discussing how the knowledge is transferred and exchanged (Ibrahim et al., 2009). In my thesis, I consider both dimensions of technological knowledge from epistemological and ontological perspectives in the context of RKT. In addition to knowledge characteristics, Michailova & Mustaffa (2012) argued that, instead of re-labelling the tacit / explicit continuum, greater efforts should also be invested into examining the relationship between knowledge characteristics and the actors in the subsidiary's knowledge transfer.

Other literature (e.g. Gupta & Govindarajan, 2000; Hsu & Iriyama, 2016; Yang et al., 2008) has investigated knowledge distance / knowledge link characteristics in the context of RKT. These studies have examined the extent to which the subsidiary knowledge stock is related, relevant and/or linked to the knowledge stock of the HQ. Recognising RKT as a 'persuading' process, compared to viewing conventional knowledge transfer as a 'teaching' process, emphasises the value and relevance of a subsidiary's knowledge stock as positively influencing RKT (Gupta & Govindarajan, 2000; McGuinness et al., 2013; Nair et al., 2016; Yang et al., 2008; Zhu et al., 2016). In the context of RKT, the HQ may be interested in transferring only that part of the subsidiary's

knowledge that it deems to be beneficial from its own point of view (Gupta & Govindarajan, 2000; Kogut & Zander, 1993). The value and relevance of a subsidiary's knowledge can help the HQ pay attention to it and recognise its potential benefits (Yang et al., 2008). Focusing on the knowledge link characteristics stems from the recognition that RKT is not a duplication of the subsidiary's knowledge but occurs through the processes of assimilation, adaptation and application within a certain practice or context at the HQ (Foss & Pedersen, 2002). The creation and transfer of knowledge within an organisation, meanwhile, are as much social processes as technical ones (Bijker, 2011; Spender, 1996). The overlap of knowledge between the subsidiary and the HQ does not guarantee that the HQ will accept and appreciate the knowledge for wider use. I argue that both technical fit and legitimacy of the subsidiary's knowledge capture HQ attention, which eventually impacts the RKT outcome. I clarify exactly what this means in my theoretical building blocks in Chapter 3.

2.4.2 Characteristics of subsidiaries

As shown in Appendix 1, the characteristics of subsidiaries have been a widely examined theme in research on RKT. The main topics in RKT research found to be related to subsidiaries (source units) include: (a) subsidiary initiatives and knowledge creation (Ambos et al., 2010; Bontis et al., 2009; Bouquet & Birkinshaw, 2008; Criscuolo, 2009; DE CICCO, 2015; Dobosz-Bourne, 2006; Driffield et al., 2016; Filippov, 2014; McGuinness et al., 2013; Najafi-Tavani et al., 2014; Pak et al., 2015; Phene & Almeida, 2003); (b) external embeddedness and networks of subsidiaries (Andersson & Forsgren, 2000; Andersson et al., 2007; Bezerra et al., 2013b; Filippov, 2014; Frost et al., 2002; Håkanson & Nobel, 2000; Kafouros et al., 2012; Meyer et al., 2011; Najafi-Tavani et al., 2012; Najafi-Tavani et al., 2014; Thory, 2008; Yamin & Otto, 2004); (c) motivation / willingness to

transfer knowledge (Holm & Sharma, 2006; McGuinness et al., 2013; Mudambi, 2002; Mudambi et al., 2014; Najafi-Tavani et al., 2012; Peltokorpi, 2015; Zorska, 2013); (d) subsidiary role (Ambos et al., 2006; Cantwell & Mudambi, 2005; Costa et al., 2015; Filippov, 2014; Kumar, 2013; Manolopoulos et al., 2007; Nair et al., 2015; Piscitello & Rabbiosi, 2006; Rabbiosi, 2011). Additionally, and related to the topic, subsidiary performance, size and/or age of the subsidiary, entry mode, ability / capability of the subsidiary and human mobility have also been extensively examined and are mentioned by scholars as influencing RKT. A more comprehensive summary is presented in Appendix 1.

Extensive theoretical and empirical work has been conducted to investigate the effect of subsidiaries' characteristics on RKT. However, there is still a lack of consensus about the role played by subsidiaries in RKT. Firstly, although the literature has highlighted the importance of subsidiaries' initiative and knowledge creation for RKT (Ambos et al., 2010; Bouquet & Birkinshaw, 2008), as well as the prominent role of subsidiaries in 'persuading' their HQs that their knowledge may be relevant and valuable for wider use, it has been recognised that subsidiaries are severely limited in their ability to drive RKT within MNCs without the cooperation of their HQs (Forsgren & Pedersen, 2000; Mudambi et al., 2014). Secondly, characteristics such as motivation or willingness to engage in RKT have been addressed, not only as subsidiary characteristics, but also as characteristics of HQs (Michailova & Mustaffa, 2012). The literature dealing with the motivation of subsidiaries to transfer knowledge uses different ways to measure it. Szulanski (1996) measured motivational disposition of subsidiaries to transfer knowledge by the perceived benefits, understanding and feasibility of transferring that knowledge. Gupta & Govindarajan (2000) measured the motivation of subsidiaries to transfer knowledge using top management team incentives, but this was not found to influence intra-MNC knowledge transfers in their empirical

studies, while it showed mixed results in research by (Jensen & Szulanski, 2004). In addition, Minbaeva et al. (2003) argued that whether or not the motivation of subsidiaries to transfer knowledge is a serious problem depends on whether HQs can attend to and motivate subsidiaries to transfer their knowledge, while from a subsidiary evolutionary perspective (Birkinshaw & Hood, 1998), a subsidiary may gain power by transferring its knowledge through RKT (Andersson & Forsgren, 2000; Mudambi & Navarra, 2004; Najafi-Tavani et al., 2014). In general, these prior works provide valuable insight into understanding the importance of the subsidiary in RKT. However, this importance of the subsidiary does not lead to a less important role for the HQ in RKT (Ambos et al., 2006), yet theory development on the latter is much scarcer.

2.4.3 Characteristics of HQs

When analysing the characteristics of HQs in RKT, studies have tended to focus on motivation / willingness and absorptive capacity. Motivational challenges for HQs to learn from and engage in RKT have attracted substantial attention, starting with Gupta & Govindarajan (2000) followed by further studies primarily focusing on how HQs overcome the 'not-invented-here' syndrome (Frost et al., 2002; Holm & Sharma, 2006; Mudambi, 2002; Mudambi et al., 2014; Najafi-Tavani et al., 2012). Related to this stream, some scholars studying MNCs in emerging countries from the strategy perspective see them as increasing engagement in springboard and knowledge-seeking foreign direct investment to compensate for their deficiencies (Luo & Tung, 2007; Mathews, 2006). Thus, RKT is an important ally in catch-up strategy to enable knowledge flow from the subsidiary to the HQ (Mathews, 2006). Further, Buckley et al. (2003) argued that for MNCs to learn from RKT depends on formal knowledge management strategy and MNCs' wider business strategies in the host countries. Taken as a whole, the above mentioned literature has helped gain an

understanding of why HQs need this kind of knowledge to enable MNCs to obtain competitive advantages by combining local knowledge from their dispersed subsidiary networks (Chung, 2014). However, such literature attempts to explain all knowledge created and transferred through exchanges underpinned by transaction cost theory (Teece, 1977), while largely ignoring knowledge as both 'a resource and a process of knowing' (Cook & Brown, 1999) along with the role the HQ plays in RKT through social interactions with its subsidiaries (Minbaeva, 2007). My thesis focuses on addressing this deficiency through a processual lens.

Along similar lines, Szulanski (1996) indicated mixed results in terms of his findings that the barriers to knowledge transfer were only, to a very small extent, motivational. Rather, the barriers to knowledge transfer are related to factors such as causal ambiguity, the receiver's absorptive capacity, and the general relational context between HQs and subsidiaries. Absorptive capacity (Cohen & Levinthal, 1990) of HQs represents a notable factor in the context of RKT. Most scholars have adopted the same definition and conceptualisation to describe absorptive capacity in RKT as the ability of HQs to recognise, assimilate and apply the value of their subsidiaries' knowledge (Ambos et al., 2006; Holm & Sharma, 2006; Hsu & Iriyama, 2016; Yamin & Otto, 2004), while a few exceptions that also adopt the term, for example Minbaeva (2007), have defined absorptive capacity as the motivation, ability and opportunity to absorb knowledge. This ability of HQs is critical for RKT; for a HQ to benefit from a subsidiary's knowledge, it must recognise and understand it (Ciabuschi et al., 2010; Kumar, 2013). Given that my thesis focuses on the role of HQ attention to RKT, I adopt the concept of absorptive capacity and introduce the details in Chapter 3.

2.4.4 The research gap in the factors influencing RKT

In general, examinations of the characteristics of knowledge, subsidiaries and HQs in relation to RKT are based on the approach of "knowledge as resource" (Grant, 1996). The majority of empirical studies have been heavily focused toward theory testing versus theory building, based on survey-based large-N hypothesis testing and variance-based design (Langley & A., 1999). Through a critical review of the extant literature, Table 1 provides a summary of the research gap that exists in the context of RKT and of how my thesis addresses these deficiencies. The knowledge-based view considers knowledge as a MNC's most strategically significant resource and argues that a critical element of a sustained competitive advantage is the heterogeneous knowledge bases and capabilities among MNCs (Grant, 1996). Many of these studies indicate that knowledge characteristics affect the efficiency of knowledge transfer, including tacitness (Piscitello & Rabbiosi, 2004; Zander & Kogut, 1995), causal ambiguity (Szulanski, 1996) and complexity (Håkanson & Nobel, 2000), and highlight that a critical element of a sustained competitive advantage is the ability to identify, integrate and apply a firm's specialised and tacit knowledge (Cohen & Levinthal, 1990). Although the 'knowledge as resource' approach has become the dominant perspective within the knowledge-based view (Grant, 1996), knowledge is also considered to be socially constructed in "a process of knowing" (Cook & Brown, 1999). As such, this approach focuses more on the process of knowing than on knowledge as an objective and transferable resource. In this view, a considerable portion of the RKT literature (refer to Appendix 2) has focused on the characteristics of the relationship between the HQs and the subsidiaries, and the RKT control and coordination mechanisms.

Table 1: Summary of the research gaps in the factors influencing RKT and the focus of this research in addressing these gaps

Factors influencing RKT	Research gaps	How these gaps are addressed in my research
Characteristics of knowledge	● addressing the single aspect of knowledge characteristics in RKT ● addressing the single aspect of knowledge classification ● emphasising the relevance of and similarity between knowledge held by the HQ and subsidiary	● focusing on the connection between knowledge characteristics, HQ attention and RKT ● combining both epistemological and ontological dimensions in knowledge classification ● focusing on both technical fit and legitimacy of knowledge
Characteristics of subsidiaries	● lack of consensus about the subsidiary's role in RKT ● dealing with the motivation of subsidiaries to transfer knowledge by using different ways to measure it	● having a much more granular focus by examining, not the level of attention to a subsidiary unit as a whole, but the level of attention to specific knowledge held by the subsidiary
Characteristics of HQs	● focusing on the conventional role of defining the strategy for knowledge transfer while ignoring the socially constructed nature of RKT	● focusing on the role of 'attention provider' through the social interaction process

2.5 Call for a new dimension for RKT?

This RKT literature is very useful for understanding the phenomenon of RKT. However, many of these studies follow a knowledge-based view to assume that knowledge has already existed and is readily perceived as valuable to HQs (Chung, 2014). RKT is not automatic, and neither are its benefits to MNCs (Ambos et al., 2006; Yang et al., 2008). In fact, RKT faces more barriers than conventional knowledge transfer, not only due to the sticky nature of the knowledge transfer (Szulanski, 2000) but also to the cognitive barriers and the asymmetry in power, resources and capability between the HQ and the subsidiary with the shift of locational and relational context of the knowledge transfer (Millar & Choi, 2009). I argue that attention theory (Ocasio, 1997; Yaniv, 2011) advances our insights into the RKT mechanism in MNCs by taking up the lens of process (Langley & A., 1999). Although recognising the critical role of HQs, namely HQ attention to RKT (e.g. by Ambos et al., 2006; Bouquet & Birkinshaw, 2008; Kumar, 2013), there is regrettably a

lack of a theoretical link between knowledge characteristics, HQ attention and RKT outcomes, and practical 'guidance' for HQs on how to attend to RKTs in order to gain benefits from them. Furthermore, not all RKTs are of benefit to MNCs (Ambos et al., 2006). Brown & Eisenhardt (1997) and Gupta & Govindarajan (2000) argued that the strategic value of the knowledge is crucial for MNCs, who should concentrate their efforts on transferring only strategically valuable knowledge. In order to achieve that, HQs should take ownership of the transfer and commit to it (Kostova & Zaheer, 1999). HQ attention captures such ownership and commitment from the HQs' side in RKT (Ambos & Mahnke, 2010). More precisely, my thesis focuses on examining the behaviour and cognitive mechanisms of HQs that convert a subsidiary-specific advantage into a firm-specific advantage in the context of RKT (Foss & Pedersen, 2002) and has a much more granular focus by examining, not the level of attention to a subsidiary unit as a whole, but the level of attention to a specific subsidiary's knowledge. To understand the effect of HQ attention on RKT in relation to knowledge characteristics, I adopt the socio-technical perspective (Trist, 1963) and the attention-based view (Ocasio, 1997), which are closely related as well as from quite distant disciplines and bodies of knowledge, in advancing our understanding of RKT (Michailova & Mustaffa, 2012). I further consider dynamics of HQ attention to RKT at multiple levels. In addition to the micro-level factors that may influence RKT, I also review literature on both internal mechanisms (meso-level) and the external context (macro-level) for RKT.

2.6 Internal mechanisms for RKT

2.6.1 Dual embeddedness

Some studies have examined the level of team dependence / interdependence in RKT (Foss & Pedersen, 2002; Håkanson & Nobel, 2000). This trend probably stems from the conceptualisation

of MNCs as differentiated networks (Ghoshal & Nohria, 1989) and from the utilisation of network theory to explain RKT. MNCs face growing challenges in managing the complexity of interactions between globalisation and local responsiveness, and they must manage 'multiple embeddedness' across heterogeneous contexts at two levels (Meyer et al., 2011). Studies of how embeddedness affects RKT have shown mixed results. Håkanson & Nobel (2000; 2001) examined the effects of both internal and external embeddedness on RKT through empirical studies of subsidiaries of Swedish MNCs and found that external embeddedness has a negative influence on RKT, while internal embeddedness has a positive influence on RKT. Frost (1998) conducted a similar study, and showed that influence is related to the entry mode of the subsidiary: local embeddedness is positively correlated with RKT if entry mode is via greenfield investment, while the relationship is the opposite if entry mode is via merger or acquisition. These studies imply that different interests may arise in the context of MNCs, so managing RKT is also a political process of negotiating and defining common interests (Carlile, 2004).

As such, the literature indicates that the relationship between HQs and subsidiaries is crucial for RKT, highlighting that HQs and subsidiaries have a mixed-motive relationship in a MNC (Ghoshal & Nohria, 1989). When HQs and subsidiaries have difficulties in establishing a proper relationship, knowledge transfer is impaired. In contrast, various mechanisms, such as control, coordination, socialisation and integration, facilitate RKT to some extent (Gupta & Govindarajan, 2000; Peltokorpi, 2015; Subramaniam & Venkatraman, 2001). However, RKTs differ from conventional knowledge transfers, due not only to the hierarchical relationships between HQs and subsidiaries, but also to the credibility of the subsidiaries' knowledge and the nature of potential payoffs perceived by the HQs (Millar & Choi, 2009). This implies that such difficulties of RKTs arise not only from cultural, geographical and linguistic differences between HQs and subsidiaries, but are

also rooted more specifically in the HQ's cognitive barriers – that is, how HQs attend to the knowledge created in subsidiaries (Ambos et al., 2006). I therefore argue that using the lens of attention (Ocasio, 1997) advances an insight into understanding the mechanism of RKT. Bouquet & Birkinshaw (2008) helpfully offer:

> Prior literature has usually dealt with "mechanistic" relationships between headquarters and subsidiaries whereby headquarters allocate budgets and resources, but the role of cognitive factors has largely been neglected. The concept of headquarters' attention contributes to a deeper understanding of how priorities and investments in the MNC can be realigned across multiple units.

It is observed that RKT, especially that which comes to HQs in developed countries from subsidiaries in developing countries, tends to be discounted and downgraded in value without proper assessment of its value in an unbiased way that makes allowance for cognitive barriers (Kumar, 2013; Millar & Choi, 2009). Regrettably, not many studies have analysed cognition in the context of RKT, at least not in comparison with the structural and relational dimensions of social capital, as well as its conjunction with other variables (Michailova & Mustaffa, 2012). My thesis aims to address this deficiency.

2.6.2 Social capital approach

An increasing number of studies have examined RKT by applying social capital theory (Inkpen & Tsang, 2005; Nahapiet & Ghoshal, 1998), extending it from primarily investigating structural elements of networks (e.g. size, position and intensity) to also include relational elements (e.g. trust, norms and the quality of the relationship between subsidiary and HQ). The structural aspect helps MNCs to carry out collective goal-directed activities, thus highlighting the critical role of the

subsidiary in the MNC corporate network and the level of dependency of the rest of the MNC on a focal subsidiary (Benson, 1975; Ghoshal & Bartlett, 1990). The relational perspective recognises a set of arrangements that distribute power, rewards and well-being in MNCs (Child et al., 2005). This perspective also suggests that HQ attention results from a bottom-up process through the subsidiary taking initiatives and building a profile at the HQ (Bouquet & Birkinshaw, 2008). However, knowledge creation and transfer tend to be simultaneous in the context of RKT (Najafi-Tavani et al., 2014). Hence, neither the structural nor the relational perspective has sufficiently covered the nature of knowledge transfer, which is essentially a process of learning that is socially constructed from working practices (Brown & Duguid, 1991).

2.6.3 Communications mechanism

Gupta and Govindarajan (2000) examined the richness of transfer channels and indicated that knowledge transfer to HQs is greater in the case of subsidiaries that are integrated more tightly with the rest of the organisation through formal mechanisms. Björkman et al. (2004) found, through an examination of 134 Finnish and Chinese MNC subsidiaries, that MNCs can influence inter-unit knowledge transfer by specifying the objectives of the subsidiary and by utilising corporate socialisation mechanisms, but found no support for any impact from management compensation systems and use of expatriate managers on knowledge transfer from a subsidiary to the rest of firm. Rabbiosi (2011) examined 280 dyads between subsidiaries and HQs and found that both the combination of a high degree of subsidiary autonomy with greater use of personal coordination mechanisms, and the combination of low subsidiary autonomy with greater use of electronic-based coordination have a positive effect on the extent of reverse knowledge transfer. This observation is a shift in emphasis in the literature in the sense of moving from examining the use of technology

and knowledge management infrastructure to more informal mechanisms of knowledge transfer such as socialisation (Michailova & Mustaffa, 2012). Along with the potential to provide in-depth understanding of this phenomenon, the existing literature has provided useful implications, bearing in mind the balance between the massive cost of building integrated knowledge management infrastructures and the uncertain benefits from investing in social capital.

2.7 External context of RKT

As previously mentioned, subsidiaries are embedded in both the MNC's knowledge network and the host country's external knowledge network, which may differ from, and even conflict with, the MNC home country's own knowledge network (Almeida & Phene, 2004). Hence, there is an important macro-level consideration evident in some RKT studies. The impact of external environmental factors on RKT has been addressed in previous research (Child, 1972), highlighting the role of institutional factors (Marton, 1986) and competitive intensity (Cui et al., 2006).

2.7.1 Institutional change

Institutional change, such as government regulation increasing the risk of making current products and services obsolete and requiring new ones to be developed (Zahra, 1996), means that MNCs may pursue explorative initiatives in managing the changing environment by leveraging their subsidiaries' knowledge (Jansen et al., 2006). The potential value of a subsidiary's knowledge applies to a firm as a whole (Rugman & Verbeke, 2001). However, the outcome of the subsidiary's knowledge is uncertain (Schulz, 2001) and thus needs to go through a legitimation process of 'selling' these issues in order to attract HQ attention (Dutton et al., 2001). HQs are more likely to consider such knowledge as having greater legitimacy (Monteiro, 2015). The external environment is an important source of legitimacy for subsidiaries, especially when a subsidiary's voice is

perceived as inadequate (Conroy & Collings, 2016). Thus, under fast changing institutional environments, a subsidiary's knowledge can foster its legitimacy by 'piggybacking' on the reputations and endorsements of key external actors or partners such as government organisations (Chan & Makino, 2007), and thus HQ attention to RKT can be captured.

2.7.2 Competitive intensity

Competitive intensity is often associated with intensive pressures for greater efficiency and a quick response to the market (Matusik & Hill, 1998). Managers use 'mental models' to simplify and understand the competitive environment that a MNC faces (Song et al., 2002), while Cyert & March (1963) argued that decision-making heuristics tend to be relatively biased and simple-minded. In order to make sense of the competitive environment, HQs tend to form simplified internal cognitive representations as the result of their knowledge and experience interacting with the environment (Song et al., 2002). Hence, HQs may attend to efficient and easily exploited methods, such as product modification and cost reduction, to rapidly respond to demanding competitive conditions (Jansen et al., 2006). Therefore, in competitive environments, the HQ is more likely to make the decision to leverage its global dispersed knowledge network in response to market competition.

Chapter 3: Theoretical Building Blocks and Propositions

RKT is both theoretically under-explored and practically under-performed, in spite of its growing importance to MNCs' global competitive advantage and innovativeness (McGuinness et al., 2013; Mudambi, 2002; Yamin & Otto, 2004; Zorska, 2013). By extending attention theory to RKT, my thesis attempts to increase the theoretical understanding of how HQ attention connects with knowledge characteristics, interactional factors and RKT outcomes in the RKT process, and attempts to practically guide HQ attention to RKT and its benefits in terms of leveraging its global dispersed knowledge in the international market. The aim of this chapter is to build an initial construct and conceptual model of how HQ attention connects with knowledge characteristics (technical fit and legitimacy), interactional factors and RKT outcomes in RKT process, and follow this with a number of explorative propositions through my empirical case study that can make up the platform for a refinement of the theoretical model. I also used the initial construct and the conceptual model as a theoretical preunderstanding (Nyström & Dahlberg, 2001) for preliminary data collection and analysis as a source for "inspiration" (Timmermans & Tavory, 2012) in extending attention theory in the context of RKT.

The literature has argued that RKT and conventional knowledge transfer have different transfer logic by highlighting the importance of knowledge characteristics in the context of RKT (Gupta & Govindarajan, 2000; Yang et al., 2008) and the dominant role of a subsidiary in 'issue-selling' (Dutton et al., 2001) and 'persuading' the HQ that its knowledge is valuable, relevant and could potentially have wider use for the HQ (Yang et al., 2008). However, the importance of the subsidiary does not lead to a less important role for the HQ in RKT. Although the literature has alluded the important role of the HQ as an 'attention provider' to create value, theory development

on HQ attention mechanism in RKT is much scarcer, with a few exceptions (e.g. Ambos et al., 2006; Kumar, 2013).

In this chapter, I start with a summary of attention theory (Ambos & Birkinshaw, 2010; Ocasio, 1997; Yaniv, 2011) and then critically challenge some of the underlying assumptions in the attention literature that impede the extension of the theory to RKT, showing how my thesis addresses these deficiencies through my initial construct and the conceptual model.

3.1 Critical review of attention theory

Table 2 provides a summary of the evolution of attention theory across the various research fields associated with the main arguments and the seminal literature.

3.1.1 Early stage of attention theory

Attention is one of the most widely researched topics in psychology and cognitive science (Pashler, 1999). As Degangi et al. (1991) argued, when a person is actively engaged in voluntary attention, functional purposeful learning can occur. Attention is selective in nature, as manifested by the process of selecting from among the many potentially available stimuli (Pashler, 1999). A number of theories (e.g. Broadbent, 1958; Treisman, 1960; Deutsch & Deutsch, 1963) have attempted to explain attention by using information processing theory. However, despite its importance, the notion of attention has not been fully explored within the organisational context. Simon (1950) was the first to adopt the notion of attention in organisation science by focusing on attention allocation as central to administrative behaviour in an organisation. March and Simon (1958) noted, furthermore, that decision-makers tend to be open to information that is aligned with their existing knowledge and information. Nevertheless, the transformation of attention from the individual to

the organisational level is not straightforward. The literature has argued that organisational 'cognitive' processes should be seen as the outcome of individual cognitive processes of the individuals who comprise either the organisation or the top management team (Yaniv, 2011).

Table 2: Summary of attention theory across various research fields

Research fields	Key arguments	Seminal literature	Locus of attention
Psychology and cognitive science	● Attention is a core cognitive process associated with human decision-making, memory and learning. ● Attention is selective in nature (selecting and responding to some information while ignoring other information).	(Pashler, 1999) (Broadbent, 1958; Treisman, 1960; Deutsch & Deutsch. 1963)	Individual
Organisation science	● Attention allocation as central to administrative behaviour in an organisation. ● Decision-makers tend to be open to information that is aligned with their existing knowledge and information.	(Simon, 1950; March & Simon, 1958)	Individual (decision-makers in the organisation)
Attention-based view	● The focus is not on information processing capacity, but rather on "whether and how available information is attended in a particular time and place". ● Attention structure is social and economic in nature, shaping how actors value issues and answers, and determining how actors allocate attention.	(Joseph & Ocasio, 2012; Ocasio, 1997; 2011; Ocasio & Joseph, 2005; Shepherd et al., 2016)	Individual (decision-makers / top management in the organisation)
MNC / IB	● Attention is the most critical, scarce and sought-after resource in MNCs. ● Structural and relational determinants of HQ attention to certain subsidiaries, its impact on MNCs and subsidiary performance. ● Positive side of attention.	(Ambos et al., 2010; Ambos & Birkinshaw, 2010; Birkinshaw et al., 2007; Bouquet & Birkinshaw, 2008; Hansen & Haas, 2001)	Individual (decision-makers / top management in MNC)

3.1.2 Attention-based view

The attention-based view was introduced by Ocasio (1997) and has been adopted as a metatheoretical perspective in both theoretical and empirical work in many organisational fields, including MNCs and international business (Ambos & Birkinshaw, 2010; Birkinshaw et al., 2007). It has made major progress in explaining how attention in organisations shapes organisational

adaptation (Ocasio, 2011). It assumes that decision-makers and organisations have limitations on their attention, so they cannot be dedicated to all information at all times. The attention-based view does not focus on information processing capacity, but rather on "whether and how available information is attended in a particular time and place" (Joseph & Ocasio, 2012).

Attention is selective in nature, meaning that actors choose to focus on issues to the exclusion of others (Ocasio, 1997). In the context of organisations, organisational attention is "the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both (a) issues: the available repertoire of categories for making sense of the environment; problems, opportunities and threats; and (b) answers: the available repertoire of action alternatives; proposals, routines, projects, programs and procedures" (Ocasio, 1997). Attention in organisations is based on three key principles according to Ocasio (1997):

I. The actions of decision-makers are based on the issues and answers they focus their attention on (focus of attention).

II. The issues and answers on which decision-makers are focused depend on the actor's particular context and situation at a particular point in time (situated attention).

III. Decision makers' contexts and situations, and how they attend to them, depend on rules, resources and social relationships within the firm, and on how these regulate "distribution and allocation of issues, answers and decision-makers in to specific activities, communications and procedures (structural distribution of attention).

Structural distribution of attention is contingent on an organisational unit's structural position, through which that unit's interests and priorities vary, and by which its focuses of attention are

differentiated across the organisation's environment (Ocasio, 1997). Attention structure is social and economic in nature, shaping how actors value issues and answers, and determining how actors allocate attention when making decisions (Joseph & Ocasio, 2012; Ocasio, 1997). This implies that attention is linked to the context in which the cognition and actions are situated by emphasising the organisational practices in which the real work of managers takes place (Kumar, 2013). This is a practice-oriented view of attention which explains how the attention of top management in MNCs, their accumulated experience, and critical aspects of the socio-technical environment in which they operate come together to create a situated cognition that has implications for RKT (Kumar, 2013).

3.1.3 Attention in MNCs

The starting point in the adoption of attention in MNC studies is the recent concept of the market for attention and the argument by Hansen & Haas (2001) that, compared to information, attention is the most critical, scarce and sought-after resource in organisations. In the context of a MNC, for the company to be successful over the long term, it is not enough simply to sell products on a global basis. Rather, the HQ has to derive benefits from accessing multiple markets and leveraging the dispersed knowledge of their knowledge network around the world (Ghoshal & Bartlett, 1990); thus, allocation of HQ attention to these units has arguably become a key issue (Bouquet & Birkinshaw, 2008; Campbell, 1989). By its nature, HQ attention is limited and selective in its focus (Ocasio, 1997), leading to the emergence of an internal market for HQ attention in many MNCs (Hansen & Haas, 2001).

The literature, as a stream of research by Bouquet, Birkinshaw and their colleagues, focuses on the structural and relational determinants of HQ attention to certain subsidiaries (Bouquet & Birkinshaw, 2008) and its impact on MNCs (Bouquet et al., 2009) or subsidiary performance

(Ambos & Birkinshaw, 2010). The structural perspective highlights the critical role of the subsidiary in the MNC's network and the level of dependency of the rest of the MNC on a focal subsidiary (Ghoshal & Bartlett, 1990). For example, many MNCs give increasing attention to their subsidiaries in China and India as they have high expectations of these emerging markets. This attention is not necessarily tied to financial investment, but to developments in these markets versus other markets, leading to more time and effort being spent on a daily basis by the top management of MNCs in understanding those markets (Ambos & Birkinshaw, 2010). Thus HQ attention becomes an important mechanism for raising a subsidiary to the position of an important player in the MNC (Birkinshaw & Hood, 1998). The relational perspective suggests that HQ attention results from a bottom-up process through the subsidiary's initiative-taking and profile-building (Bouquet & Birkinshaw, 2008) leading to a re-distribution of power, rewards and well-being in MNCs (Child et al., 2005).

3.1.4 The limitations of existing attention theory in the context of knowledge transfer

Even though the role of the HQ involved in knowledge transfer has been discussed in the literature (e.g. Ambos & Mahnke, 2010; Ciabuschi et al., 2010; Gupta & Govindarajan, 2000), there has been limited attention to the effect that HQ attention may have on RKT (Ambos et al., 2006). Although the attention-based view (Ocasio, 1997) and its adoption in MNC studies (Bouquet & Birkinshaw, 2008) advance our insight into the influence of attention on decision-makers in a firm, I challenge several underlying assumptions in the attention literature that constrain the application of the construct in knowledge transfer research. See Table 3 for an overall summary.

Table 3: The limitations of attention theory in the context of RKT

Attention theory	Limitations of the literature	Extension of the theory in the context of RKT in my thesis
Attention-based view (Ocasio, 1997)	● focus on the structural conditions for attention as a 'commodity' more than on attention itself ● focus on the decision-makers / top management in MNC	● apply the lens of process to HQ attention to RKT ● focus not only related to top management but also to other agents influencing organisational attention
Attention in MNCs (Ambos & Birkinshaw, 2010; Birkinshaw et al., 2007; Bouquet & Birkinshaw, 2008)	● the level of attention to a subsidiary unit ● positive side of HQ attention and assumption that HQ attention is always a desirable outcome	● a much more granular focus examining HQ attention to specific RKT tasks at multiple levels (macro-, meso- and micro-) ● consideration of 'both' sides of HQ attention

Firstly, the literature (e.g. Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008) views attention as a 'commodity' defined as "the extent to which a HQ recognises and gives credit to a subsidiary". This tends to explain how attention can be 'allocated' or 'obtained' in MNCs while largely ignoring the socially structured nature of organisational attention (Kumar, 2013; Ocasio, 1997; Ocasio & Joseph, 2005) underpinned by exchange logic. I argue that HQ attention to knowledge in the context of RKT is maintained through continuing social and collaborative processes between the HQ and subsidiary (Nonaka & Takeuchi, 1995). Applying the processual perspective to HQ attention in RKT, Yaniv (2011) defined organisational attention and its relevance to knowledge creation as:

> … a set of cyclic organizational routines and processes that determine which knowledge will enter into organizational memory, and which knowledge will be filtered or be considered less relevant to organizational memory.

This definition casts attention as process in the context of knowledge creation and transfer; however, it tends to reduce organisational attention to its external enabling factors related to the organisational structure, so it does not explicitly explain the mechanism of HQ attention itself, and does not directly and adequately address the link between knowledge characteristics, HQ attention

and RKT, as well as the practical problem of 'how to guide HQ attention in RKT'. My thesis addresses these deficiencies by applying the lens of process to HQ attention to RKT, and how it connects with knowledge characteristics and other interactional factors.

Secondly, I note that the issue of 'level' of analysis in the attention literature applies in the context of RKT. Most of the literature (e.g. Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008) on attention in MNCs focuses methodologically on the analysis of the firm or subsidiary level (meso-) which does not help to practically guide HQs on how to attend to a specific RKT task in association with the subsidiary's knowledge. Building on the micro-foundations of RKT (Håkanson & Nobel, 2000; Yang et al., 2008), I argue that the conceptualisation of HQ attention to RKT needs to occur in close association with the characteristics of the knowledge to be transferred. Whilst subsidiaries are embedded in both the MNC's knowledge network and the host country's external knowledge network, MNCs face challenges in managing the complexity of 'multiple embeddedness' across heterogeneous contexts at two levels (Meyer et al., 2011). Hence, there is an important institutional (macro-) level consideration in HQ attention to RKT. My thesis aims to extend attention theory (Bouquet & Birkinshaw, 2008; Ocasio, 1997; Yaniv, 2011) in the context of RKT by considering the dynamic of HQ attention to RKT at multiple levels. I find discussion of micro-, meso- and macro-levels of an analysis in the attention and RKT literature, but seldom are they integrated in the same study. Therefore, in my thesis, I adopt a much more granular focus (Monteiro, 2015) by examining the attention to specific RKT tasks in association with the subsidiary's knowledge characteristics and interactional factors. In this way, I advance the attention-based view (Ocasio, 1997) in the context of RKT by offering a holistic explanation of how knowledge characteristics and interactional factors combine to influence HQ attention to RKT, and by practically guiding MNCs on how to manage RKT and how to benefit from it through HQ attention.

Furthermore, according to Ocasio (1997), organisational attention is the attention of an organisation's decision-makers. The top management team has an important influence on the selection of inputs to be processed by the organisation. I argue, however, that other members of the organisation may also sometimes impact on organisational attention (Yaniv, 2011). For instance, members who possess some critical knowledge (e.g. technical or engineering know-how, salient marketing skills etc.) or have access to critical sources of information (e.g. personal or professional relations, social networks etc.), can also have a significant influence on organisational attention. Thus, I focus in my thesis on HQ attention that is not only related to top management but also that of other agents influencing organisational selection of which knowledge from a subsidiary is to be processed and used at the HQ.

The literature on MNC (e.g. Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008; 2009) has an important implication for our understanding of the effect of HQ attention on a subsidiary's performance and on the MNC as a whole. It has focused on the positive side of HQ attention and has assumed that HQ attention is always a desirable outcome for subsidiaries' activities, while largely neglecting to explore the negative side of HQ attention whereby too much HQ attention can be detrimental for knowledge transfer from subsidiary to HQ (Ciabuschi et al., 2010; Conroy & Collings, 2016). Considering 'both' sides of HQ attention to have important implications for guiding HQ attention to RKT has inspired me to explore in my thesis the effect not only of the amount of HQ attention but also of the type of HQ attention to RKT, and to identify under which scenarios MNCs benefit from HQ attention to RKT in association with subsidiaries' knowledge characteristics.

3.2 Extension of attention theory in the context of RKT

3.2.1 RKT provides a unique asymmetry through which HQ attention plays an important role

RKT is not automatic, and neither are its benefit to MNCs (Ambos et al., 2006). I argue that RKT provides a unique asymmetry through which HQ attention plays an important role. In the context of RKT, the HQ plays an important role, through its attention, for the success of RKT and for the MNC's ability to benefit from that RKT (Ambos et al., 2006). Earlier research on RKT focused primarily on the presence of knowledge transfer between HQs and their subsidiaries (Håkanson & Nobel, 2000) and the dominant role of subsidiaries in RKT through bottom-up influencing mechanisms, such as 'persuading' (Yang et al., 2008) or 'issue-selling' (Dutton et al., 2001) or 'voicing'(Bouquet & Birkinshaw, 2008). It largely ignored the fact that, even if a subsidiary's knowledge might be potentially beneficial for a MNC, without attention from the HQ, this valuable knowledge can hardly be extracted at the HQ (Brock & Yaniv, 2007). On the one hand, the subsidiary's knowledge embedded in the host country's knowledge network is often tacit and hard to evaluate (Szulanski, 1996), so a HQ that pays only little attention to the subsidiary's knowledge may be unable to recognise whether this knowledge is valuable and relevant for wider use (Yang et al., 2008). Since potential recipients are unlikely to leverage knowledge they do not recognise, low levels of attention devoted by the HQ to the subsidiary's knowledge in RKT may carry a high risk of value destruction (Ambos & Mahnke, 2010; Ciabuschi et al., 2010). On the other hand, the host country's external knowledge network may differ and even conflict with the MNC home country's own knowledge (Almeida & Phene, 2004), the subsidiary may prefer not to engage in RKT by taking its knowledge to be a competitive advantage for its own power resource without seeking HQ attention (Minbaeva et al., 2003). As argued by Brock & Yaniv (2007), a lack of HQ attention may result in a 'broken link' between relevant available knowledge and the MNC's

competitive advantage. Further, with the shift in the relational context of knowledge transfer between the HQ and the subsidiary in RKT, the subsidiary may oversell the value and potential of its knowledge to the HQ even though it may not be suitable or beneficial to the MNC (Conroy & Collings, 2016). HQ attention can be more important in the RKT context than in conventional knowledge transfer because it helps HQs be the 'safeguard' that avoids such 'irrelevant' or 'inappropriate' knowledge being transferred (Chung, 2014).

HQ attention is a powerful mechanism by which a subsidiary's knowledge can be leveraged across the MNC's global knowledge networks (Ambos & Birkinshaw, 2010). Successfully leveraging their subsidiaries' knowledge needs HQs to take ownership of the transfer (Kostova, 1999). HQ attention captures the degree of such ownership and commitment from the HQs' side in RKT. Conventionally, HQs play a key role in distributing resources, building up coordinating systems and cultivating the right social culture for knowledge transfer to take place (Bouquet & Birkinshaw, 2008). The literature has indicated that, in addition to finance investment and resource commitments, HQ attention has positive signalling effects that affect a subsidiary's commitment and motivation and that this, in turn, may influence the effectiveness of RKT (Dutton & Ashford, 1993). For instance, HQ attention can facilitate the set-up of appropriate organisational policies and arrangements for receiving a subsidiary's knowledge, allowing the subsidiary to see the benefits of engaging in RKT (Chung, 2014). Further, Edwards (1998) found that successful cross-border knowledge transfer from subsidiaries was mostly related to an influential role exercised by the HQs. Viewing HQ attention as a 'gateway' (Yaniv, 2011) to mediate between knowledge and action does not merely imply a 'channel' between the HQ and the subsidiary for transferring knowledge, but also implies the important influence of HQ attention through enhancing the likelihood of the knowledge being recognised and accepted at the HQ, and of 'learning' and 'joint

knowledge creation' taking place through the RKT process (Noorderhaven & Harzing, 2009). These attentional mechanisms can be even more important in the RKT context than in conventional knowledge transfer because, as mentioned before, they help to prevent the barrier of the transfer being subject to the opportunistic (Minbaeva et al., 2003) 'not-invented-here' syndrome (Cohen & Levinthal, 1990), and can even act as a safeguard for avoiding the transfer of non-strategic or irrelevant knowledge which may not be suitable or beneficial for the HQ's context (Gupta & Govindarajan, 2000; Yang et al., 2008).

Further, I argue that HQ attention in RKT is evolutionary in nature. HQ attention to specific knowledge of a subsidiary according to its 'attention capacity' (Yaniv, 2011) that is affected by the HQ's absorptive capacity related to its previous knowledge (Cohen & Levinthal, 1990) and bounded rationality (Simon, 1950). The selection of certain subsidiary knowledge and its adoption at the HQ is reflected in the HQ's actions and therefore in its outcomes or behaviour (Kumar & Demir, 2013). This implies that HQ attention to RKT inherently entails evolutionary development and path dependencies because the HQ's new knowledge becomes part of existing knowledge which affects the HQ attention to future subsidiary knowledge (Weick, 1979). This has also been supported by Yaniv (2011) in his argument that organisational attention is 'cyclic' or 'spiral' in nature. Further, it has also been argued in recent international business research that MNCs can engage in 'institutional innovation' in order to introduce new knowledge (Regnér & Edman, 2014). In the context of RKT, MNCs may purposefully change or create new institutions to enable knowledge transfer and thus develop their attentional practices to RKT over time (Regnér & Edman, 2014). Building on the aforementioned arguments, I have developed the following explorative proposition:

Proposition 1: RKT provides a unique asymmetry through which HQ attention plays an important role to enable wider use of subsidiary knowledge at the HQ, and over time, HQ may benefit from devoting its attention to RKT in terms of leveraging its subsidiary knowledge in the international market.

3.2.2 HQ attention to RKT as a managerial process

Attention has been recognised as a scarce resource in organisations (Ocasio, 1997). The previous IB literature often studied organisational attention as a 'commodity' focusing on its positive side (Conroy & Collings, 2016) and defined attention as "the extent to which a HQ recognises and gives credit to a subsidiary" (Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008). Although viewing HQ attention as a 'commodity' or 'object' that that a MNC can obtain through exchanges underpinned transaction cost logic (Teece, 1977) provides for expositional simplicity and empirical convenience, it largely ignored organisational attention is socially constructed and tacit in nature (Kumar & Demir, 2013; Ocasio, 1997). For instance, HQ attention to some knowledge in the context of RKT may not exist at the beginning, but may emerge as the outcome of interaction between the HQ and subsidiary. I argue that HQ attention in the context of knowledge transfer remains weakly conceptualized as a 'commodity' that impedes the adoption of the construct in RKT study. In contrast, I conceptualise HQ attention in the context of RKT as a process that unfolds over time. To benefit from RKT requires MNC through a series of tasks. Each of these tasks requires HQ attentional resources. Therefore, to capture the richness of RKT fully and accurately, these tasks should be studied explicitly when studying RKT. Three crucial tasks through HQ attention in the context of RKT are the recognising, sense-making and exploiting the subsidiary knowledge at the HQ.

To leverage subsidiary knowledge over time from the global dispersed knowledge network, HQ must first recognise potential of the subsidiary knowledge that could be for wider use. Recognising process refers to the discovery and identification of possibilities of new resource combination and novel ways of knowledge creation between the HQ and the subsidiary. In contrast to conventional knowledge transfer, with the shift of relational context in RKT, the ability of HQ to continuously notice and identify the knowledge sources that could be further exploited through it attention is crucial for achieving and sustaining international competitiveness for MNCs (Yang et al., 2008). HQ attention could be seeking in nature (Kumar, 2013; Kumar & Demir, 2013). As such, the HQ may recognise the need and initiate the knowledge-seeking from its global dispersed subsidiaries to improve its global competitive advantage in some way (Zenger & Todd, 2004). HQ must then decide whether to pursue the RKT opportunity that requires considerable managerial judgement through the sense-making process. Sense-making is subjective cognitive process (Ocasio, 1997) that is a facet of two-way exchange between "issue-selling" (Dutton & Ashford, 1993) by the subsidiary and "issue-buying" by the HQ (Barnett, 2008) of a MNC in the context of RKT. Finally, HQ must maintain its focus of time and efforts in the given subsidiary knowledge at the context of HQ in order to exploit it. Exploiting refers to use or deployment of the subsidiary knowledge at the context of HQ. RKT is not a full replication of a subsidiary knowledge at the HQ, but may involve the modification and transformation of knowledge at the HQ (Argote et al., 2000). Therefore, in addition to recognising and sense-making, exploiting the subsidiary knowledge at the HQ also requires the sustainable HQ attentional resources. Combing these insights, I have developed the explorative proposition as follows:

Proposition 2: HQ attention to RKT is not an object that a MNC can obtain but a set of managerial processes through which HQ recognising, sense-making and exploiting the subsidiary's knowledge for wider use at the HQ.

The field of RKT inherently entails processual elements, evolutionary development and path dependencies (Birkinshaw & Hood, 1998; Frost, 2001; Kogut & Zander, 1993). HQ attention to RKT in a MNC can be understood as a cumulative, path-dependent process that is shaped by multiple level factors (micro-, meso- and macro-). In my thesis, I focus on HQ attention as a cognitive mechanism in the context of RKT that enables me to focus on a broader set of cognitive factors that have so far been overlooked for an illusion of unlimited control and rationality in intra-organisational knowledge transfer (Chung, 2014). In the context of RKT, even if RKT is the key strategic goal, the precise factors explaining its successful implementation remain unclear (Najafi-Tavani et al., 2012). This unexplained variance may be subject to the role of chance, but it may also encapsulate important unobserved and under-researched HQ attention process in RKT that is tacit and contextual in nature. I argue that study of HQ attention process in RKT should be in close association with subsidiary knowledge characteristics and interactional factors between the HQ and the subsidiary (Ambos et al., 2006; Kumar, 2013).

3.2.3 HQ attention to RKT in close association with knowledge characteristics

The RKT literature has explicitly examined the micro-foundations of knowledge characteristics, such as knowledge relevance (Nair et al., 2016; Rui et al., 2016; Yang et al., 2008), technology characteristics (Håkanson & Nobel, 2000) and product specificity and similarity (Zhu et al., 2016), which enhance the attractiveness and credibility of subsidiary knowledge and thus capture HQ attention to it (Kumar, 2013; Millar & Choi, 2009). It is regrettable that no clear link is addressed

in the existing literature between the subsidiary's knowledge characteristics, HQ attention and RKT outcomes. As a result of that, HQ attention in the context of knowledge transfer remains weakly conceptualised. My research seeks to address this deficiency.

Capacity and selection are considered to be major aspects of organisational attention (Yaniv, 2011). Specifically, a HQ's cognitive structures, which are closely linked with its absorptive capacity – its prior knowledge and experience – may become rigid in the RKT context (Millar & Choi, 2009). Limitation of a HQ's absorptive capacity can cause knowledge unfitness, which is a constraint for RKT (Yildiz & Fey, 2010) and determines which subsidiary knowledge can be recognised, assimilated and applied at the HQ. On the other hand, the limited attentional capacity of HQs also results in their bounded capacity to be rational (Simon, 1950), which confers on HQs their ability to maximise over the set of all conceived alternatives when dealing with real-life knowledge transfers.

Since HQ attention is a scarce and critical resource, it is argued that the HQ should strive to manage it strategically and deploy it towards that knowledge of subsidiaries that may yield the greatest returns for MNCs (Ambos & Birkinshaw, 2010). Several empirical studies of RKT have pointed to the facets of how HQ attention can direct the strategic role of their subsidiaries as the key source of knowledge for them and other MNC units (Chung, 2014). A HQ has access to a subsidiary's various sources of knowledge, but due to its limited attention capacity, it cannot deal with them all. HQ attention mediates the subsidiary's knowledge and RKT outcome since the unavailability of a subsidiary's knowledge can be noticed and used by the HQ (Ocasio, 1997). In another words, RKT depends on the subsidiary's knowledge penetrating the HQ's attention filter (Yaniv, 2011).

However, only paying attention is not enough; it is important to have the appropriate means to facilitate RKT through HQ attention (ul Haq et al., 2017). HQ attention could be a double-edged sword for a subsidiary, and the effects of HQ attention in the knowledge transfer process are ambiguous (Ciabuschi et al., 2012). Ambos & Birkinshaw (2010) argued that HQ attention is a scarce resource that creates value for MNCs in the knowledge transfer process. Ciabuschi et al. (2012) made a similar point in terms of HQ involvement in the knowledge transfer process from knowledge-owning subsidiaries, while the key question is how HQs add value to knowledge transfer (Ambos & Mahnke, 2010). HQs are unlikely to benefit from RKT if they neither understand the subsidiary's knowledge nor are in a position to contribute to the RKT process. Therefore, I argue that HQ attention should be in close association with the knowledge source at the subsidiary in order to benefit from RKT. However, HQ attention to RKT is a socially constructed process (Ocasio, 1997), and there is some uncertainty as to the extent to which RKT is actually taking place, given that RKT is largely a deliberate and variable action (Chung, 2014). It requires both HQs' and subsidiaries' willingness and readiness to comply with the technical and social context for RKT implementation (Najafi-Tavani et al., 2012; Najafi-Tavani et al., 2014). It is an incomplete explanation for HQ attention to a specific RKT task solely based on the strategic position or 'weight' of the subsidiary in a MNC (Bouquet & Birkinshaw, 2008). Following one of central claims of the attention-based view that what firms do depends on what issues and answers they focus their attention on (Ocasio, 1997), it is important to identify the HQ's attention mechanisms in close association with the knowledge characteristics to enable RKT.

3.3 Knowledge characteristics and HQ attention to RKT

In order to build an explorative theoretical link between knowledge characteristics and HQ attention, I start with 'knowledge relevance' theory which has been widely adopted in RKT studies (Nair et al., 2016; Rui et al., 2016; Yang et al., 2008). Relevance is used to describe "how pertinent, connected, or applicable some information is to a given matter" (Yang et al., 2008) and is defined as "the degree to which external knowledge has the potential to connect to local knowledge" (Schulz, 2003). In the RKT literature, relevance is measured by the overlap and similarity of knowledge between the HQ and subsidiary in a firm, underpinning the assumption that similarity and attraction are positively associated (Sabini, 1992). However, I struggle to adopt the term in my explorative theoretical framework because of two main challenges. First, high similarity and overlap of knowledge between the HQ and subsidiary does not guarantee that the HQ will accept and appreciate the knowledge for wider use. In fact, as argued by (Chung, 2014), the main challenge in RKT versus conventional knowledge transfer is the issue of legitimacy of the subsidiary's knowledge at the HQ. Second, relevance mixes technical and cognitive aspects within one construct, even though they may require different understanding in RKT practices. Inspired by this, I step outside of the business literature to explore a holistic approach to capture knowledge characteristics in the context of RKT.

Therefore, based on the socio-technical framework, I adopt the constructs of *technical fit* and *legitimacy* to explicate the difference between the technical and social characteristics of a subsidiary's knowledge. The socio-technical approach was initially introduced by Trist (1963) to emphasise the interrelationships between technological and social factors in understanding organisational behaviour. I argue that this approach fits the processual study in the context of reverse technology transfer better than knowledge 'relevance' theory. A growing number of studies

(e.g. Chai & Kim, 2009; Guzman & Trivelato, 2008; Handzic, 2011; Pan & Scarbrough, 1998; Søndergaard et al., 2007) have started to apply this approach for a more holistic view of knowledge transfer which recognises the interplay between technical and social factors. RKT is not a free-floating phenomenon, but rather arises in an organisational and operational context (Søndergaard et al., 2007). The literature has emphasised that the context of the knowledge link between the subsidiary and the HQ is of key importance for understanding RKT (Yang et al., 2008). Following a socio-technical approach, my thesis highlights the interplay between *technical fit* and *legitimacy* of the subsidiary's knowledge, and the critical role of HQ attention, together driving the distinctive outcomes through the RKT process. My approach also builds on the seminal work of Cook & Brown (1999), who argued for knowledge as both "a resource" and " a process of knowing", which has also been recognised by researchers such as Spender (1996) and Bijker (2011) in the strategy management area in terms of knowledge creation and transfer within organisations being as much a technical process as a social one. This implies that it is important to consider both technical (fit) and social (legitimacy) characteristics of a subsidiary's knowledge in a holistic way in the context of RKT. Taken together, my thesis attempts to offer a holistic explanation for an under-explored phenomenon – RKT.

3.3.1 Technical fit of knowledge and HQ attention to RKT

Technical fit is an important dimension in knowledge transfer processes that stems from the challenge of re-contextualisation of the knowledge source at the knowledge recipient (Ansari et al., 2010). Subsidiaries have access to diverse sources of new ideas and knowledge originating from their local environments, so they grow in terms of knowledge development (Birkinshaw & Hood, 1998). Leveraging the diverse sources of knowledge residing in the networks of subsidiaries is

crucial for MNCs and their success in general (Kogut & Zander, 1993; Nonaka & Takeuchi, 1995). External embeddedness, in terms of the strength or closeness of the relationship between subsidiaries and their local suppliers, customers and competitors, affects the ability of a subsidiary to absorb and develop new knowledge (Håkanson & Nobel, 2001). However, RKT does not imply a 'full' replication of a subsidiary's knowledge at its HQ (Foss & Pedersen, 2002). The higher the level of external embeddedness, the more the knowledge developed is context-specific (Andersson et al., 2002). Such context-specific knowledge at the subsidiary is likely to be difficult to transfer, and may not be applicable to the HQ (Najafi-Tavani et al., 2012). Indeed, in the context of RKT, HQs often realise that they need to adapt certain components of a subsidiary's knowledge to fit the context of the home countries (Ansari et al., 2010), which implies that RKT is less likely to occur than conventional knowledge transfer due to the greater effort and risk associated with such transfer and adaptation (Hsu & Iriyama, 2016).

I adopt the construct of technical fit to capture this technical aspect of knowledge characteristics; this has been recognised as an important dimension in the technology transfer process (Ansari et al., 2010). Technical fit in my thesis means the degree to which the characteristics of a subsidiary's knowledge are compatible with the technologies already in use at the HQ. This represents not only technical similarity internally within a MNC (micro-level), but also the similarity of the external knowledge network (macro-level), such as the supply chain network, between HQ and subsidiary, given that subsidiaries are embedded in their local business networks which influence their knowledge creation (Meyer et al., 2011). On the subsidiary's side, knowledge fit relates to its technical knowledge foundation and characteristics (Rogers, 2010). On the HQ's side, knowledge fit relates to its technological base and absorptive capacity (Cohen & Levinthal, 1990). In my thesis, focusing on the context of RKT, I deal with HQs' absorptive capacity, based not only on absolute

accumulated knowledge at HQs but also on the technical compatibility of subsidiaries' knowledge for HQs.

Technical fit offers important implications for the connection between a subsidiary's knowledge characteristics and the role of HQ attention to RKT (Ambos et al., 2006) which have been paid rather little attention in the extant literature. On the one hand, a high level of knowledge fit implies low risk of failure; i.e. there is less time and effort spent in terms of the adaptation and application of the subsidiary's knowledge at the HQ. One example of technical fit is the transfer of the Six Sigma methodology in the 1990s; one reason GE was more successful than Motorola in implementing this approach was that it already had a good technological foundation in quality management and human performance management that were quite compatible with Six Sigma. Thus GE was better positioned than Motorola to generate value from the processes required by the Six Sigma approach (Birkinshaw & Mol, 2008). On the other hand, HQ attention is influenced by prior cognitive orientation (Ocasio, 2011) and thus a HQ tends to avoid analysing information that runs counter to its previous experience and knowledge (Monteiro, 2015). I argue that high technical fit can capture HQ attention to a subsidiary's knowledge and recognition of its potential benefits, as HQ commitment to learning from a subsidiary is less in the context of RKT (Yang et al., 2008).

The extant literature has extensively considered the concept of organisational fit (Kostova & Roth, 2002; Venkatraman, 1989), while traditional discussions of fit have tended to emphasise the static matching of organisations to a particular context variable (Ansari et al., 2010). I adopt technical fit from the dynamic perspective in the context of RKT (Zajac et al., 2010), which may involve the knowledge receiver, the HQ, in developing its absorptive capacity through its cognitive investment during knowledge transfer, thus influencing the technical fit between itself and the subsidiary over

time. Little research has examined how HQ attention connects with the subsidiary's technical fit from the longitudinal perspective, which is addressed in my empirical case study. Thus:

Proposition 3: HQ attention to RKT is closely associated with technical fit of subsidiary knowledge.

3.3.2 Legitimacy of knowledge and HQ attention to RKT

In addition to the technical aspect of knowledge characteristics, I argue that the social aspect of a subsidiary's knowledge also has important implications for how HQs adapt and apply that knowledge (Gupta & Govindarajan, 2000; Minbaeva, 2007). Drawing on legitimacy theory of organisations (Deephouse & Suchman, 2008; Suchman, 1995), I focus on the compatibility of the subsidiary's knowledge with the context of the HQ – i.e. knowledge legitimacy, whether a subsidiary's knowledge can be accepted and appreciated by its HQ for wider use based on its beliefs, norms and practices (Cohen et al., 1996). Legitimacy, a central concept in institutional theory, has been conceptualised as the perceived consonance of an entity with the socially constructed set of values, norms, beliefs and practices in its context, and has received much attention in the literature (Deephouse & Suchman, 2008). However, few scholars have looked into legitimacy of technology and knowledge (Bergek et al., 2008; Markard et al., 2016). I apply the notion in the context of RKT, looking into the legitimacy of the subsidiary's knowledge, and arguing that one critical task in the process of RKT, compared to conventional knowledge transfer, is to legitimise the subsidiary's knowledge at the HQ (Yang et al., 2008). What does knowledge legitimacy mean? Dewey (2008) offers an illuminating example: in achieving medical services, many patients legitimatise their medical knowledge by using the language and perspective already accepted in the medical / psychological field, so they conform to practitioners' power and can thus be viewed as credible

and worthy of 'sought-after' treatments. The study of such cognitive and behavioural mechanisms for RKT is scarcer than for technical fit.

Subsidiary knowledge that is perceived to be relevant and beneficial is not guaranteed to be accepted and appreciated by HQs depending on their beliefs and practices in relation to that specific knowledge domain (Kostova & Roth, 2002). If a subsidiary's knowledge is well accepted, compatible with the HQs' established practices, appreciated and perhaps even endorsed by the HQ, it possesses a high degree of legitimacy (Markard et al., 2016). Knowledge legitimacy is essential for resource mobilisation and successful development in the knowledge transfer process (Bergek et al., 2008), but it is neither given nor purely emergent (Markard et al., 2016). Instead, knowledge legitimacy is created in a collective, social process that remains subject to contingencies (Johnson et al., 2006). With the shift of the relational context of knowledge transfer in RKT, knowledge that is widely used, valued and taken for granted by the subsidiary may be much less so by the HQ (Hall & Soskice, 2003).

The existing literature highlights the question of the legitimacy of novel knowledge and suggests that one critical task in the process of knowledge transfer from one place is related to the legitimation of the knowledge at another place (Kostova & Roth, 2002). By providing particular rules and regulations, norms and values, as well as cognitive frames for certain knowledge and not others, HQ institutions (meso-level) may constitute a critical part of the context for adaptation and application of a subsidiary's knowledge (Fortwengel, 2017). How HQ attention connects with such knowledge legitimacy dynamics, i.e. changes in the alignment of a subsidiary's knowledge in the context of the HQ, is what I am interested in. Thus:

Proposition 4: HQ attention to RKT is closely associated with legitimacy of subsidiary knowledge

In sum, research on knowledge theory highlights the different natures of perspectives on knowledge, namely as a resource (Grant, 1996; Gupta & Govindarajan, 2000) or as a process of knowing (Cook & Brown, 1999). I adopt a socio-technical perspective to integrate these two dimensions (technical fit and legitimacy) and offer important implications by considering both the technical and social characteristics of knowledge in the context of RKT (Bijker, 2011; Spender, 1996). Although both sides of knowledge have been separately highlighted in the existing literature (Ansari et al., 2010) as important dimensions for knowledge transfer, I argue that these two dimensions of a subsidiary's knowledge characteristics tend to co-exist and they are likely to work in an interactive way in the context of RKT, which serves as a theoretical preunderstanding for my empirical case study. Specifically, technical fit and legitimacy do not necessary coincide, and misalignment in either of these two dimensions may lead to high transfer risks or low acceptance at HQs (Zajac et al., 2010). My second argument, building on the dynamic perspective of knowledge fit and legitimacy (Zajac et al., 2010), highlights the critical role of the HQ, not as a cognitive entity, but through its managerial process, i.e. its attentional mechanisms (Ocasio, 1997) for engaging in RKT. Previous research has highlighted that knowledge transfer can be organised and coordinated in different ways at the recipient unit (Gupta & Govindarajan, 2000; Håkanson & Nobel, 2000; Millar & Choi, 2009). However, there is still no clear mapping of how knowledge characteristics in the two dimensions, technical fit and legitimacy, may be related to each other over the course of the knowledge transfer, or of how HQ attention may consequently connect with the technical fit and legitimacy of the subsidiary's knowledge and combine with other interactional factors to enable distinctive RKT outcomes.

3.4 Initial construct and conceptual model

My thesis leverages the RKT setting as a research context to advance our understanding of the mechanism of HQ attention in RKT, making use of the lens of process, and how a MNC may benefit over time from HQ attentional mechanism in terms of leveraging its subsidiary knowledge. To gain a deep understanding of this relatively under-explored subject, I attempt to build an initial construct by reconceptualising HQ attention as process and the conceptual model in linking between HQ attention, knowledge characteristics, interactional factors and RKT outcome (Figure 2) as well as summarise the four explorative propositions (Table 4). This conceptual model is concerned with two building blocks: HQ attention to RKT as a process that centres on HQ recognising, sense-making and exploiting the subsidiary knowledge and, its connection with subsidiary knowledge characteristics (technical fit and legitimacy), interactional factors and RKT outcomes. These are linked together as the key explorative explanation how RKT occurs over time in a MNC. Previous research has highlighted the importance of knowledge characteristics for RKT in comparison with conventional knowledge transfer (Yang et al., 2008); however, the social aspect of knowledge characteristics (i.e. legitimacy) has largely been ignored. I build on the socio-technical aspect (Trist, 1963) by integrating the two dimensions, technical fit and legitimacy of the knowledge characteristics in the context of RKT, and argue that these dimensions of subsidiary knowledge characteristics tend to co-exist and are likely to work in an interactional way in the context of RKT. Further, I highlight that the challenge for MNCs in managing RKT is to reconcile the changing dynamic between knowledge technical fit and legitimacy. Further, this conceptual model suggests that HQ attention to RKT is not only related to the HQ per se as a cognitive entity, but also is influenced by subsidiary knowledge characteristics (technical fit and legitimacy) and interactional factors between the HQ and the subsidiary. I also posit that paying attention is not

enough in itself for MNCs, but HQs also need to have appropriate means to facilitate RKT, as their ability to do so evolves through attention to RKT. This study aims to extend attention theory (Bouquet & Birkinshaw, 2008; Ocasio, 1997; Yaniv, 2011) in the context of RKT by exploring the mechanism of HQ attention to RKT and how a MNC may benefit over time from HQ attentional mechanism in terms of leveraging its subsidiary knowledge. This conceptual model remains temporal before my empirical case study which will make up a platform for a refinement of the initial conceptual model. I will elaborate on this in Chapter 4.

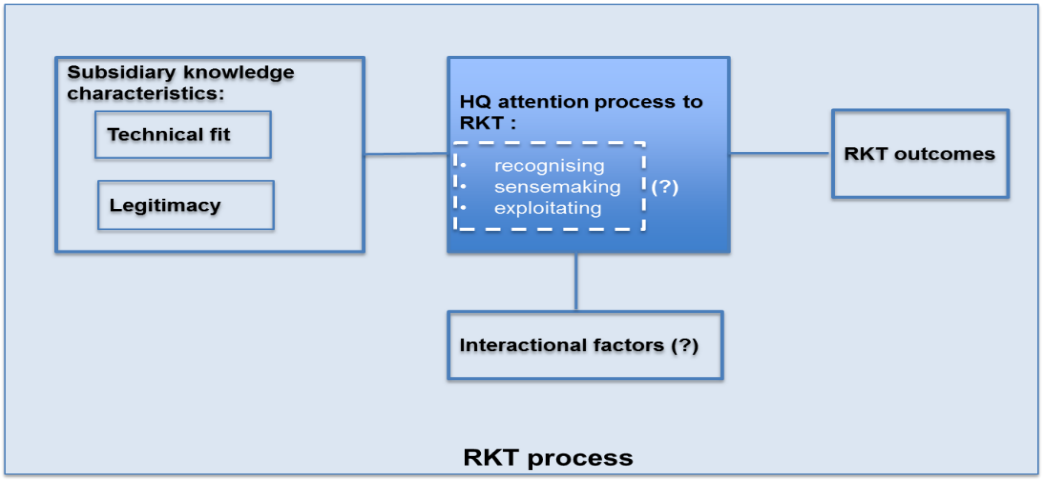


Figure 2: Initial construct and conceptual model of HQ attention to RKT

Table 4: Summary of the four propositions

Proposition 1	RKT provides a unique asymmetry through which HQ attention plays an important role to enable wider use of subsidiary knowledge at the HQ, and over time, HQ may benefit from devoting its attention to RKT in terms of leveraging its subsidiary knowledge in the international market.
Proposition 2	HQ attention to RKT is not an object that a MNC can obtain but a set of managerial processes through which HQ recognising, sense-making and exploiting the subsidiary's knowledge for wider use at the HQ.
Proposition 3	HQ attention to RKT is closely associated with technical fit of subsidiary knowledge.
Proposition 4	HQ attention to RKT is closely associated with legitimacy of subsidiary knowledge

Chapter 4: Research Method

This chapter describes and justifies how the research in this thesis is conducted. It reiterates the research questions presented in Chapter 1, provides an overview and justification of the choice of critical realism philosophy, and explains the choice of the qualitative case study method. The chapter includes an overview of the case study method, with a discussion of four RKT events across time within a single organisation. It describes the backgrounds of the selected case and explains how interviews were used to collect data. It provides information on where the interviews took place, how the interviewees were selected and how the interviews were conducted. Furthermore, it discusses the importance of trust between interviewees and interviewer. Information is also provided on additional data collection and how the data has been used for the analysis. The chapter concludes with a discussion of validation, reliability and ethical issues in qualitative case study research and how these were addressed in this research.

In order to explore the mechanism of HQ attention in the context of RKT, I adopt a longitudinal case study approach by following multiple RKT events in a single organisation across time (Yin, 2013). I use the case study approach, as much information and process-based data (Langley & A., 1999) can be collected through analysis of cases. This has enabled me not only to address my research questions relating to how HQ attention connects with subsidiary knowledge characteristics and RKT outcomes, but also to develop an in-depth understanding of HQ attention to RKT using the lens of process, and of how MNCs benefit from HQ attention to RKT over time. I incorporate both the HQ and the subsidiary in my data collection allowing me to account for the influence of different perspectives on knowledge transfer across hierarchical and geographical boundaries, and to identify the key factors without losing the discerning elements.

4.1 Research philosophy / paradigm

As presented in Chapter 1, the research questions addressed are:

RQ1: How does HQ attention affect RKT?

RQ2: How do knowledge characteristics and interactional factors combine to influence HQ attention to RKT?

RQ3: How does a MNC benefit over time from HQ attention in terms of leveraging the knowledge?

The research presented in this thesis attempts to achieve two goals by exploring: 1) how knowledge characteristics, interactional factors and HQ attention combine to influence RKT; 2) how MNCs benefit from HQ attention to RKT over time. My empirical research is underpinned by critical realism (Sayer, 2010). One aim of critical realism is to identify the mechanism that leads to certain outcomes; how any particular mechanism actually does or does not operate varies depending upon the context (Fleetwood, 2005). RKT is a fairly new and under-researched phenomenon (Ambos et al., 2006; Håkanson & Nobel, 2000). Firstly, the positivist approach would not generate an appropriate answer to research questions of an explorative nature. The nature of positivism is its nomothetic epistemological stance, which implies the existence of regularities in material or social settings that provide the basis for both explanation and prediction (Easton, 2010). Further, the crucial problem is that constant conjunction of elements or variables does not adequately provide insight and answer the 'how' question (Sorrell, 2018). As Michailova & Mustaffa (2012) argued, research on subsidiary knowledge flows is clearly biased in favour of quantitative examination. Thus, positivism does not help address my 'how' research questions. Finally, I have also found limitations on interpretivism in the context of my research, which in general deny the possibility of knowing what is real and reject the possibility of discerning causality (Easton, 2010). For

example, what is not clear in the interpretivist approach is how to judge which single interpretation is to be better than others.

In this thesis, I argue that critical realism is strongly justified in offering a way forward for addressing my research questions (RQs 1, 2 and 3). Critical realism emphasises identifying the mechanisms (RQ1) and how they work (RQ3), and discovering if they have been activated and under what conditions (RQ2) (Sayer, 2001). Critical realism is a relatively new approach to ontological, epistemological and axiological issues involving an awareness of the limitations of positivism and interpretivism (Somerville, 2012). It seeks to bridge some long-standing divisions within the social sciences between positivism and interpretivism (Sorrell, 2018). The primary goal of critical realism is not to predict or to interpret, but to *explain* – in other words, to develop empirically supported theories and posit hypotheses about why, how and under what conditions particular phenomena occur (Sorrell, 2018). The aims of my thesis are to address the mechanism of HQ attention in the context of RKT and how it connects with knowledge characteristics and RKT outcomes, and to generate an in-depth understanding of 'how a MNC benefits from HQ attention to RKT over time'. The critical realist approach helps to clarify that HQ attention to RKT is a mechanism that is present in managerial processes, rather than a static commodity or object that MNCs can obtain, and that it becomes a capability over time through which MNCs can leverage the subsidiary knowledge in the international market.

4.2 Research design

The recognition, sense-making and exploitation of subsidiary knowledge for wider use in a MNC through HQ attention is processual, evolutionary and path-dependent in nature, which can only be uncovered through long term data (Peeters et al., 2014; Yaniv, 2011). To gain a deep understanding

of the mechanism of HQ attention to RKT, I have adopted a single longitudinal case study method (Yin, 2013) for this research. Critical realism provides a very powerful justification for the use of case studies, as they offer the possibility of studying a problem-defined situation in great detail (Easton, 2010). The case study method is suitable for studying complex social phenomena using multiple sources of evidence and is typically used to answer questions like 'how' or 'why', or to explore a contemporary phenomenon in a real-life context (Yin, 2013). Its strengths, especially in exploring new phenomena and building new theories, are that it has less potential for research bias than theory built from incremental studies or axiomatic deduction, because it deals with the constant juxtaposition of conflicting realities, which tends to "unfreeze" thinking (Eisenhardt, 1989).

4.2.1 Case selection

I have selected and portrayed a longitudinal case study design by tracing four RKT events (Yin, 2013) at a Chinese subsidiary of a medium-sized American high-tech MNC (EBS) which leads in the gas detection industry. The gas detection market is regionally categorised into North America, Latin America, Western Europe, Eastern Europe, Asia and Pacific (APAC), and the Middle East and Africa. APAC and the Middle East are expected to be the most lucrative markets for gas detection systems due to their increasing industrialisation and commercial activities. Developing countries like China, India, United Arab Emirates and Saudi Arabia have heavily invested in commercial and industrial infrastructure. See Chapter 5 for a detailed introduction to the gas detection industry.

A worldwide leader in people protection and safety product innovation and development, EBS started in the 1970s, based in the US, and launched its Chinese subsidiary in 2000, based in

Shanghai. EBS's main products include detection instruments which keep people safe from hazardous gases generated in dangerous workplaces, such as mines, oil and gas installations, and aerospace stations. EBS produces a variety of gas detector products, ranging from portable detectors (battery-operated devices used to monitor the working environment) to fixed gas detectors (mounted near operational areas in workplaces). In addition to gas detectors, EBS provides customers with a software-based service so they can outsource their safety management activities to EBS. Over the last two decades, the institutional environment has been experiencing a significant change in the emerging countries (Iyer, 2016). The EBS HQ has been shifting its focus from leveraging the Chinese subsidiary from a local market explorer and low cost production base initially into an important source of knowledge for jointly developing a technological solution with the centralised R&D centre at the HQ in response to global change in regulatory requirements. This elevates the need for RKT between the Chinese subsidiary and the EBS HQ. For these main reasons, EBS is an interesting and appropriate setting for studying the effect of HQ attention to RKT across borders and across time.

The multiple RKT events produce rich descriptions of the contextual setting (Yin, 2013), which allows me to explore the mechanism of HQ attention in relation to knowledge characteristics and RKT outcomes. I trace the four RKT events across time in a single organisation, which provides the insight for a better understanding of how the MNC benefits from HQ attention to RKT over time. By conducting the historical process of the tracing of an organisation over time, I obtain a rich context in which to investigate how HQ attention to RKT evolves over time as the subsidiary experiences a variety of changes across different development stages and influences the MNC's ability to leverage its subsidiary's knowledge.

In sum, the integration of a four-RKT-event design across time with a single organisation is appropriate for this study, as I am studying an under-explored phenomenon (Balogun & Johnson, 2004; Eisenhardt & Graebner, 2007) with the aim of answering my process-based research questions. As Birkinshaw et al. (2011) argued, in order to understand "the complexities of emergent and evolving phenomena", such as in this research, it is often inappropriate to engage in large-scale, cross-sectional studies or reductionist methods in the absence of a well-developed theory. Focusing on a single organisation with only one subsidiary as a critical case (Flyvbjerg, 2016), I can control for factors beyond the scope of this study, such as rivalry for attention between subsidiaries, to allow key causal links to emerge. I adopt the RKT event as the unit of analysis which enables me to collect fine-grained data and develop a granular focus to understand the mechanisms of HQ attention to knowledge (Alexander & Hearld, 2009), which has largely been ignored in previous research on RKT.

4.2.2 Multiple-RKT-event design

I use temporal bracketing strategy (Langley & A., 1999) to facilitate an embedded multiple-RKT-event design. I have conducted a process of tracing the four RKT events (A/B/C/D) (see Table 5) at EBS's Chinese subsidiary over 18 years. In order to test the emergent abductive themes developed from the explorative theoretical framework and to explain the observations, I deliberately incorporated a RKT event (B) that failed to test alternative explanations to account for these phenomena (Timmermans & Tavory, 2012; Yin, 2013). The subsidiary experienced a variety of strategic stages, including local market exploration and learning, autonomous local research and development, transfer of local knowledge to a global centralised R&D function, and return of localisation. The temporal bracketing approach has been endorsed especially for process-based

research design (Langley & A., 1999; Langley et al., 2013). I use this strategy not only as a way of structuring the description of the RKT events in the case, but also as a way of offering opportunities for my structuring of the process analysis and sense-making of the empirical data. This has given me a rich context in which to investigate the under-explored phenomenon of RKT from subsidiaries in developing countries to HQs in developed countries and the role of HQ attention in the RKT process over time. These four RKT events covered a range of different types of RKT in the specific research contexts, enabling me to adopt a granular focus (Alexander & Hearld, 2009) to understand HQ attention to each knowledge creation and transfer project and its effects on knowledge transfer from its Chinese subsidiary to the American HQ.

Table 5: Background information on the four RKT events

Four RKT events in EBS	**RKT event A**	**RKT event B**	**RKT event C**	**RKT event D**
RKT background	EBS is already a leading worldwide manufacturer providing high-end industrial safety products. It has been in China since 2000 to explore the market. There is pressure from a global competitor to develop a compliance (i.e. low cost-based but effective) product. The Chinese subsidiary is being leveraged to develop a new compliance product in response to this global competition.	EBS's Chinese subsidiary initiated a product redesign (i.e. new configuration based on the existing compliance product) for the Chinese market which may also apply in the HQ's home market. EBS HQ shifted its attention to global-oriented centralised R&D at the HQ. The project redesign for the worldwide market is called off.	The global energy industry downturn means EBS global revenue dropped after 2014 but China became its new growth point. New Chinese regulation in 2014 required modification of the existing products, affecting around 50% of EBS business in China. There is a need for the centralised R&D centre at the HQ to work out the solution for this technical issue by leveraging its global knowledge network.	EBS's Chinese subsidiary initiated a product solution which may address the global compliance market for EBS in line with its new strategy enhancing that technology. It was rejected initially by EBS HQ but won acceptance finally after being legitimated through reframing of the purpose and audience of the technology by the HQ.
RKT occurrence time	2001 - 2002	2011 - 2012	2015 - 2016	2017 - 2018
The knowledge being transferred	Integration of existing HQ product knowledge with EBS's local subsidiary's engineering know-how and supply chain knowledge.	N/A (project called off)	Localised technology innovation at EBS subsidiary combining local regulatory, competitor and supply chain knowledge.	EBS subsidiary's product enhancement technology combining with local supply chain and manufacturing knowledge.

4.2.3 Data collection

I study these four RKT events at EBS from 2001 to 2018. Choosing a point in time to collect data is a critical step in the process of conducting longitudinal research (Pettigrew, 1990). September 2015 was an appropriate point to start this study process, firstly because RKT event C had just occurred, so I could collect the data for RKT events C and D in real time from the beginning. Secondly, there was a great opportunity when the EBS HQ revisited its global product and technology development strategy established between the HQ and its Chinese subsidiary. I became involved in the discussions and came to have a good understanding of previous RKT events involving transfer over time from EBS's Chinese subsidiary to the HQ, which helped us to achieve very rich retrospective data for RKT events A and B. See Figure 3 which summarises the data period and data collection time.

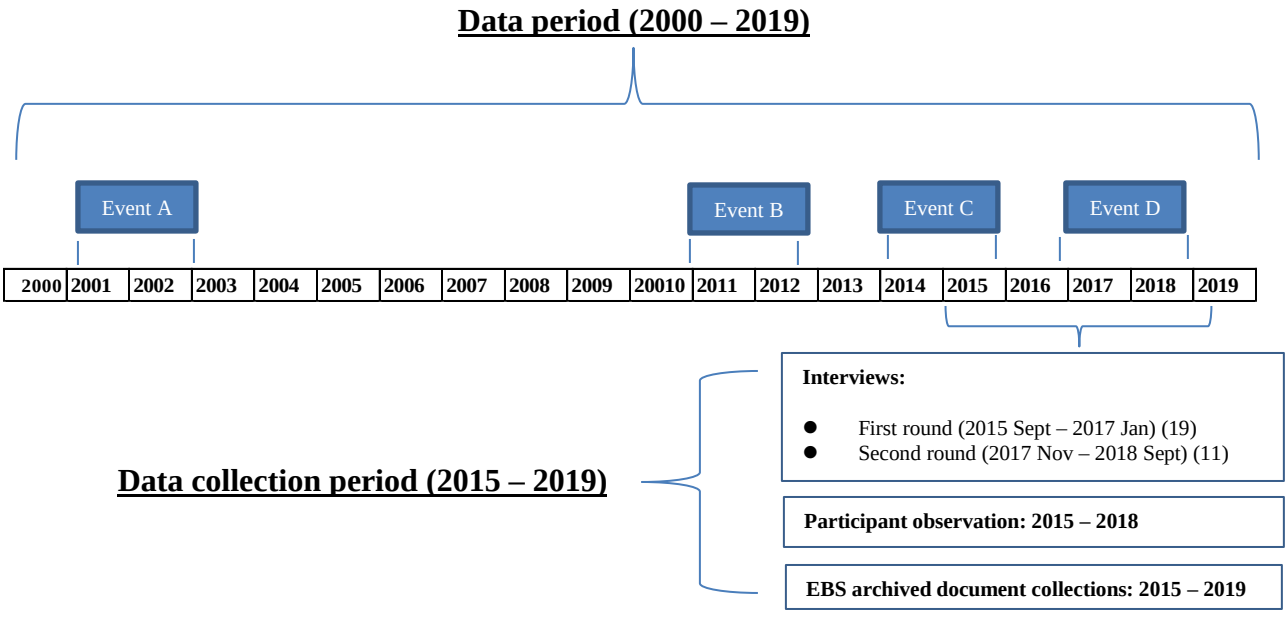


Figure 3: Summary of data period and data collection time

I gathered extensive empirical materials, incorporating a variety of primary and secondary sources, including participant observation, semi-structured interviews and the company's archived documents (Eisenhardt, 1989). The participant observation data helped me to perceive reality from a viewpoint within the case rather than one external (Yin, 2013) to the RKT events and to investigate the social process of the knowledge transfers from the subsidiary to the HQ. Semi-structured interviews with both EBS HQ and subsidiary managers formed the main method of data collection as these are flexible enough to facilitate exploration of under-examined phenomena (Yin, 2013). By means of 546 archival files (more than 2,000 pages) and 30 semi-structured interviews with 19 members of current and former staff of both the HQ and the subsidiary between September 2015 and September 2018, I collected a reliable and rich data set for my longitudinal single case study. See Figure 4 for a summary of the data triangulation in my research.

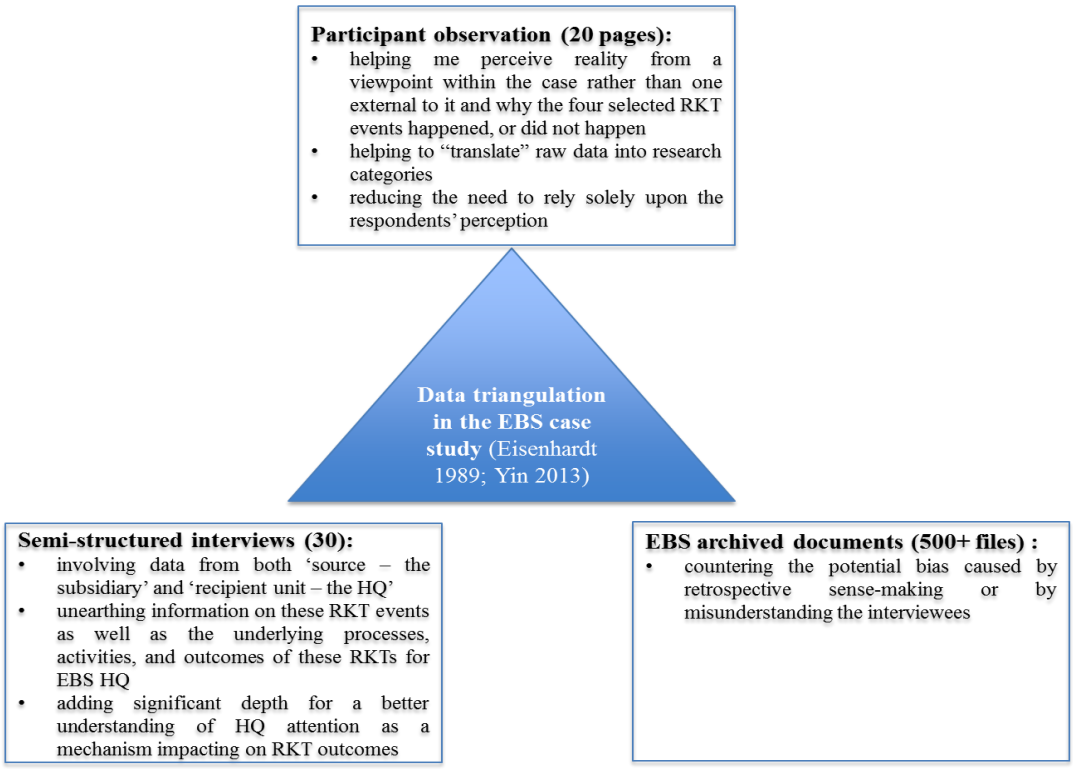


Figure 4: Data triangulation in the EBS case study

Participant observation:

Participant observation, as a method, has provided me with certain unusual opportunities for collecting 'insider' information regarding the technical and social aspects of the subsidiary's knowledge characteristics, and has helped to 'translate' raw data into research categories, given that both interviewees and participant observers share a jargon common to the knowledge transfer process (Yin, 2013). As an employee and key decision-maker at the subsidiary of EBS, I had several good opportunities to be involved in strategic discussions about the technological knowledge transfer from EBS's Chinese subsidiary to its HQ in the US. These participant observations have helped me to perceive reality from a viewpoint within the case, rather than one external to it, and to focus on why the four selected RKT events happened, or did not happen. Direct observation has brought many benefits, including reducing the need to rely solely upon the respondents' perceptions of the technical fit and legitimacy of the subsidiary's knowledge with respect to the HQ, and giving insight into the dynamic process of HQ attention to RKT. I collected data by attending weekly project meetings (RKT events C and D), and monthly EBS global product roadmap meetings whenever the four RKT events were addressed or discussed. I used journals to take 12 sets of notes (more than 20 pages) from these meetings and discussions, and verified the accuracy of my participant observations through informal discussions with other people from EBS who were involved in the same field meetings in order to manage the potential biases, given my mixed role as both a researcher and an insider in the company (Meyer, 1992).

Interviews:

As this study is about HQ attention to RKT between a subsidiary in China and its HQ in the US, I targeted interview participants from different levels of the hierarchy and from different functions,

including the HQ's CEO, COO, vice-president, directors, managers and engineers and a previous subsidiary head, as well as subsidiary managers and engineers, all of whom are key stakeholders and decision-makers in these RKT events. This study thus involves data from both 'source – the subsidiary' and 'recipient unit – the HQ', promising to offer a deep insight into the process of RKT. Due to logistical constraints, I held two interviews via telephone, with the COO and the previous subsidiary head, while the other interviews were all conducted face-to-face in China or the US. The interview with the global president was unstructured, encouraging him to share his insight into how the EBS HQ attended to the subsidiary's knowledge, how that knowledge was adopted and applied at the HQ, and how it affected EBS's global business and competitiveness. The rest of the interviews were semi-structured, with a limited number of key questions, but were managed in a narrative interview style (McCormack, 2004). See Table 6 for a summary of the interviews in the EBS case study.

The interview protocol started with questions about the interviewee's role and responsibility in EBS and their involvement in the selected RKT events (A/B/C/D). To capture the outcomes of these RKT events, the respondents were first asked to answer questions focusing on whether the identified technological knowledge of the subsidiary pertaining to the selected RKT events was transferred and used by the EBS HQ. The respondents were then asked to provide information on the outcomes of these RKTs at the EBS HQ and how the HQ benefited from these. In line with the theoretical framework developed above, special attention was paid to the role of HQ attention in these RKT processes and the distinctive context of the subsidiary's knowledge in terms of its technical fit and legitimacy at the HQ. To capture the dimension of HQ attention, I asked respondents not only to indicate the level of HQ attention (i.e. *time* and *effort*) but also the direction of HQ attention in these RKTs and how it affected the RKT outcomes. These interviews, aiming

to unearth information on these RKT events, as well as on their underlying processes, activities and outcomes for the EBS HQ, added significantly more depth to the understanding of how HQ attention as a mechanism impacts on RKT outcomes. In total, more than 1,665 minutes of interview material were collected and most of the interviews were transcribed.

Table 6: Respondents in 30 semi-structured interviews between September 2015 and September 2018

RKT event #	Unit	Respondents	Total time in minutes (number of interviews)
A	HQ	R&D engineer	60
	HQ	Quality director	60
	HQ	CEO	30
	Subsidiary	Subsidiary head	30
	Subsidiary	Service manager	60
	Subsidiary	R&D engineer	60 (2)
	Subsidiary	Production line leader	60
	Subsidiary	HR director	60
B	HQ	Quality director	60
	HQ	Project manager	60
	HQ	Engineering director	60
	HQ	R&D director	60
	HQ	Vice-president	30
	HQ	COO	45
	Subsidiary	Service manager	30
	Subsidiary	R&D engineer	60 (2)
	Subsidiary	Project manager	120
C	HQ	CEO	30
	HQ	Engineering director	60
	Subsidiary	Project manager	60
	Subsidiary	Engineering director	60
D	HQ	Engineering director	120 (2)
	HQ	R&D director	90
	HQ	Vice-president	60
	Subsidiary	Product manager	120
	Subsidiary	Engineering manager	60
	Subsidiary	Manufacturing director	60

Archived documents:

While interview material is an excellent source of contextualised data, it is also known to suffer from certain weakness, such as retrospective sense-making (Eisenhardt & Graebner, 2007). In order to counter these potential biases, the data were triangulated, and a large case study database was created, in which 546 corporate archived files were included. For this database, I accessed EBS's internal documents, such as CEO speeches, meeting minutes, presentation slides, and lessons learned from product development projects. These documents helped me to corroborate and enrich the data I had collected from the participant observations and interviews. I also obtained objective evidence of HQ attention to these RKTs in terms of visible and supportive dimensions (Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008).

4.2.4 Data analysis

To disentangle the process dynamics of HQ attention to RKT, I adopted an 'abductive' approach (Timmermans & Tavory, 2012) that builds on a critical realist perspective, with the three strategies in combination for my process data analysis including narrative, temporal bracketing and visual mapping (Langley & A., 1999). Data analysis involved three broad steps through iterations between writing narratives, coding and revisiting the literature (Easton, 2010; Guzman & Trivelato, 2008). The research process is described in Figure 5.

First, the case material was initially chronologically ordered to allow the process of transfer to emerge over time in the four RKT events. I initially followed the three themes of HQ attention to RKT derived from the literature: recognition, sense-making and exploitation of the subsidiary's knowledge at the HQ. This led to the creation of case narratives, which were not only descriptive in indicating the evolution of the RKT events over time, but also analytical in describing the dynamics of the EBS HQ attention to these RKTs as a process over time. Furthermore, I also used

the visual mapping strategy followed with a narrative for each RKT event as an 'intermediary' step between the raw process data and a more abstract conceptualisation (Langley & A., 1999). The visual process mapping of each RKT event allowed the simultaneous representation and understanding of the factors at multiple levels across time and space between the HQ and subsidiary that shaped EBS HQ attention to its subsidiary's knowledge. As such, this visual mapping strategy offered me a means of data reduction and synthesis in my longitudinal case study (Langley & A., 1999). Through this, I looked for indicators, such as attitude and speed of adoption at the HQ in relation to the knowledge being transferred, suggesting whether or not the subsidiary's knowledge was recognised and understood, and how the HQ made sense of the knowledge and thus exploited it.

In the second step, I continued to refine the themes through an iterative process by moving back and forth between the primary and secondary data through my fieldwork and the literature (Eisenhardt, 1989). I shared my research among a community of inquiry and presented it at international academic conferences (see The Author), which stimulated the refinement of my theoretical constructs (Timmermans & Tavory, 2012). Through revisiting the coding, memo writing and transcriptions, I recognised a new theme emerging through the process of EBS HQ making sense of its subsidiary knowledge, which I initially called *legitimation*, indicating a process of legitimising the value of the subsidiary knowledge in the eyes of the HQ. I then turned to the literature and reviewed the work on legitimation, which has featured to a small extent within the IB literature in the context of knowledge transfer (Kostova, 1999; Liao & Yu, 2012; Markard et al., 2016; Suchman, 1995). This review suggested that the legitimation process through HQ attention may have both a cognitive and an evaluative side. This implied that the legitimation process in the context of RKT may not only be related to the initial characteristics of subsidiary knowledge stock

(i.e. technical fit and legitimacy) but also to other factors at different levels that could be facets of relational, spatial and temporal emergence (Langley et al., 2013). This therefore inspired me go back to the fieldwork and the empirical data to seek any indicator that may shape the HQ legitimation process. By doing that, I sought a situational fit between observed evidence and the newly emerged theoretical theme (Timmermans & Tavory, 2012). By iteratively condensing the content of the time-ordered matrices, I synthesised what was happening during the different stages of the RKT events and why certain decisions were made by the subsidiary and the HQ, and then identified the mechanisms of HQ attention to RKT through recognition, legitimation and exploitation of its subsidiary knowledge at the HQ.

In the third and final step, applying the 'constant comparative' method of analysis (Gibbert & Ruigrok, 2010), I actively searched for evidence that would contradict my emerging analytical insight (Ewan Ferlie et al., 2005). When evidence conflicted, I reiterated between the data and the emerging model to reconcile the evidence through deeper probing of the meaning (Eisenhardt, 1989). I developed a conceptual model of the mechanism of HQ attention to RKT and how EBS benefited from HQ attention in terms of leveraging its subsidiary knowledge over time. See Appendices 3-5 for the coding of these themes that emerged in the Findings and Discussion section. Drawing on multiple sources of evidence, such as the participant observations, the interviews and the company's archived documents, I eliminated measurement errors (Yin, 2013). By doing so I managed to increase as much as possible the fit between our emerging observations and the empirical material.

4.3 Validity and reliability

Credibility of qualitative research is based on construct validity, internal validity, external validity and reliability (Patton, 2005). Construct validity was adhered to in the data collection phase by developing a detailed and comprehensive literature review covering the main research constructs (Strauss & Corbin, 1990). Internal validity was established through 'constant comparison' techniques of within- and cross-RKT event analysis between the current data and previous literature (Eisenhardt, 1989). Adherence to external validity was achieved through analytical generalisation by providing a clear rationale for the case sample selection (Eisenhardt, 1989). Reliability allows for replication of the case study and this was achieved through recording all face-to-face interviews, carefully transcribing them in the native language and presenting accurate extracted data in the findings section (Yin, 2013).

4.4 Ethical issues

To ensure the confidentiality of the company and participants, the company name of EBS was anonymous and a confidentiality agreement was included in the research project. Moreover, participants had the right to not answer any question that they considered an invasion of privacy or of confidential company information. The individual responses were kept confidential and are only known by the participants, the research supervisors and the researcher. Great care has been employed to maintain anonymity and confidentiality.

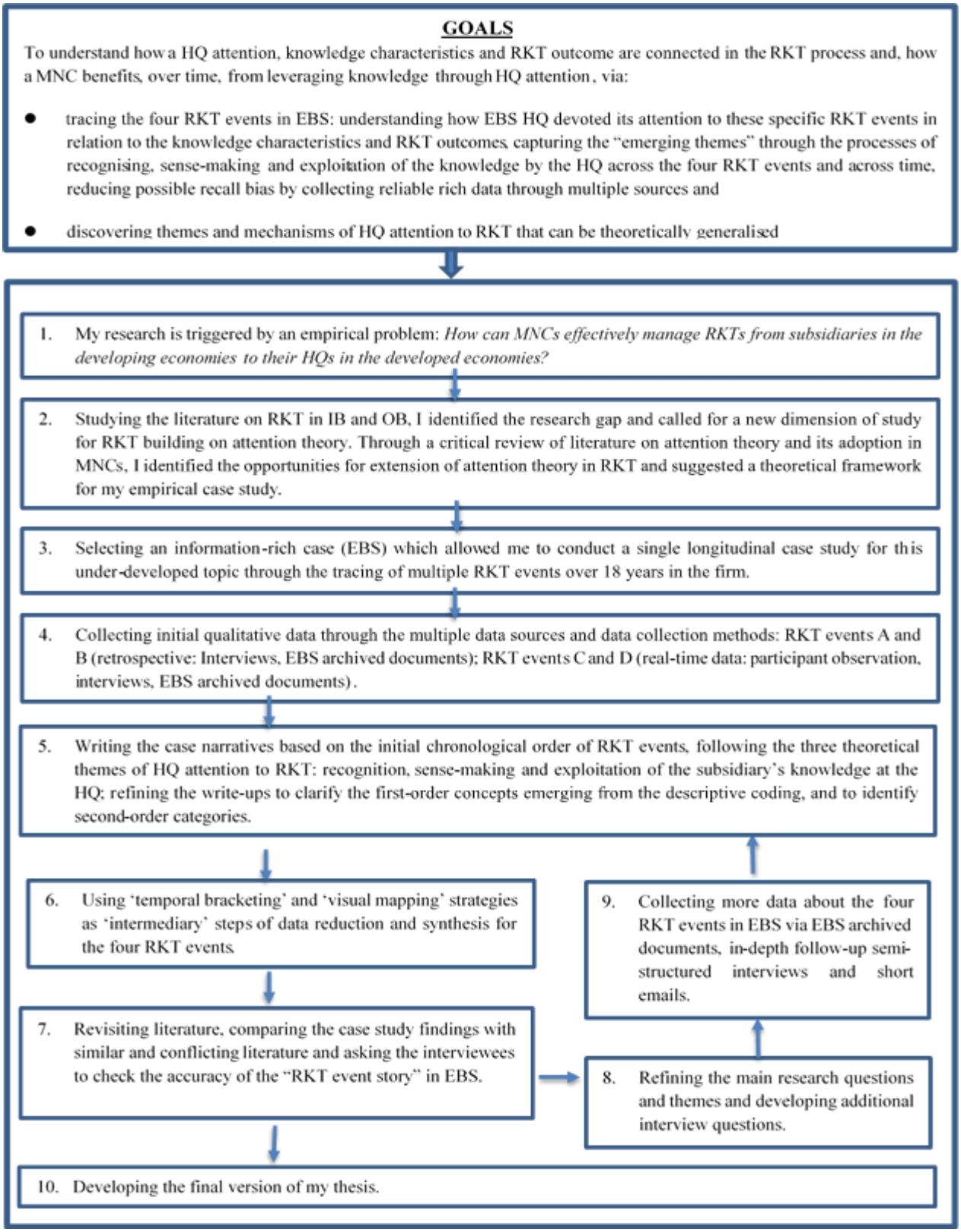


Figure 5: The research process of a single longitudinal case study of EBS

Chapter 5: Case Study

In this chapter, I first give the background to the gas detection industry, its technology and regulatory requirements, following this with the narratives of the four RKT events (A, B, C, D) in EBS from 2001 to 2018, and summarising the findings across the four RKT events. The aim of this chapter is to provide the narrative over time of the four RKT events that occurred within EBS and the role played by the EBS HQ attention in these RKTs in association with its subsidiary knowledge characteristics and the RKT outcomes.

5.1 Case background

5.1.1 The gas detection industry

Even as government agencies, safety organisations, and employers strive to eliminate deaths at work, there are workers dying every day from injuries incurred on the job (Janocha, 2013). According to an American Federation of Labor and Congress of Industrial Organizations report (AFL-CIO, 2018) on the state of health and safety protections for America's workers, 5,190 workers lost their lives at their jobs as a result of injuries in 2016. Each day in the US, an average of 14 workers die because of workplace injuries – women and men who go to work, never to return home to their families. The cost of these injuries and illnesses is enormous, estimated at 250 billion to 360 billion dollars a year. Despite improvement in workplace health and safety conditions, there are too many workers who remain at serious risk of injury, illness or death from chemical plant explosions, major fires, collapsing buildings and so on. Occupational injuries can happen anywhere worldwide and at any time.

The modern era in the gas detection industry began in the 1990s when the Occupational Safety and Health Administration (OSHA) in the US adopted a very significant piece of legislation, The Confined Space Act of 1993, 29CFR1910.146. For the first time, workers were required, by law, to use a real-time, 'direct reading' instrument to determine if the atmospheric conditions were safe prior to entering a permit-required confined space. Similar regulations and laws quickly followed in Canada and other countries around the world. These acts, which were designed to prevent injury and death in confined space accidents, have resulted in the proliferation of the use of portable gas detectors. The key drivers of the gas detection market are stringent government safety norms, growing investment in energy-related industries such as oil and gas, chemical industries, mining industries, and increasing commercial and residential infrastructure development. From a regional perspective, North America, Latin America, Eastern Europe and Western Europe together contributed 50% of the global gas detection market in 2014, with the Asia-Pacific region, excluding Japan, contributing 35%, making it the largest geographical segment in the global gas detection market (ISHN, 2015).

5.1.2 Gas detection technology

A gas detection system is a combination of equipment or machines that detect, measure and indicate the concentration of certain gases in the air via different technologies. They are widely used to avoid toxic exposure and fire for fire crews, safety managers, law enforcement personnel, environmental consultants, confined space telecommunications, electrical and utility workers, and many others. The products are usually battery-operated devices and are found in workplaces for safety purposes. Typical gas detectors include two categories, portable and fixed detectors. Portable gas detectors can help workers monitor their personal exposure by detecting toxic or flammable

gases in an individual workers' breathing zone. Alarm settings on the instruments are used for this, and are generally related to physical and toxic characteristics of a specific gas. Fixed gas detectors are permanently installed to monitor the ambient air. Both portable and fixed gas detectors can have single or multiple sensor points connected to a common display, alarm, and calibration control.

Sensor technology is the foundation of any gas detector, whether portable or fixed, and the cornerstone of accurate compliance reporting. The sensor types applied are varied, including toxic sensors, combustible gas sensors and oxygen sensors. Every sensor has its capabilities and limitations. If the capability of a sensor does not match the application, the sensor's limit is exceeded, which means inaccurate data and premature wearing out of the sensor. Electrochemical sensors have traditionally been used for detecting toxic gases and oxygen. Other widely accepted sensing technologies include flame ionisation detectors, photoionisation detectors, and dual beam non-dispersive infra-red sensors. Another key component of a gas detector is the battery. All portable gas detectors are battery powered, using either primary or secondary cells. The batteries are the main energy source and hence, of primary importance to the product certification process (Sheriff & Lochhead, 1994).

Gas detection equipment usage and maintenance are considered to be very complex. In terms of usage, products require a basic understanding of hazards (e.g. gas stratification), knowledge of the action steps to be taken when there is an alarm, and comprehension of the display (e.g. gas readings, battery life), no matter how simple the operation is. For maintenance though, the level of complexity can be even higher. Tremendous infrastructure is often necessary to ensure proper management of function testing and calibration procedures, documentation, management of the calibration of gaseous materials, instrument maintenance and repair. The evolution of gas detection technology spans the period of gas monitoring, reducing complexity by offering accessories that

automate troublesome tasks such as function testing, calibration and record keeping, and providing a proactive service solution by addressing not only the customer's safety but also the productivity of operations.

5.1.3 Gas detection regulations

Given that the gas detector is a sophisticated piece of modern electronic instrumentation, which enables complete protection of the user through monitoring hazardous areas for flammable and toxic gases, it has to conform to the necessary standards to ensure it is safe when used in such a hazardous area. There are many reasons for certifying gas detection products for reliability. Gas detection systems can be very complex, requiring extensive knowledge to competently review them for compliance with applicable codes and accepted standards. One requirement is to ensure the safety of electrical equipment particularly in hazardous areas. This has been formalised in many countries into a legal requirement to have the equipment certified by an independent third party authority (Sheriff & Lochhead, 1994). On the one hand, these regulations require the owner or operator to ensure the process is designed in compliance with recognised and generally accepted good engineering practices; on the other hand, the regulations also require an analysis that evaluates the safety systems (such as interlocks, detection) that are in place to mitigate hazards.

A number of organisations have published standards and recommended practices relating to gas detection systems, such as the International Electrotechnical Commission (IEC), the International Society for Measurement and Control (ISA), and Underwriters Laboratories (UL). Since 2004, China has required all mines, construction firms and producers of hazardous chemicals, fireworks and civilian explosives to obtain a 'safe production license', which needs infrastructure and equipment to meet safety demands (ISHN, 2004). The same technical standards do not apply

internationally, so the need for product certifications has to be addressed country by country in order to obtain approval for products that a company might sell in the region.

Reviewing safety systems for third party certification or approval by the authority which has jurisdiction is complex. Many of the technical standards are generally performance-based and do not specify product configuration or architecture. In different countries, the level of performance testing may vary considerably. For example, Australia has a standard based on the Canadian requirements which has fairly comprehensive performance testing but very few industrial gas detectors have been tested with it in that country, whilst in the US there are major differences in performance testing between the two main testing authorities for gas detectors (Sheriff & Lochhead, 1994). In addition to the standards themselves, there are the interpretations of the guidelines in the standards by the individual certification authorities. These interpretations may vary considerably between one authority and another, even within the same country. This has important implications for a gas detector manufacturer, as there is sometimes difficulty in achieving compliance, particularly where innovative design concepts are used which have not been seen by the certification authority in one country, but have been approved by the certification authority in another country.

5.1.4 EBS in the gas detection industry

As a worldwide leader in people protection and safety product innovation and development, EBS is dedicated to eliminating deaths on the job. The main EBS products include portable gas detection instruments that keep people safe from hazardous gases generated in dangerous workplaces such as mines, oil and gas fields, and the aerospace industry. Besides producing instruments, EBS has also provided customers with a software-based service since 2003 based on a different philosophy,

safety as a service, which produces critical data about an organisation's detection programme, addressing not only the safety issue for customer, but also productivity. This service was leased and docked by EBS at users' stations, providing real-time readings for detector alarms, exposure and usage. This helps make workers safer by providing transparency with respect to gas detector alarms, exposure and usage. This software-based service solves common challenges faced in gas detection programmes related to reliably maintaining equipment, and ensuring proper usage of instruments in the field. EBS has seen tremendous success with this service business, especially in the North American market since 2006 (see Appendix 2).

Many of the capabilities for a MNC that are the foundation of competitiveness are grounded in knowledge (Spender & Grant, 1996). This is particularly the case for a MNC for whom competitive advantages in international markets rely on leveraging its global dispersed subsidiary knowledge network. EBS is a small to mid-sized high-tech company in the safety industry. Its home-based advantages (i.e. those developed at the HQ based in the developed country) are not enough for sustaining its competitive advantage in international markets. It is the leveraging of not only low cost-based resources but also of transforming technological knowledge, and even localised innovation by its subsidiary in China, that are crucial to EBS in succeeding internationally.

5.2 Introduction to the four RKT events in EBS

5.2.1 RKT event A: reverse transfer of new product development

Figure 7 provides a summary of the time line of key activities that EBS HQ and its subsidiary engaged in through RKT event A. As China was booming in the energy industry (including mining, and oil and gas), heavy investment in commercial and industrial infrastructure made it one of the most lucrative markets for gas detection systems. In order to address the gas detection market in

China, EBS China was established in August 2000 as a wholly owned subsidiary of EBS Corporation. Before that, EBS had established a joint venture with a Chinese partner in the 1990s, but this failed after three years due to conflicts between the partners over strategy and values. In the same month of 2000, Subsidiary Head A was also assigned to Shanghai by the global chief executive officer (CEO A) to launch EBS's Chinese subsidiary. Before Subsidiary Head A was asked to move to China, she was working as the vice-president of global research and development (R&D) of EBS.

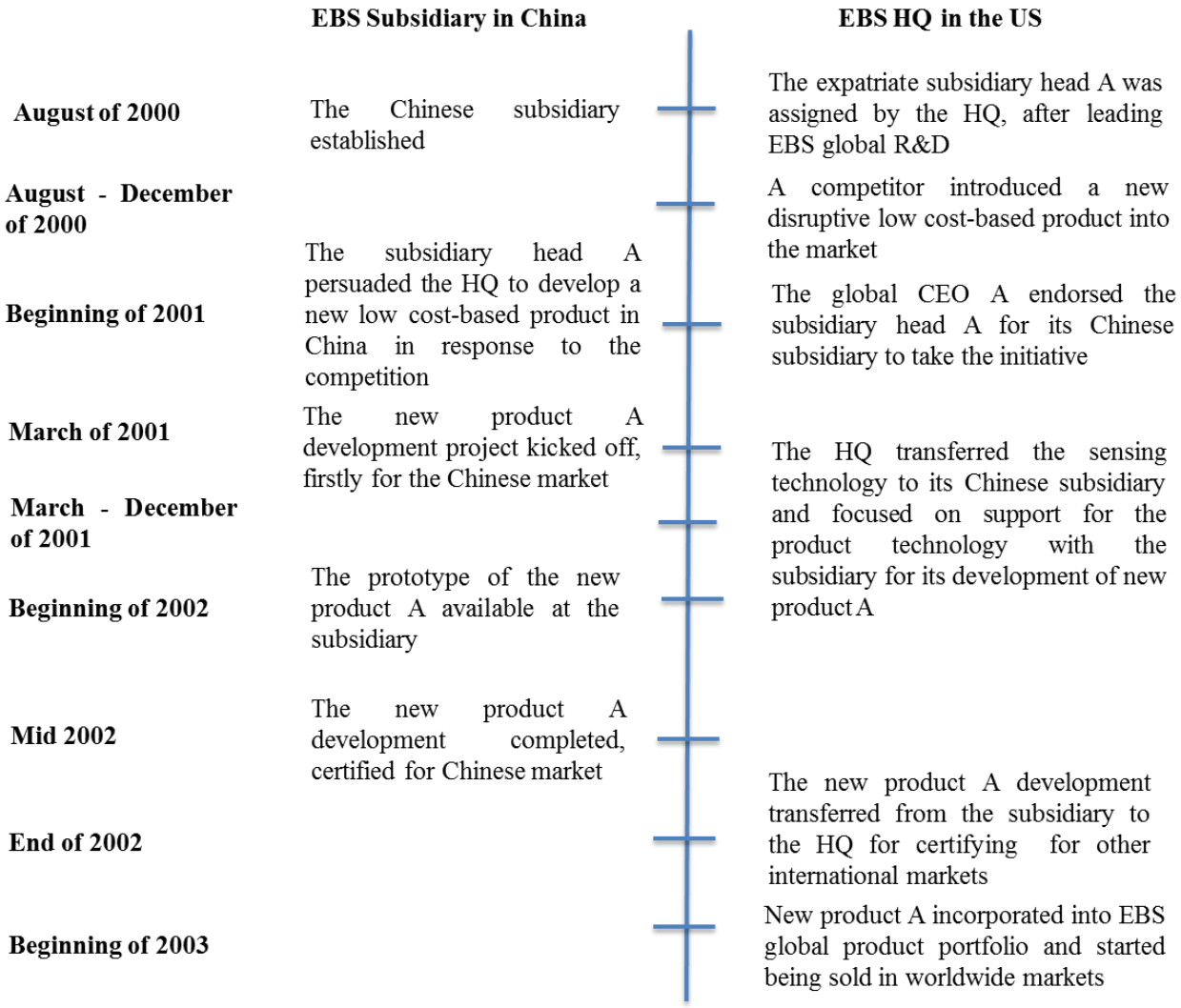


Figure 7: Time line of key activities that EBS HQ and its subsidiary engaged in during RKT event A

Like a lot of technology-based foreign companies, at the early stage of EBS China, products and technologies were introduced from its HQ to explore the market in China. The transfer of gas sensor production at the beginning of 2001 was the first key milestone for both the subsidiary and the company as a whole. Sensor technology is the core of a gas detection system. Sensor production was a highly labour-intensive (i.e. substantial manual assembly activity throughout the manufacturing process) and tacit knowledge-intensive process that required highly skilled and experienced operators to work on chemical processes using microscopes. This happened not only because of the strong confidence the EBS HQ had in the Chinese market, but also because of the prosperous Chinese labour market and robust supply chain ecosystem, known as the 'world's factory' and providing high-skilled, low cost labour resources. Thus, the EBS HQ had a strong belief in production in China to serve the worldwide market.

During this period, the Chinese subsidiary was not only acquiring knowledge from the HQ, but was also developing an in-depth understanding of the needs of local customers. With only a few international players in the market, EBS China grew its business and increased its market share quickly. Consequently, EBS China also gained autonomy and accountability in providing products and solutions to serve the local market.

Recognition of the subsidiary's knowledge at the HQ:

At the end of 2000, one of EBS's competitors introduced a new 'toy-like' gas detector (i.e. plastic, lightweight and low cost) that was disruptive to the market because the conventional design of gas detectors used a metal case. EBS recognised a need to design a similar lightweight and low cost product in order to compete globally. By having both an in-depth understanding of EBS products

and technologies, having served as EBS global R&D vice-president at EBS HQ before moving to China, and with an increasing understanding of the Chinese market, EBS's Chinese Subsidiary Head A talked to the CEO A and suggested that the Chinese subsidiary should take the initiative. This was agreed by the CEO A, and thus EBS's Chinese subsidiary started on the design of a new low cost and maintenance-free gas detector (i.e. product A) in March 2001, serving primarily local Chinese customers first, then exploring the market in the rest of the world.

Sense-making of the subsidiary's knowledge at the HQ:

The technology for the development of this new product through EBS China's R&D activities involved manufacturing and supply chain know-how from China and certain product design knowledge transferred from the HQ in the US. Most of this engineering and manufacturing know-how was then held by individuals at the subsidiary. EBS China had a fairly small team at that time leading this new product development project, including the two engineers possessing mechanical and electrical skills under the leadership of Subsidiary Head A. These two engineers, who were hired locally and were very experienced, together with another local sensor engineer and Subsidiary Head A, were recognised and named by the HQ as the 'four guardian warriors' in the Chinese subsidiary's R&D team (a HR director at the subsidiary). The electronic engineer was in charge of both hardware and firmware design for product A, which benefited from good integration of the hardware and software parts, considering the 'big picture' of the product property at the early stage of its development. This was critical for a new 'compliance' (i.e. simple and low cost-based) product design because simplicity and time-to-market are the key success factors in responding to market competition. In addition to the design engineers, a local production team was also set up in order to support the new product A development and local production in China. Some talented

people with rich manufacturing backgrounds and experience were hired locally. A production line leader, who was involved in the product development, recalled:

> My perception was that EBS was struggling with the building of some circuit board samples for product A when I joined the company at the beginning of 2002… I was asked whether I had experience in the hand-soldering of circuit boards. In the end, I completed the manual soldering of six circuit boards as one of the tasks in my interview. The electronic engineer was fairly satisfied with my work. At that time, EBS China did not have a systematic production manufacturing capability but relied on personal experience until investment in the new production line in 2006.

Despite a relatively small team and a simple working environment during the initial period of the subsidiary in China, the team had good morale. A research and development engineer at the subsidiary, who was involved in the new product development team, recalled:

> It was a great time. We did not know whether we would succeed given that there was nothing we could learn from the past. But the HQ, especially our global CEO, gave great autonomy and trust to the Chinese subsidiary. Consequently, the Chinese subsidiary had time to learn and accumulate new knowledge and experience. Everybody, including our driver, had a strong desire to succeed so we could demonstrate to the HQ that the Chinese subsidiary had the ability to design a good product. The schedule was very tight because of the competition in the market. There was strong teamwork under the great leadership of Subsidiary Head A. She was always holding conference calls with the R&D team at the HQ to discuss the product design issue in the middle of the night in China.

Along the way, there were inevitable conflicts between the Chinese R&D team and the global R&D team at the HQ. This went beyond the technical discussions, and concerned alignment of priorities related to the time-to-market of new products and project management practices. In order to achieve alignment between the HQ and the subsidiary at this time, Subsidiary Head A had to spend as much as half of her time at the HQ working with cross-functional teams on the new product development. In addition, top management support from the HQ was also indispensable for 'winning acceptance'. A quality director at the HQ, who was involved in the project, recalled:

> Chinese Subsidiary Head A was very straightforward, and thus not all engineers in the global R&D team bought into and supported the project, although she used to lead the global R&D function at the HQ. There was also a conflict in the project between her and other people at the executive level. I, as a software engineer, had a lot of debate with her at that time. And I was told by somebody that I may be fired if CEO A was there or knew that.

In the end, the new product A was successfully developed by mid-2002, serving the Chinese market first. Furthermore, this new product was also strongly embraced by EBS HQ. Despite its compact size, the product included features usually found only in high-end gas detectors including a large, liquid crystal display (LCD), internal vibrating alarm, audible / visual alarms and simple push-button operation. Another advantage of the new product was its 'simplicity'. "A very simple design, for instance, by using a changeable battery, benefits us by quickly achieving the global certifications for this new product at the HQ", as noted by a research and development engineer at the HQ.

Exploitation of the subsidiary's knowledge at the HQ:

In order to achieve the international certifications for addressing the global market, the new product technology started to transfer from the Chinese subsidiary to the global R&D and certification teams. The substantial technological knowledge (e.g. product circuit boards, mechanical drawings, and product specifications and descriptions) of the new product had been documented at the subsidiary and could be directly transferred through the EBS documentation system. However, there were also intensive discussions about the new product between the global R&D team and the chief mechanical and electronic design engineers at the Chinese subsidiary, as well as Subsidiary Head A in order to transfer the product knowledge from the Chinese subsidiary to the EBS HQ so the global certification engineers could communicate about and manage the testing with the international certification agency at the HQ. In some cases, the global certification engineers focused on clarification of the test requirements with the HQ's certification agency. In that case, EBS HQ delivered the requirement according to feedback from the home country's certification agency to the design engineers at the Chinese subsidiary, who directly helped to make an adaptation for the product and drive the product knowledge transfer.

The successful new (i.e. low cost-based) compliance product technology transfer from the Chinese subsidiary to the HQ at the end 2002 helped EBS to close a critical gap in its global product portfolio as they previously focused on high-end gas detection technology. The product was successfully introduced into the global market and became "a hot saleable product" for EBS for more than 10 years (Chinese Subsidiary Head B). See Figure 7 below for the details.

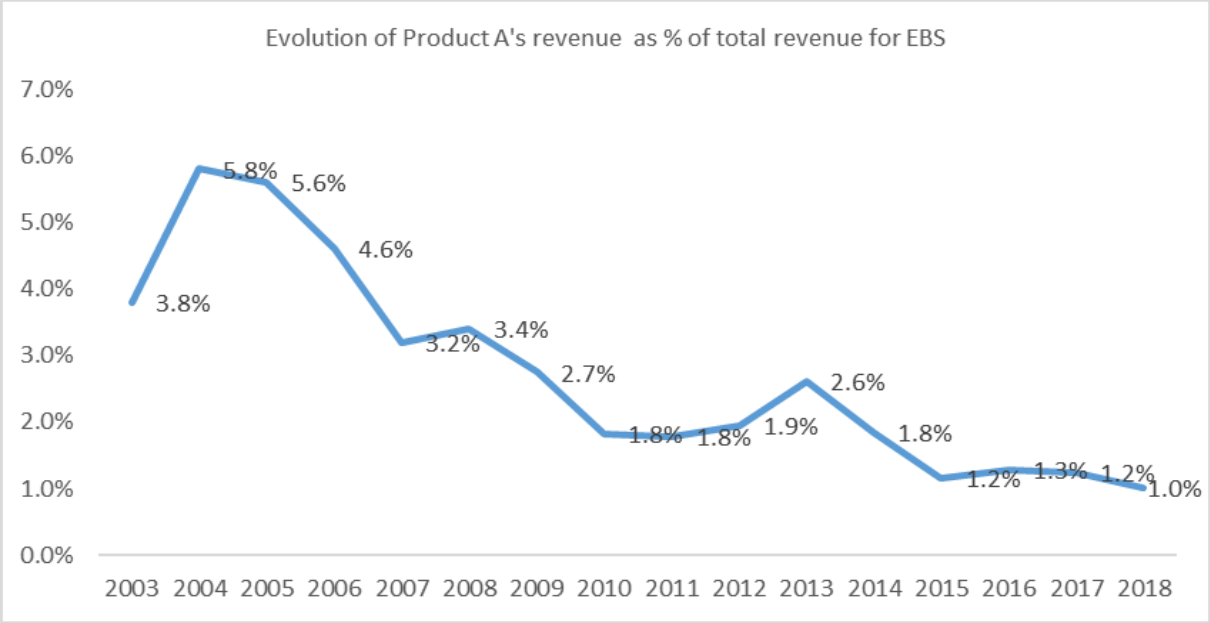


Figure 7: The revenue evolution of Product A as a percentage of EBS total revenue (2003-2018) (Source: EBS production team internal archive file)

5.2.2 RKT event B: project called off and RKT failed

Recognition of the subsidiary's knowledge at the HQ:

Figure 8 provides a summary of the time line of key activities that EBS HQ and its subsidiary engaged in through RKT event B. Through conversations with Chinese Subsidiary Head B at EBS HQ, a new single gas instrument redesign had been triggered at the end of 2010. In March 2011, Chinese Subsidiary Head B and the project manager at the subsidiary, together with the global R&D leadership team, met at the HQ to review a business case for a single gas instrument redesign that would leverage the existing product A design. After this meeting, a project for the product redesign (product B) based on product A moved into the planning stage.

In April 2011, the project manager at the subsidiary created a project plan for product B. The project would be covering two scopes. The first would add a new configuration for an updated

mechanical housing for product B, reusing much of the existing design for product A, and would obtain related certifications for the Chinese market. The second would add the configuration which was already present in existing product A into this new housing and obtain global certifications. A product requirement document that was initially developed in June 2011 was refined in August 2011 along with the project plan based on comments from the EBS global R&D team.

The technology for the redesign of product B involved the HQ's product knowledge and the subsidiary's local supply chain knowledge. The engineering team at the subsidiary was actively engaged in creating the concept design, the system level requirement documentation, and test plans, as well as in conducting experiments and analysis to investigate technical challenges with this project. The teams, including Technical Service, Marketing, Manufacturing, and Supply Chain groups at the subsidiary, and the Product Management team at the HQ, were also actively engaged at the early stage of the execution of the project.

Substantial detailed design work was quickly launched at the subsidiary. For instance, a prototype circuit board was designed by the subsidiary engineering team, reviewed by a global team, then updated, laid out, ordered and assembled at the subsidiary. A mechanical design was also completed, reviewed at the Chinese subsidiary only, and prepared for tooling. A supplier was also selected as the primary plastics supplier. Some firmware development took place on the first version of the prototype circuit board, but the code was not taken to feature completion or reviewed outside of the engineering team at the HQ. Certification initiated projects that addressed both the Chinese and global situations in parallel.

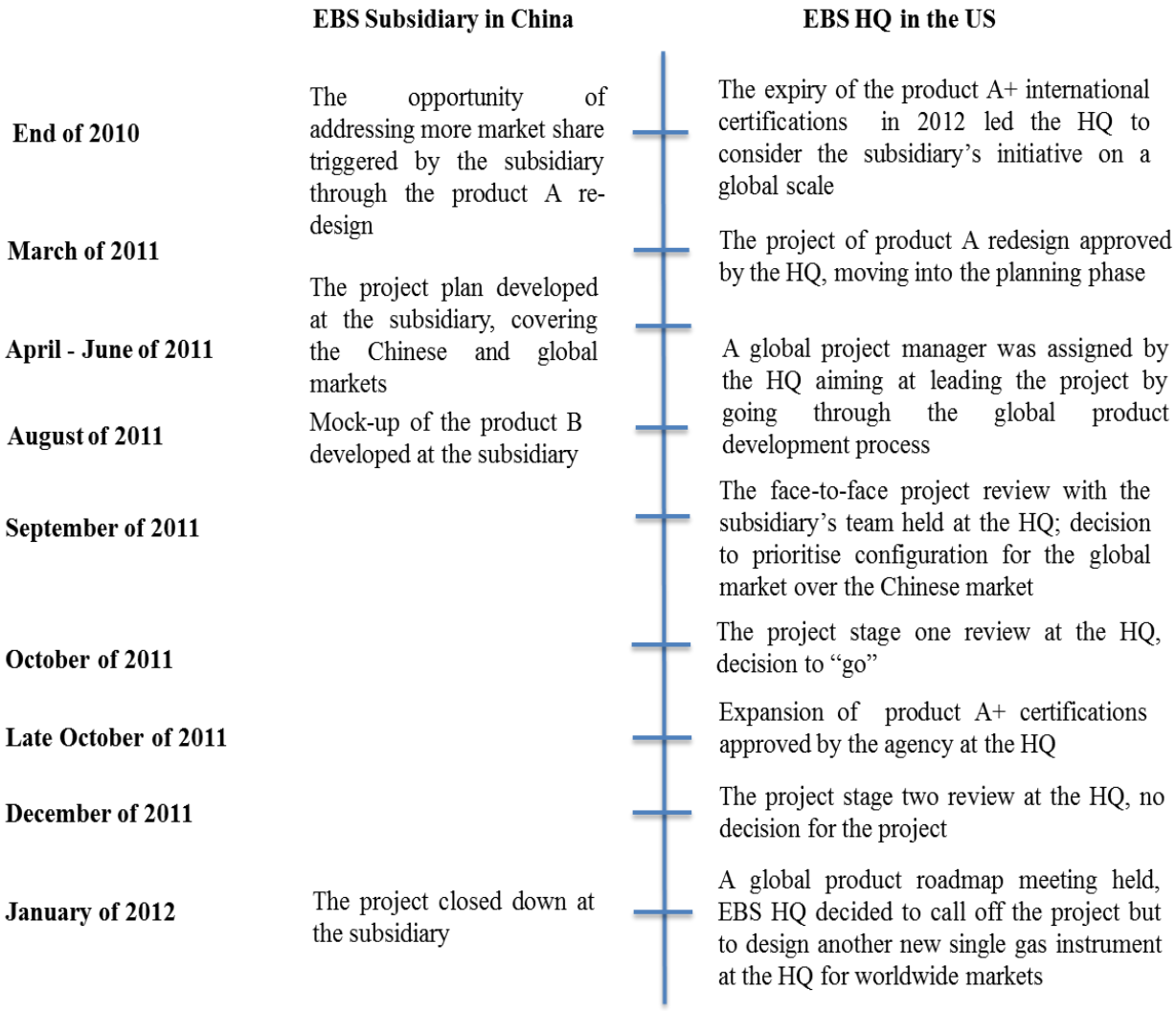


Figure 8: Time line of key activities that EBS HQ and its subsidiary engaged in during RKT event B

Sense-making of the subsidiary's knowledge at the HQ

The team was originally planning a Q4 2011 launch to target both the Chinese and global markets. The urgency was due to regulations which would cause an EBS high-end single gas detection instrument (Product A+, in the same product portfolio as Products A and B) to lose its international certificate in July 2012, which would deeply cut sales and drive the obsolescence of the product.

There was a desire to coincide the launch of product B at the Chinese subsidiary with the launch of a new project at the HQ.

During the execution phase, there were no official project gate reviews, and the project's status was not regularly reported to the leadership at the HQ until August 2011. In August 2011, a project manager at the HQ was identified by the global engineering director to take the project of product redesign through the global product design flow (a process and principles guiding new product development or product modification for EBS) by working with the project manager at the Chinese subsidiary. During August 2011, the two project managers, one from the HQ and one from the subsidiary, initiated discussions to take stock of the project's state and involved other functional managers at the HQ in discussing the project and representing their groups through the product design flow. Training related to global product design flow was also provided to the Chinese subsidiary.

In late August 2011, the Chinese subsidiary team looked to take the mechanical design to tooling with the selected plastics supplier. The project manager at EBS HQ requested via email to delay tooling until the supplier's processes and the product flow processes had been followed. There was a miscommunication, however, and the Chinese subsidiary team met with the supplier, resolved misunderstandings regarding their processes, and started tooling. This was prior to any official product gate review. It was not until the project manager at the subsidiary visited the HQ in mid-September in 2011, that the project manager at the HQ learned that tooling had been initiated. The decision was then made to put it on hold immediately. The project manager informed the supplier and confirmed that tooling was put on hold until further notice. The two project managers also met with other groups at the HQ to plan and work on the project. During the conversation with the Product Management team and a review of a mock-up of the potential mechanical design for

product B, it was decided that product B's size, based on existing product A and increased to accommodate the new configuration, was too large to be successful in the global market. It was decided that the project scope would change to provide two instruments, keeping the existing product A size for one configuration and the larger size for another configuration. The Product Management team at the HQ updated the product requirement documents and prioritised the configuration for the global market over the configuration for the Chinese market, with the hope that both could launch at the same time.

In September 2011, an email was sent to relevant members of the corporate executive committee and the project team announcing the official formation of the global product design flow team intended to take the project through that process. In October 2011, the stage one review was held as part of the product design flow process. The decision was a 'go', with a direction to address product cost concerns. The engineering team at the subsidiary performed a cost analysis and conducted a process to assess and drive down the product cost.

In late October 2011, the international certification agency notified EBS HQ that they would extend the deadline for product A+ from July 2012 to July 2016. Following a monthly project roadmap meeting in November 2011, attended by all members of the corporate executive steering team and the Product Management team at the HQ, the decision was made to change the project scope, to only specifically target the Chinese market. No global certification for product B would be pursued. A stage two review was held in December 2011, attended by all members of the corporate executive. This meeting did not result in a decision on the project. Not all leaders were in alignment with the direction of the project and the value of the new product B.

Exploitation of the subsidiary's knowledge failed and the RKT project was called off:

In an effort to get to a decision prior to the Product Roadmap meeting week, which would occur during the Chinese New Year, the project manager at the HQ initiated a meeting in January 2012, attended by all global corporate executives except Chinese Subsidiary Head B, to discuss and align the direction of the project. The decision was to launch a new, global (low cost-based) single gas compliance instrument at the HQ with a completely new design and supporting all configurations that were offered in the global market within the next two years, in light of:

- the change in one product's expected life due to change in certification timing;
- the discussion leading to a compelling value positioning for a new global product;
- the belief in 'one-size-fits-all' by centralising the product design and modification at the HQ to address worldwide markets.

This was also indicated in a statement by the COO at the HQ in 2012:

> New product development at EBS was very slow in the past years. The company developed only one new product every two years. My expectation is that we develop at least two new products every year. In order to achieve this goal, we must adopt a 'centralisation' model. This means one global product development team, based at the HQ, and one global new product development process, which should be adapted from the existing 'gate review model'. With these measures, we can guarantee the efficient procedures and consistent quality, which is the foundation of fast innovation.

This new global product would replace existing product A, likely within one quarter of being launched. Given that decision, proceeding with the product B redesign could not be justified as it would have to be taken off the market within four to five quarters of being launched. EBS HQ

decided that the project should be cancelled. In February 2012, the project team met to ensure the project was closed down.

5.2.3 RKT event C: reverse transfer of localised technical innovation

In 2014, EBS experienced an overall decline in business with the downturn in global energy industries, such as oil and gas, which had previously been the main customers of the company, in addition to the pressure from market competition and changes in local regulations and technology standards, e.g. China Compulsory Certification on safety and fire alarm products (CCCF). EBS urgently needed a solution to modify its products in order to produce and sell them in China while complying with the new local technical regulation. According to the new standard, around 60 percent of the products that EBS was selling in China would be included in its scope, potentially cutting by around 50 percent EBS's total revenue in China. And most urgently, EBS needed at least one product certified by CCCF by the end of 2015 as a 'pass' for joining a central bidding process organised by a large Chinese customer at the beginning of 2016. See Figure 9 for a summary of the time line of key activities that EBS HQ and its subsidiary engaged in during RKT event C.

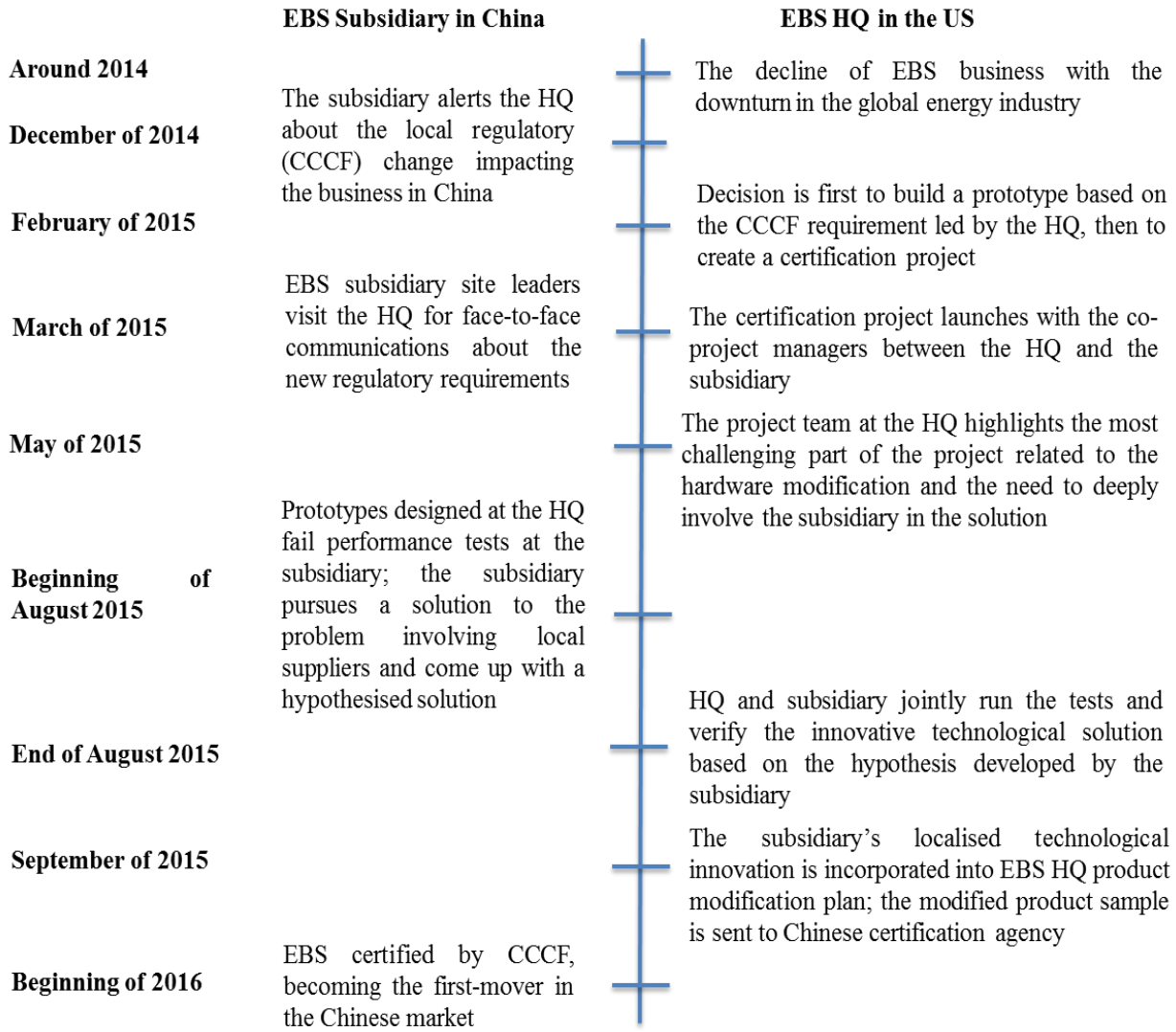


Figure 9: Time line of key activities that EBS HQ and its subsidiary engaged in during RKT event C

Recognition of the subsidiary's knowledge at the HQ:

The first message was shared with the global R&D team at the HQ by a certification leader in December 2014 as a 'heads-up'. It was then followed up by Chinese Subsidiary Head B via email with the corporate executive team at the HQ, including the global COO, the operations VP, the senior product management director and the engineering director. The discussion was to come up with a plan to build a prototype based on a given product to be identified as quickly as possible in

order to submit it to the Chinese test agency, CCCF. In February 2015, the decision was that, according to the discussion between Chinese Subsidiary Head B and the global engineering and product management leaders at the HQ, a prototype based on a given product (i.e. product C) would first be produced at the HQ in the US and then a certification project would be set up through the formal EBS global product development process to complete the entire product modification. This decision was also due to the fact that all new product development and modification for EBS customers worldwide were managed and controlled at the HQ since the adoption of the 'one-size-fits-all' strategy in 2012. By doing so, EBS HQ believed that they would learn about the test requirements and criteria as well as the options in the certification project, given that the CCCF technical requirement for the battery performance, especially at low temperatures, was a common challenge for all safety instrument manufacturers. It was also decided that a product management engineer at the HQ would coordinate the building of the prototype globally, and the Chinese subsidiary team was in charge of translating the technical requirements documents from Chinese into English and helping to clarify any questions of ambiguity relating to the translated documents.

In order to achieve a better alignment with the HQ in terms of the level of priority and urgency devoted to the compliance product for the Chinese market, as well as more detailed clarification of the CCCF requirements, the Chinese subsidiary invested significant time and effort in communicating with the different teams at the HQ. In March 2015, the Chinese operations vice-president at the subsidiary paid a visit to the HQ and presented the topic at the EBS global monthly product roadmap meeting and answered questions from more than 30 members of the audience, including corporate executives, the function leaders and senior engineers at the HQ. This visit to the HQ and the face-to-face communications not only gave a holistic view of, and background to the new regulatory requirement, but also highlighted the potential risks and challenges in terms of

the product modifications. As a result of this meeting, a formal certification project was launched at the HQ in order to support the Chinese CCCF certifications. The goal of the project was to achieve the CCCF certification for product C, which was selected and decided by the end of 2015. In parallel with this, co-project managers were assigned from both the HQ and the subsidiary to jointly lead the project management. It had been recognised by the HQ that the success of the project depended on involving strong collaboration and teamwork between the HQ and the subsidiary.

In order to move the project forward, one of urgent tasks was to finalise as soon as possible the prototype in order for the Chinese agency to give their first feedback and approval. There were three major components and challenges with building the prototype that needed to be incorporated into the project. These included the firmware changes that were in progress at the HQ, changes to the manual and relevant documentation which were mainly driven by the subsidiary, and hardware changes including the mechanical parts and the battery. The changes in the hardware were the most challenging part. Although a lot of work had been done by the global product management team at the HQ, given that this item had the longest lead time among the three requested changes, there were still a number of open questions in terms of the expected functionality and test methods that needed to be clarified with the local Chinese test agency, given that the description of several items in the regulatory documents was fairly generic. This was realised and addressed by the project manager at the HQ in a project follow-up meeting in May 2015:

> We have discussed our challenges internally… and would like to propose some part of the project be carried out through the Chinese subsidiary… and the engineering and product management supporting at the HQ. The product management team at the HQ had done a lot of work to get drawings ready to make this happen, but there is still a lot we need to work on

> with the local Chinese test agency to clarify the detailed requirement for making changes. We should use the Chinese subsidiary team to help those communications and organise with the suppliers to get the new mechanical part we need…

Communications and coordinating activities at a global level were not simple and could lead to risk, miscommunication, and delays in the project. With the co-project managers, a regular (weekly) meeting between the HQ and the subsidiary worked very well in following up and updating the project status by using the same language. In addition, specific meetings were also organised, involving team members from multiple functions as they were needed to clarify questions from the HQ and to update the test results from the subsidiary. These regular and irregular meetings, facilitated by the co-project managers, provided the leadership team and all key stakeholders globally with a systematic overview and update so they could have a good understanding of the project's progress. Further, some ideas for solutions to problems were suggested through the intensive interactions among the different teams at the HQ and the subsidiary. Risk management was one example. This was a challenge at the beginning of the project because risks were being misunderstood as issues. When this issue was realised by the project manager at the HQ through a conversation with his counterpart at the subsidiary about a concern over the test result for a modified item, he proposed a risk assessment for the project and also conducted training in risk assessment as a tool and process for the subsidiary through the WebEx. Once the teams were synchronised over the meaning of 'risk' and how risks were to be managed, this led to all stakeholders in the project being on the same page. In addition, through the new global standard product management process, the minutes of all discussions, including the weekly project review meetings, had been documented in a dedicated product management system. The changes associated with the product, as well as the solutions for any specific technical issues, had also been

recorded in a separate global engineering management system. With these processes of documentation and information tracking in place, the technological knowledge associated with the product modification, as well as relevant background and context, were all accessible for follow-up and further research.

Along the way, the biggest challenge for the product modification happened at the beginning of August 2015. The engineering team at the subsidiary re-ran a low temperature test by simulating the set-up of the agency test on one of the batches of units with the final hardware change completed at the HQ; the units failed this test. The engineering team at the subsidiary looked into the root cause, as the only change compared to the test at the HQ was the use of a different batch of batteries. This feedback was also provided to the project manager and the engineering team leader at the HQ. In parallel, the original test data at the HQ was revisited by the project team, while the engineering team at the subsidiary ran the test again using different batches of batteries. The subsequent tests saw some instruments passing the low temperature test, and some not. As a result, the engineering team at the subsidiary continued to look into why. Meanwhile, one item found at the subsidiary was that reducing the temperature even by one or two degrees could have drastic results on instrument performance; in fact, the test chamber used at the Chinese subsidiary was four to five degrees colder than reported. In addition, another item discussed through the weekly project review was that the batteries being used were one year old, even though this had always been the case.

Given these findings, the engineering team at the HQ recommended that new batteries be used instead of old stocks. In consideration of this potential risk from variance in the batches of batteries and the availability of new material to support the sample built for the test agency, a communication to the battery supplier was triggered involving the supply chain team at the subsidiary. Early discussion between the engineering and supply chain teams at the subsidiary, and the supplier

concentrated on the availability of a special battery which could meet the low temperature requirement of CCCF and the process of controlling batch variance for the battery. However, the supplier's answer was not very positive regarding a low temperature solution for safety industry customers, given the common practices and limitations of battery technology applying in extreme environmental contexts (i.e. the capability of the battery cell to perform at both low and high temperature). Despite the disappointing feedback from the supplier regarding an immediate solution, a very important insight was captured by the EBS engineer through conversations with the supplier, which was that the key for battery cells to work in low temperatures was to minimise the operating voltage of the instrument. This could be achieved through either a change of the mechanical design of the product (i.e. adding a physical temperature protection mechanism) or a reduction in the operating voltage of the instrument. The former solution was actually recognised by the EBS engineer through reverse engineering of a competitor's product, but this would require a longer lead time and also risk impacting the functions in the existing design. The latter solution sounded more reasonable and was preferred considering the deadline for the project and sample submission to the agency, and was discussed with the HQ immediately. However, the feedback from the product team at the HQ was that the only possible way to reduce the operating voltage of the instrument would be to change the hardware, which would not be completed before the deadline in September 2015. Although this was discussed across the function teams at the HQ, it was agreed that this conclusion was only hypothetical. The Chinese subsidiary team was continuously encouraged to pursue any other alternative.

Sense-making of the subsidiary's knowledge at the HQ:

In parallel, the project manager at the HQ updated the global leadership team on the risk of delaying submission of the test sample to the Chinese agency due to the battery test failing at low

temperature. Also, it was expected that the battery failure investigation would put the project several weeks behind the initial submission deadline unless the schedule could be pulled in. With the feedback from the HQ and with no immediate solution, the sense of urgency of the project schedule drove the subsidiary team to sit together to discuss a plan for the next step. One idea from an electronic engineer during this brainstorming across the subsidiary functional teams was to try a change of firmware, rather than hardware, in order to reduce the operating voltage of the instrument to the level expected. This idea was not only to benefit the project by shortening the lead time but also, based on this engineer's knowledge and understanding of the hardware (i.e. the circuit board), in terms of the product design. This idea was supported by the team at the subsidiary and was immediately communicated to the engineering team at the HQ through the project manager at the subsidiary. Although several questions were raised, e.g. about the optimal value of the output voltage, the engineering team at the HQ strongly supported the subsidiary so they could run experiments with several rounds of discussion back and forth between the subsidiary and the HQ teams until a final optimal value was identified at the end of August 2015. The solution (i.e. reducing the instrument's operating voltage through a firmware change rather than a hardware change) provided by the subsidiary was eventually accepted and supported by the HQ.

Exploitation of the subsidiary's knowledge at the HQ:

This localised technological innovation to solve the battery issue was successfully incorporated into the global product modification plan at the HQ and the product modification was eventually completed based on the new Chinese regulatory technical requirement. In the first week of September 2015, EBS shipped the agency units to the China Certification Center for Fire Alarm Products just before the deadline for submission. After intensive testing of the different items over three to four weeks, the CCCF test agency informed EBS in the last week of September 2015 that

all tests had been passed. At the beginning of 2016, the CCCF test agency formally released its certificate to EBS. This was a great milestone for EBS in turning crisis into a first-mover advantage. A letter from the global operations vice-president to the Chinese subsidiary team stated:

> I want to thank you all for your great work and accomplishments on the CCCF project. I reflect back a year or so ago. I was at the HQ and received an urgent call from the COO, who then tied in our global product management director to discuss the crisis we had with the new CCCF requirement for China. A year ago, we had no clear path to compliance. Now we are positioned to be a market leader versus other international companies on CCCF compliance. Tremendous progress. Great job… and please keep us moving forward…

Following the global operations vice-president, the global CEO also sent a letter of congratulations to the Chinese subsidiary team, and announced this to the whole company in the monthly communications meeting in March. The marketing team at the HQ created a graphic to celebrate the success of the project that was displayed in the atrium at the HQ (see Figure 10).

Figure 10: Celebration of the success of the project at the HQ (Source: EBS internal archival file)

5.2.4 RKT event D: reverse transfer of product enhancement technology

Figure 11 provides a summary of the time line of the key activities that EBS HQ and its subsidiary engaged in during RKT event D.

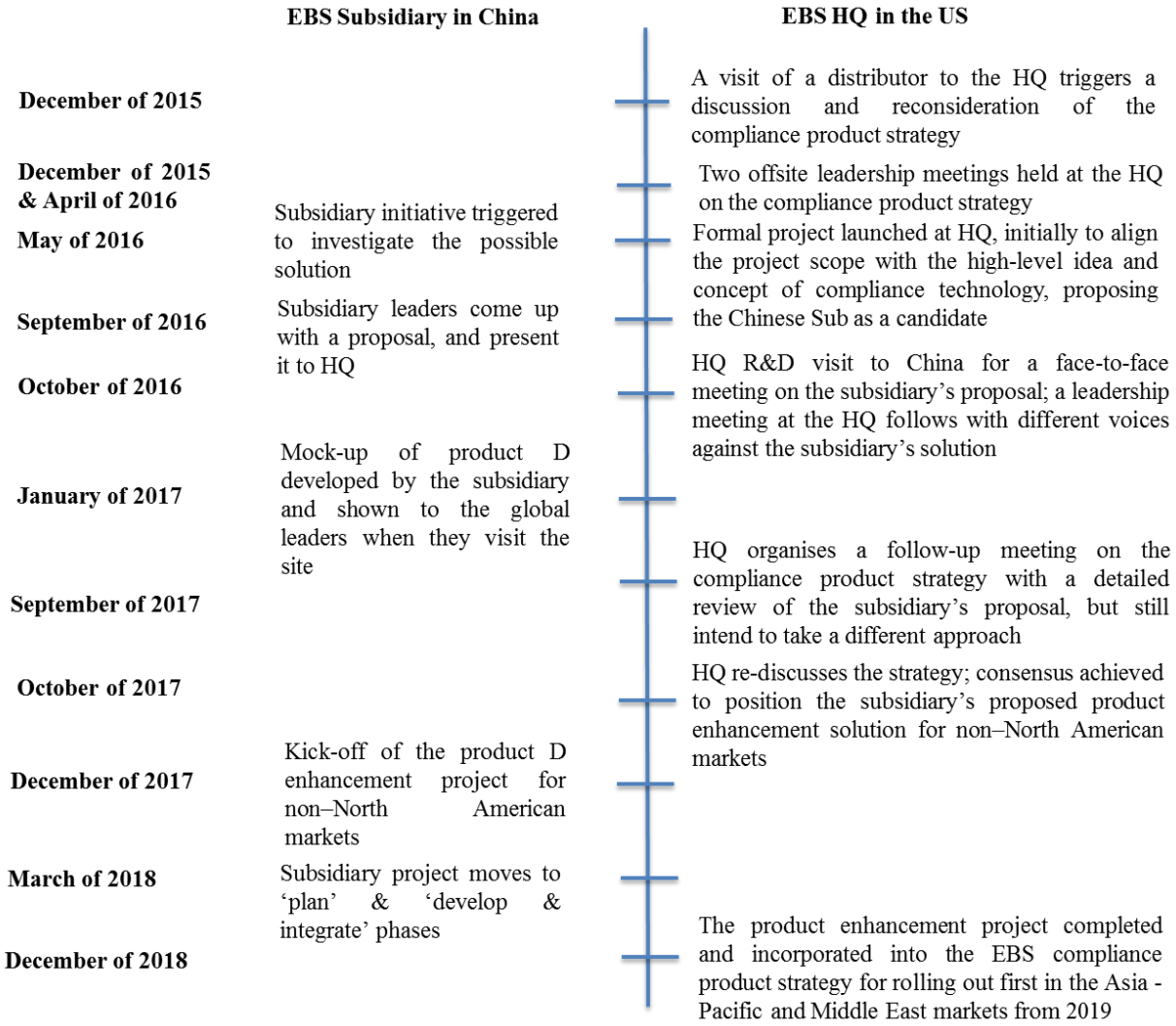


Figure 11: Time line of the key activities that EBS HQ and its subsidiary engage in during RKT event D

Recognition of the subsidiary's knowledge at the HQ:

In December 2015, the visit of a distributor to EBS's HQ triggered a discussion within the corporate leadership team on whether EBS should reconsider its strategy on compliance product technology

(i.e. cheaper with fewer features but with the quality of a high-end product) by re-embracing these distributors. EBS had had a long partnership with this distributor to sell its instruments worldwide, including the compliance products in its single gas and multi-gas detector portfolio. Through selling compliance products with much less complexity than high-end software-based gas detectors, the distributor had served the end customer directly by accumulating substantial knowledge of EBS's products over time. Around ten years before, a change in EBS's business strategy to focus on a software-based service and enhance visibility for the end customers jeopardised the relationship between EBS and the distributor (particularly in North America). Over the previous four to five years, the engineering and product management teams at the HQ had mainly focused on new high-end technology (e.g. wireless, Internet of things-based solutions) development and research beyond gas detectors to serve customers interested in safety. This visit of the distributor's senior leadership team to the EBS HQ drove EBS to 're-embrace' the distributor and to 're-think' its compliance product strategy in order to support the distributor.

In December 2015 and April 2016, EBS organised two offsite meetings of corporate executives and R&D team leaders to follow up compliance product technology. As a result of these discussions, in May 2016 a formal project was launched at the HQ through the EBS global product development process. The goal of the project at the initial stage was to align its scope with the high-level idea and concept of compliance technology that EBS wanted to re-develop or enhance. One of the conclusions from the meetings implied that the Chinese subsidiary (as opposed to the HQ) could also be a candidate to lead the project through 'product-enhancement', based on an existing product design (i.e. product D), rather than new product development. This signal from the HQ, although not a final decision, immediately motivated and triggered EBS's Chinese subsidiary to take the initiative to investigate the feasibility of the potential opportunity.

The subsidiary, involving the local product management, engineering and supply chain teams, made a systematic assessment of product D in terms of its cost, quality and certification status. Technologically, product D was designed by the HQ in 2004 and was then transferred to the subsidiary which became the only EBS production base for the product from 2005. Product D had had a very good reputation, especially in the Chinese and Asia-Pacific markets. Many customers still liked the product ten years after it was launched because of its high performance-to-price ratio and reliable product performance, although it was not compatible with EBS's software-based system. Both EBS HQ and the subsidiary were fairly familiar with the product technology. The assessment by the subsidiary's team showed that most of the international certifications were still valid and active, and thus no significant effort and investment were expected if the enhanced product would be positioned to sell globally. In parallel, the cost analysis showed a great opportunity for cost reduction with product D, for example through replacement of some components, given that product D had had no major change over the previous ten years since it had been launched. Further, risks to the supply of certain components due to the end-of-life status of their material was also addressed to further justify product enhancement in order to expand product D's life in the market. However, this justification of product D enhancement from the engineering and supply chain perspective at the subsidiary did not proceed without problems. The commercial leader in the Asia-Pacific region expressed a different opinion in a leadership team discussion with the global CEO that, rather than investing in compliance product enhancement, EBS should accelerate its software-based service alliance with its customers in China and the Asia-Pacific region, in order to significantly grow EBS's business in this market. The potential conflict in priorities did not stop the subsidiary's initiative to investigate and explore product D enhancement,

given the strong belief of the subsidiary team that product enhancement would both benefit product margin and improve performance for its loyal customer base – the distributors.

Sense-making of the subsidiary's knowledge at the HQ:

In September 2016, Chinese Subsidiary Head D and the local product manager presented the investigation and evaluation of product D enhancement at the HQ. The leadership team, including the product management and engineering directors at the HQ, gave positive feedback, showing interest in terms of the cost saving and product performance improvement opportunities. In October 2016, a visit by the global engineering director and two senior product engineers to the site in China helped the leaders and R&D team at the HQ to have a more detailed understanding of the rationale behind simultaneously achieving cost reduction and performance improvement for product D, as well as of the approaches that the subsidiary would adopt.

Meanwhile, at the HQ the corporate leadership team kept an open mind about the multiple options for the multi-gas compliance technology strategy. In a follow-up meeting at the HQ in October 2016, the discussion about the multi-gas compliance instrument concluded that the long term option of starting from scratch should be taken to fulfil the desire for a highly innovative design. A strong voice at the HQ wanted a clean start for the design with a new concept for a four-gas instrument. Based on that discussion, the global product director was to write the marketing requirement document, after which the leadership team at the HQ would determine how the project would fall into the global product roadmap. In parallel, in the interim period before the new concept of the multi-gas instrument was available, EBS wanted to continue to sell product D. The global product management director needed to make a decision on the brand labelling (e.g. whether to change the name or the colour), the on-line sales channel (e.g. Amazon) and a given distributor in North

America. There was also discussion about the charging circuit in product D no longer being compliant with two certifications (i.e. UL / CSA) in the North American market. The team at the HQ needed to understand the implications of this. However, it was discussed to move forward with the labelling / channel decision, rather than product D enhancement, in order to 'get in the game' in terms of compliance instruments. Despite the high level of consensus on the direction of the multi-gas compliance technology strategy, the proposed labelling / channel solution was perceived by the EBS subsidiary as inconclusive as it would not address the short term challenges in terms of the material end-of-life issues and the increasing pressure on the compliance product's margin, especially in the emerging countries like China and India.

In January 2017, a mock-up of an enhanced product D was built at the subsidiary through 3D printing technology. This was an important milestone for the subsidiary in moving from the stage of the concept / innovative ideas / thoughts on the product enhancement, as covered in the presentation, into the stage of a solid model being available so that people could see and physically feel how the 'future product' would be. This mock-up was shown and presented to the global operations vice-president and global CFO when they visited the subsidiary site in January 2017. The site visit and the face-to-face interaction with the subsidiary team further improved the corporate leaders' confidence that product D enhancement driven by the subsidiary made sense. In his feedback to the subsidiary after the site visit, the global operations vice-president wrote:

> The China subsidiary team has had a very positive impact on EBS corporate performance… Subsidiary Head D and his team is continuing to develop their skills by pursuing an advanced degree in business. The subsidiary team feels appreciated and sees the opportunity to further impact the business by supporting business growth in the region. [We] discussed long term engineering strategy for the China team. I am very confident of the competence of the

subsidiary team. This team will continue to support ‘in China for China’. A step forward as the HQ provides opportunities for further engineering support on sensors and perhaps compliance instruments. I appreciate that the team allows the HQ to ‘pull’ in order to drive an appropriate level of investment in Chinese engineering.

With the different opinions and beliefs on the compliance instrument technology among different people and teams, it was hard to turn all of the discussions and decisions into a concrete action plan; instead, there was a slow-moving process of negotiation and alignment between EBS’s subsidiary and HQ. Things started to change when a regular engineering review was held between the subsidiary and the HQ in September 2017. The meeting was called by the global engineering director to review the progress that the Chinese subsidiary had made in developing a multi-gas compliance instrument. The agenda of the meeting covered the estimations for the lead time for product D enhancement, budget and cost, as well as discussion of the following questions: “Should product D focus on the global market or the Chinese market?” “Should this project go through a process of new product development or product enhancement?” “Should the enhanced product be positioned as a high-end or only as a compliance instrument?” Although these questions had been addressed before, it was requested this time to come up with more detailed answers in order to prepare for a final decision at an upcoming technology strategy meeting in October 2017. Through the conversation in the engineering review, the product manager at the HQ indicated that the HQ’s team intended to design the new product based on the global market requirement, and thus some features usually found only in high-end gas detectors had to be included in the scope.

In the last week of October 2017, a technology strategy meeting was held at the HQ. One of topics at the meeting was multi-gas compliance instrument strategy. During the meeting, the commercial

leader for North America was strongly against the option of product D enhancement to address the market in that region, which represented 70 percent of EBS's global revenue. He stated:

> For the North America market, we need a much longer life instrument for the compliance market. With product D, we are competing with '7 year old' instruments. Even with product D enhancement, the compliance instrument does not align with EBS's value of safety first and highest quality.

However, the leadership team all supported looking into the global market opportunities outside of North America for product D enhancement, such as in the European and Middle East markets. As long as the investigation of other market opportunities was on-going, the pressure to improve the product margin in the emerging countries kept increasing. The global CFO pushed the subsidiary to come up with a plan to improve the overall product margin in the Asia-Pacific market through either increasing the product selling price or reducing the product cost. This drove the HQ to reconsider and justify the continuation of product D enhancement from a different perspective. In the last week of November 2017, the global operations vice-president sent an email to Chinese Subsidiary Head D implying the 'green light' for the product D enhancement project based on his discussions with the global CEO and the product management director. Based on that, through joint working between the engineering team at the subsidiary and the global product management team at the HQ, a new business case was created for product D enhancement by expanding sales into the Middle East and North African markets without adding too much effort for the engineering team, and focusing on cost reduction while sustaining a good level of product performance. A presentation was made based on the updated business case at the product roadmap meeting in December 2017. A good alignment across the different teams was achieved and, at the end of the

meeting, an official ‘go’ was given to the product D enhancement project, which would be led by the Chinese subsidiary. The global operations vice-president stated:

> It is a long journey. I am glad eventually we can move this project forward. It is a result of entire global team effort. The global product management team helped to model product D in support of the Chinese market as well as that in the Middle East and North Africa. Seems like the business case is much stronger. I believe this compliance product enhancement will not only reduce the product cost but also deliver a better product performance for our customers.

Exploitation of the subsidiary’s knowledge at the HQ:

In order to transit the project into the execution phase smoothly, substantial work was required by the team in order to clarify the detailed scope and to align with the target. This not only included the project’s expenses, cost savings target and schedule, but also the configuration of the product and targeted scope of certification. Some discussion and decision making needed to involve multiple functional stakeholders at the global level, such as the commercial, product management and engineering teams at the HQ. Although all decisions associated with the project went through an EBS global product management review on a monthly basis, a certain number of the discussions involved informal meetings from time to time among the teams globally. In January 2018, the project moved into the ‘Go-To-Define’ stage, which was completely taken on by a project manager at the subsidiary. The global product management and engineering systems were well leveraged by the subsidiary team in providing regular updates on the project or addressing any technical issue that may need the global engineering team’s support at the HQ. In March 2018, the project moved into the ‘Plan’ stage and then the ‘Develop and Integrate’ phase after two months. Along the way, the project went well. In October 2018, an email from the commercial leader in North America to

the Chinese Subsidiary Head D asked whether it would be possible to have certification for the North American market for enhanced product D. This further improved the confidence of the EBS subsidiary team that there would be a natural pull and demand well beyond the current scope once the team had completed product D enhancement. In December 2018, the project was completed on schedule and on budget. In January 2019, the new compliance product, the enhanced version of product D, went officially to rollout for the China and Asia-Pacific market as a first step. Product D's margin was significantly improved, by more than 30 percent, through the product enhancement compared with the old version. The overall product performance, including several key product performance indicators (e.g. gas response lead time and sensitivity), was also improved by using the latest components for the instrument. Moreover, the success of the project also led EBS HQ to reconsider its overall compliance instrument strategy in terms of product enhancement, not only for emerging countries such as China, but also potentially for the home market in North America.

5.3 Case findings

In this section, the empirical findings from the case study are presented. Analogous to the data analysis process, narrative case histories were chronologically ordered and combined with the temporal bracketing and visual mapping strategies of tracing the four RKT events in EBS over time, in order to address my research questions. In the sections below, I first outline the knowledge conversion in form and source from the subsidiary to the HQ through the RKT process, from the ontological and epistemological perspectives. I then highlight my empirical findings regarding how HQ attention combines with knowledge characteristics and interactional factors to influence RKT through the four RKT events. Through the findings section, I engage in discussion of the critical

role of HQ attention to RKT and, in Chapter 6, of how a MNC benefits over time in terms of its ability to leverage knowledge through HQ attention to RKT.

5.3.1 Outline of the knowledge conversion in form and source through the RKT process

RKT plays an important role in transforming a subsidiary's locational advantage and the knowledge it has developed into a competitive advantage for the entire MNC (Nair et al., 2017). Knowledge has different forms; it can be tacit or codified, and it exists everywhere, within individuals or organisations (Ibrahim et al., 2009). Whilst RKT is not a 'full' duplication of the subsidiary knowledge at the HQ but typically occurs with modification and adaption of the subsidiary knowledge in form and source based in a certain practice or context at the HQ (Foss & Pedersen, 2002). Figure 12 gives an overview to illustrate the knowledge conversion in form and source from the subsidiary to the HQ in the four RKT events in EBS over time the through RKT process.

In RKT event A, the new product development technology at the subsidiary involved the HQ's product knowledge, and the subsidiary's engineering know-how and supply chain knowledge. The primary target at the subsidiary was to design a new low cost-based instrument, while maintaining a good level of quality and reliability of the product to serve the safety industries. Not only was low cost driving the supply chain knowledge (e.g. sourcing of low cost materials), but the local engineering know-how to integrate the HQ's product knowledge (e.g. gas sensor technology) with local mechanical and electronic designs in an efficient and effective way also turned these into a successful new 'saleable' product for EBS.

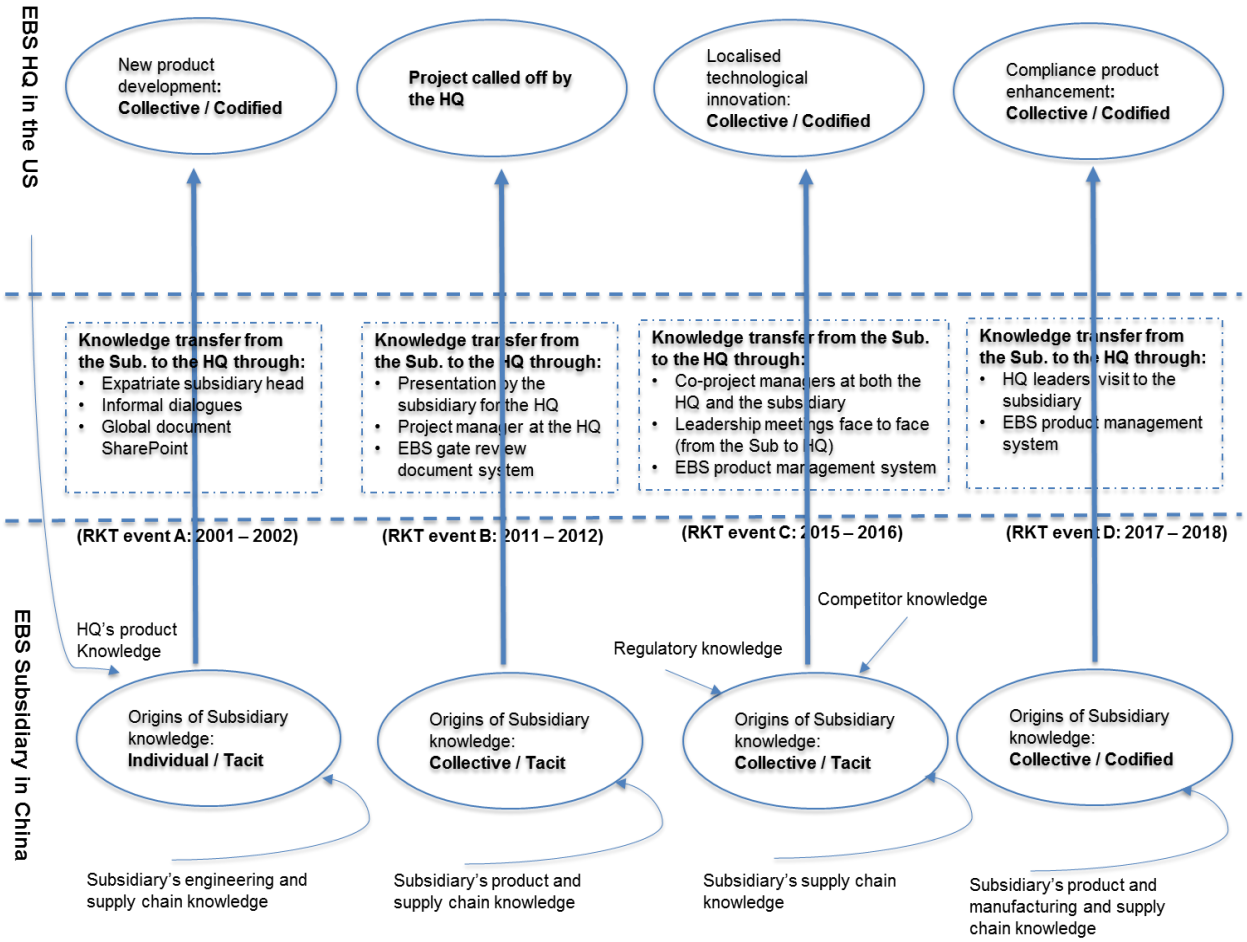


Figure 12: The knowledge conversion from the subsidiary to the HQ in the four RKT events in EBS over time through RKT process

This knowledge and experience did not exist explicitly with the subsidiary at a collective level, but were carried more by the two design engineers (i.e. the mechanical and electronic designers) and Subsidiary Head A. This also revealed that, in the initial period, the EBS subsidiary's knowledge management was immature, relying heavily on people individually. Most of the product and engineering know-how and know-why were held by key people and talents, e.g. Subsidiary Head A and the two design engineers at the EBS subsidiary. The transfer of knowledge from the EBS subsidiary to the HQ benefited from the expatriate Subsidiary Head A, who was playing the important role of a "boundary spanner" (Schotter & Beamish, 2011) between the subsidiary and

the HQ. Moreover, informal dialogues between the two Chinese subsidiary engineers and the engineering team at the HQ helped to convert these individuals' tacit knowledge at the level of the EBS subsidiary into collective codified product technology knowledge at the EBS HQ, documented in an EBS global engineering SharePoint document. As a result, EBS HQ successfully managed and obtained its global product certifications through the agency at the HQ. Eventually, EBS benefited from this collective codified product knowledge in supporting and maintaining sales of this product and service, up until the present day, in its worldwide markets (see Figure 7).

The knowledge creation at the subsidiary in RKT event B was triggered several years after product A was introduced into the market. As the market competition had increased in China, EBS's Chinese subsidiary identified a growing opportunity for single-gas instrument sales in China through the redesign of product A involving addition of new gas configurations and change of the existing mechanical design so as to reduce product cost. Given the centralised product development strategy at the HQ at that time and the need for a strong business case to justify investment in the product redesign, the EBS subsidiary included global market demand beyond its Chinese customers in the initial business case in order to obtain support from the HQ. Despite a broader scope, the technology for the product redesign involved mainly the local supply chain and product knowledge which had been fairly familiar to the HQ. Although the product redesign involved multiple functions (e.g. manufacturing, supply chain, product and engineering) at the subsidiary as a whole, the substantial associated knowledge was collectively tacit in nature and led to a learning process. For instance, when there was a question or an idea from the engineering team, this often triggered the supply chain team to approach the suppliers on the feasibility of sourcing the material. Thus, feedback that could eventually be adopted by the engineering team usually went through a number

of rounds of discussions between the EBS supply chain team at the subsidiary and the suppliers in addition to site visits to suppliers.

In addition to the formal presentations made to the HQ by Subsidiary Head B and the project manager from the subsidiary, the value and importance of face-to-face interactions among the teams was well acknowledged. Unfortunately, this was only addressed by the project manager at the HQ after he came on board when the project was past the halfway stage. The project manager at the HQ stated in the lessons learnt document for the project:

> It is crucial to have substantial face-to-face interaction at the start and plan travel at critical points in the project. Many team members acknowledged the face-to-face meetings that did occur during the early phase of the project. It is recommended that the leadership meeting, if starting another product development project with a global team, budget for and expect the team to assemble together in person to kick the project off. The investment is well worth the cost given the impact it has on the quality of team formation and the speed of project initiation. Additionally, the team was planning on team members travelling during critical moments in the project (i.e. having the mechanical and electrical engineers travel from the Chinese subsidiary to the US HQ when the verification and validation testing was being done to expedite problem solving). This should be planned for in future global projects.

Further, a global document system was also intended for use in the project in RKT event B. Unfortunately, the benefit to knowledge transfer in the project was very limited, given that it was used at a late stage in the project, right before the project was called off by the HQ. There were several issues that arose because the system was newly developed at the HQ. There was confusion regarding roles and responsibilities, for example, between the subsidiary and the HQ engineering

team members. Additionally, training with the system for the subsidiary was only partially completed, which led to misunderstanding and miscommunication of project documentation for those who had not been trained.

The knowledge created at the subsidiary in RKT event C was collectively tacit. On the one hand, the technological innovation for the battery at low temperatures was derived from a collective effort and teamwork at the subsidiary, involving multiple functions such as the engineering, product and supply chain teams. Without intensive interactions and brainstorming between the teams, the electronic engineer would not have come up with the idea and would not have pursued the technical solution to the product modification through changing the firmware rather than the hardware. On the other hand, the technological innovation in the project in RKT event C deeply involved local regulation and competitors, as well as the battery suppliers' knowledge. The local embedded regulatory knowledge could not be easily captured through translated documentation by the EBS HQ. Several questions were clarified through back and forth discussions between the EBS Chinese subsidiary and the local certification agency, given that the descriptions of a certain number of items were fairly generic, and often required face-to-face discussions. As a result, it took a while for the EBS HQ to clearly and holistically understand the CCCF requirements. Further, the idea of the subsidiary's electronic engineer to adapt the operating voltage of the instrument through changing the firmware was also generated through the intensive interactions between the EBS subsidiary supply chain team, the battery supplier and himself over several weeks.

As this innovative idea emerged at the subsidiary, the regular meetings of the co-project managers, bridging between the HQ and the subsidiary, turned the collective tacit knowledge at the subsidiary into a successful technological solution incorporated into the overall product modification at the HQ through repeated experiments run by both sides. Additionally, this localised technological

innovation has been well recorded and documented through the EBS global product management system, including not only the final solution – the optimal value of the operating voltage – but also the detailed analysis and test results of each option through the entire problem-solving process. This knowledge recorded in the product management system is generally accessible for anyone who may need it for historical tracking or further study. The product management system was used not only for information storage but also as a dynamic communications tools for the key stakeholders related to the project. For example, the system ensures automatic emails are sent to team members when any document is updated, and this sets expectations that team members will manually communicate changes.

The knowledge created at the subsidiary in RKT event D was collectively codified. Despite substantial efforts in investigating in detail the opportunities for cost reduction and product performance improvement, the assessment and feasibility study for product D enhancement were well documented collectively at the subsidiary in a standard template used in EBS. The subsidiary later built the mock-up based on these documents, which enhanced the confidence of EBS HQ in the product enhancement knowledge through seeing the same language used at the early stage of the project. Although the subsidiary's explicit product enhancement proposal was in the "same language", according to the EBS product management process, there was a long journey for the subsidiary knowledge to win 'acceptance' by the HQ through its sense-making of the continuation of product D enhancement for wider use in the firm.

Once the project in RKT event D was officially kicked off in November 2017, it strictly followed the EBS product management process at each step, including the scope, define, plan, develop and integrate, and validate phases, until the product was rolled out in December 2018. Through these project execution phases, there was a total of more than 100 documents worked on by the project

team and other key stakeholders, such as the product technical requirement, business case, project plan, risk assessment, verification and validation report, and so on. More importantly, once the project team met any problem or challenge, everybody could automatically refer to the criteria and practice contained in the EBS product management platform for solutions. This channel, the EBS global product management platform, helped to smoothly transfer the subsidiary's product enhancement knowledge to the HQ and made it accessible collectively to the entire company as and when it might be needed.

The empirical findings from each RKT event in my research have revealed that knowledge through the RKT process is not the movement of a 'physical commodity' from one place to another, but a process of "reconciling discrepancies in meaning" (Nonaka & Takeuchi, 1995) and a process of 'justifying' and 'accepting' the subsidiary knowledge for wider use by the HQ, which I initially called "legitimation" (Deephouse & Suchman, 2008; Suchman, 1995). This also involved the circumstance (RKT event D) in Nonaka's process of combination (Nonaka, 1991). However, Nonaka (1991) highlighted the process of "systemizing concepts into a knowledge system" in the combination model, such as documents, meetings, information technology networks and large-scale databases (Nonaka & Takeuchi, 1995). It does not recognise that in the course of transferring codified subsidiary knowledge, different beliefs, norms and practices at the HQ are often revealed that create barriers to accepting the subsidiary knowledge for wider use in the firm (Kostova & Zaheer, 1999). I highlight that knowledge legitimation is a key missing element in the extant RKT literature.

5.3.2 HQ attention to RKT through recognition, legitimation and exploitation

The existing literature has highlighted the important role of a subsidiary in the RKT process, through persuading the HQ that the transfer of its knowledge is relevant and valuable for global use (Yang et al., 2008). However, my empirical findings have revealed that RKT is more likely to take place when the HQ pays attention. More specifically, HQ attention to RKT occurs as multilevel processes in which the subsidiary's knowledge is discovered and identified for potential wider use (*recognition*), accepted and appreciated (*legitimation*) and eventually used at the HQ (*exploitation*). These three processes are interrelated and proceed iteratively through the coordination, negotiation and alignment of interests and cognition between the subsidiary and the HQ across time and location. My fieldwork provides a nice illustration of that. For example, the recognition and exploitation of the subsidiary's knowledge by the HQ through the expatriate Subsidiary Head A and the HQ's top management endorsement was crucial for the success of RKT event A. Although it was initiated by the subsidiary, RKT failed in RKT event B as a result of the HQ shifting its attention to a HQ-centralised 'one-size-fits-all' product development philosophy, resulting in loss of legitimacy for the subsidiary's knowledge. Similarly, the RKT in RKT event C benefited significantly from the substantial time and effort (attention) invested by the HQ through the co-project managers. When the HQ failed to work out a solution for the product technical issue, joint working on technological problem solving with the subsidiary led to creation of a localised innovation at the subsidiary and the legitimation of that knowledge which was transferred to the HQ for global product modification. Further, the RKT in RKT event D would not have happened without HQ attention in legitimating knowledge by creating a favourable policy environment at the HQ. Table 7 gives an overall summary of the recognition, legitimation and exploitation processes in HQ attention to RKT across the four RKT events.

Table 7: Recognition, legitimation and exploitation processes in HQ attention to RKT

RKT Event	Characteristics of the processes of HQ attention to RKT		
	Recognition	**Legitimation**	**Exploitation**
A	● The need for the knowledge is triggered by the HQ through scanning the external competitive environment ● The HQ devotes time to associate and connect knowledge through the expatriate subsidiary head	● Top management endorsement ● Cognitive alignment through the expatriate subsidiary head ● Mimicking of the success of stepped approach: new product introduced first to China, then transferred to the HQ in the US	● Focus of time and effort on the re-contextualisation of the subsidiary's knowledge at the HQ ● Synthesis of the advantages between HQ and Sub, turning them into a global 'saleable' product
B	● Subsidiary issue-selling through conversations and formal presentation at the HQ	● HQ shifting philosophy from new product development towards a HQ-centric model causes loss of legitimacy for the subsidiary's knowledge	● Create monitoring ● Prevention of the HQ from being distracted by its subsidiary's knowledge that is not aligned with the HQ
C	● Discovery of the opportunity by the HQ through searching for a solution to a technological problem ● Identification of the opportunity by means of co-project management	● Manipulate the institutional context of the subsidiary's knowledge at the HQ (i.e. *right* people, *right* place and *right* time)	● Facilitate the set-up of an environment that allowed experimentation and joint HQ-Sub working ● Shaping of 'HQ-centric' awareness of NPD
D	● A conversation with a customer triggers the search for knowledge ● Identification of the knowledge by the HQ through social interactions between HQ and subsidiary	● Change the audience (application of the technology) ● Reframe the purpose of the technology	● Create a favourable policy environment for accepting the knowledge at the HQ, and incorporation into the global strategy for addressing the compliance market and the distributors

Recognition:

The subsidiary's knowledge needs to first be recognised before the HQ can choose to act upon it in the RKT process (Szulanski, 2000). Even though the existing RKT literature has highlighted the important role of bottom-up influencing mechanisms, such as "issue-selling" (Dutton et al., 2001) or "persuading" (Yang et al., 2008) or "voicing" (Bouquet & Birkinshaw, 2008), which promote the recognition of the subsidiary's knowledge by the HQ, my empirical findings have indicated that the top-down mechanisms of HQ attention play an important role in discovering and identifying RKT opportunities.

In RKT event A, the need to develop a low cost-based instrument was triggered by EBS HQ's scanning of its external competitive environment, which used to focus on high-end gas detection technology research and development primarily for the developed countries. The HQ devoting time to associating and connecting the subsidiary's cost advantage with the HQ's product technology through the expatriate Subsidiary Head A, fostered the identification of the subsidiary's new product development and its potential being seen by EBS HQ in response to its global competition. In RKT event B, the subsidiary's knowledge was discovered at the HQ through a conversation with Subsidiary Head B and the managers. This was followed with formal presentations by the subsidiary's project manager at the HQ. In RKT event C, the discovery of the RKT opportunity was initially through EBS HQ searching for the solution to a technological problem. The identification of the localised technological innovation that could be used for the global modification at the HQ emerged through a joint working process on problem solving by means of co-project management between EBS HQ and the subsidiary. Lastly, in RKT event D, a conversation with a customer at the HQ triggered the search for knowledge (compliance product technology for the distributors). The identification of the subsidiary's product enhancement proposal by the HQ benefited from the social interactions between the HQ and the subsidiary, such as the site visits to the subsidiary and face-to-face meetings. In summary, HQ attention plays an important role in proactively recognising the opportunity for RKT, through the search for the solution to a problem and social interactions between the HQ and the subsidiary.

Legitimation:

The 'principal-agent' relationship between HQs and subsidiaries implies that the conventional 'top-down' transfer is legitimate and necessary (Chung, 2014), particularly in knowledge-exploiting foreign direct investment (Dunning, 2000). RKT has to go through a legitimation process, even

though the knowledge has been noticed by the HQ, in order to win its 'social acceptance' (Markard et al., 2016). The legitimating of knowledge represents a significant commitment of time and resources by organisations, which is crucial for the success of knowledge exploitation at the HQ in the context of RKT (Johnson et al., 2006). Once the subsidiary's knowledge is legitimated, it becomes a corporate priority which may be leveraged for wider global use while the HQ maintains the power relationship vis-à-vis the subsidiary in the RKT process (Ambos et al., 2010). My empirical findings imply not only the importance of the characteristics of the subsidiary's knowledge stock – the extent to which it conforms with the context of the HQ – but also that the HQ can purposely influence and even create legitimacy of the subsidiary's knowledge as an institutional entrepreneur (Suchman, 1995). Since technological knowledge may not be immediately accepted by people, HQ attention towards the legitimation of the subsidiary can be perceived as a cumulative unfolding across time (Johnson et al., 2006).

In RKT event A, the HQ making sense of the subsidiary's knowledge was not trivial through the process of knowledge creation and transfer from the EBS subsidiary to its HQ, even though the new product knowledge created at the subsidiary had a high level of conformity with the HQ's belief. EBS HQ maintained a high level of legitimacy for the subsidiary's knowledge through the top management endorsement of the RKT. Further, the intensive communications through the expatriate Subsidiary Head A fostered the cognitive alignment of the subsidiary's new product development with wider use by the HQ. The stepped approach, with the new product being introduced first to China, then transferred to the HQ, further enhanced the legitimacy of the subsidiary's knowledge through its adoption in the global markets. Initially in RKT event B, with the external institutional environment leading to the expiry of the international certification for a product, EBS HQ recognised that the subsidiary's product redesign technology may help EBS

sustain its position in the market. However, the legitimacy of the subsidiary's knowledge was lost once EBS HQ shifted its philosophy from new product development towards a HQ-centric-based model rather than leveraging its subsidiary's product redesign knowledge. As a result, EBS HQ increased its monitoring of the subsidiary's knowledge and eventually called off the knowledge transfer project. In RKT event C, EBS HQ initially organised the prototype and product modification by itself, because at the time its Chinese subsidiary was not perceived as a legitimate source for a technical solution. As the HQ's engineering team made no progress after a few months, EBS HQ recognised that the 'right' way may be to encourage the EBS subsidiary to become involved and contribute more on the hardware change part of the product modification, given that the subsidiary team was 'supposed' to have a better understanding of, and insight into the Chinese regulatory requirements than the people at the HQ in the US. By means of co-project managers at both the HQ and the subsidiary facilitating intensive interactions between the teams across time, the HQ perceived the potential solution from the Chinese subsidiary as more legitimate than at the earlier stage; there were the right people with a good track record, the right place close to the Chinese testing agency and customers, and the right time because the HQ had no solution for the issue. In RKT event D, EBS HQ created legitimacy for the subsidiary's knowledge through changing the audience. Rather than focusing on the North American market but on the Asia-Pacific and North African markets, by reframing the purpose of the knowledge as to improve the product margin and manage the challenge of end-of-life of materials rather than to increase revenue, the subsidiary's knowledge was accepted by the HQ. In summary, the legitimation of knowledge is a time-consuming process which involves substantial HQ attentional resources (time and effort) in making sense of the subsidiary's knowledge through negotiation and cognition alignment. I further elaborate the details of this in the following subsection.

Exploitation:

Once the subsidiary's knowledge is recognised and legitimated, the HQ still needs to maintain its time and effort to organise the knowledge exploitation, adoption and application (Szulanski, 2000). Focused time and effort during the knowledge exploitation stage is crucial for the success of RKT through continuous HQ attention in a certain direction so that the transferred knowledge can be institutionalised and routinised within the context of the HQ (Cohen et al., 1996).

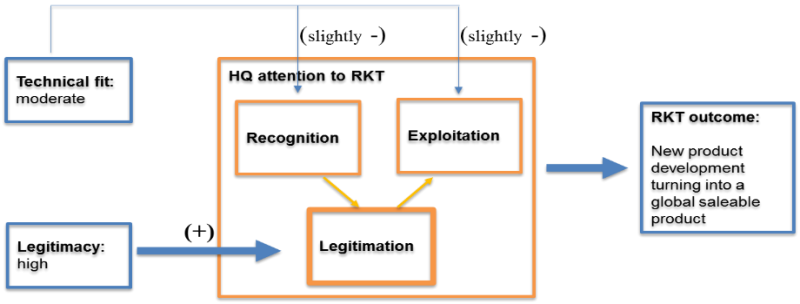
In RKT event A, although the new product development knowledge had been documented at the subsidiary, intensive discussion and interactions on the detailed design between the subsidiary and the HQ were requested in order to apply the new product development to the EBS global market. EBS HQ maintained the time and energy it devoted towards re-contextualisation of the subsidiary's knowledge based on the test requirements of the certification agency at the HQ. By doing so, EBS HQ eventually synthesised the cost advantages of the subsidiary and the HQ's product technology, and turned them into a global 'saleable' product in the product portfolio for its worldwide market. In RKT event B, with the loss of legitimacy of the subsidiary's knowledge, EBS HQ increased the monitoring of the knowledge. By doing that, EBS prevented the HQ from being distracted by its subsidiary's knowledge, which was not aligned with the HQ's new product development philosophy. In RKT event C, EBS HQ maintained its time and effort in supporting the setting up of an environment that allowed repeated experimentation and working together on the knowledge creation and transfer between the HQ and the subsidiary through the problem-solving process. In this way, EBS HQ leveraged the subsidiary's localised innovation and eventually turned the crisis due to the regulatory change into a first-mover advantage. Further, this also shaped EBS's 'HQ-centric' orientation in terms of its awareness of product development for its international market. In RKT event D, RKT was impeded at the beginning although it was fairly familiar to the HQ, due

to the subsidiary's knowledge being perceived as 'illegitimate' by EBS HQ, especially by the commercial team for the North American market. Through intensive interactions, such as the leadership team's visit to the site and face-to-face demonstration of the mock-up of the new product, over a period of years between the HQ and the subsidiary, EBS HQ deliberately created a favourable policy environment for exploiting the knowledge at the HQ, by changing the audience and reframing the purpose of the subsidiary's knowledge. By focusing on the legitimation of the knowledge, EBS HQ harvested the subsidiary's knowledge through the EBS global product management platform and incorporated it into the global strategy for addressing compliance markets and the distributors.

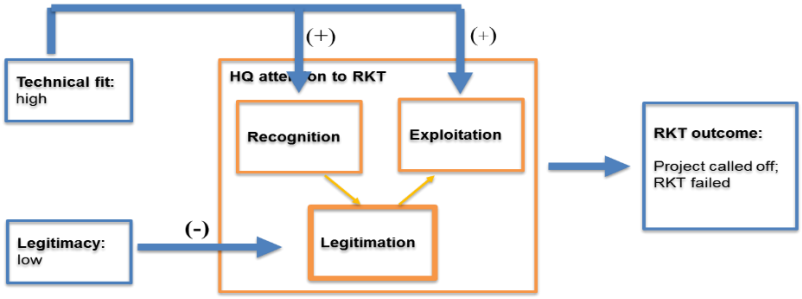
5.3.3 The relationship between knowledge characteristics and HQ attention to RKT

As mentioned previously, HQ attention to RKT should be in close association with knowledge characteristics in order to benefit from RKT. In this subsection, I turn to a different aspect of how knowledge characteristics influence HQ attention to RKT. The HQ is limited in its ability to attend to all external knowledge sources through its global dispersed knowledge networks, so it has to choose which to act on by screening out others (Bouquet & Birkinshaw, 2008; Ocasio, 1997). Thus, the literature has highlighted the selective nature of the attention in responding to external environmental stimuli (Levinthal & March, 1993; Ocasio, 1997); this has also been observed in the confirmatory external knowledge search behaviour at a collective level in a firm (Ambos & Birkinshaw, 2010). The existing literature has linked the determinants of HQ attention to certain subsidiaries' knowledge with the structural and relational characteristics of the subsidiary as a whole rather than a specific RKT task. In my research, I attempt to reveal the relationship between HQ attention to RKT and knowledge characteristics by adopting the constructs of technical fit and

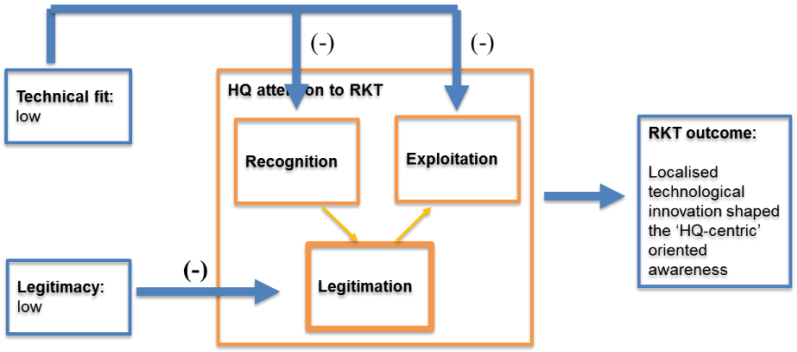
legitimacy at a more granular level (Monteiro, 2015). See Figure 13 for a summary of the relationship between knowledge characteristics and HQ attention to RKT across four RKT events.



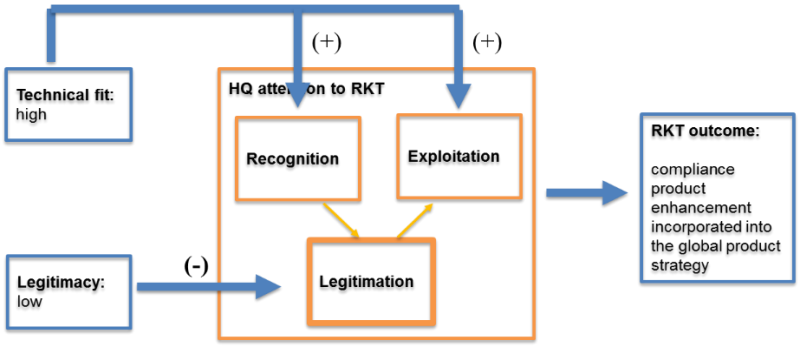
RKT Event A



RKT Event B



RKT Event C



RKT Event D

Figure 13: Summary of the relationship between knowledge characteristics and HQ attention to RKT across four RKT events

Technical fit and HQ attention to RKT:

Technical fit is an important factor for knowledge transfer given that the knowledge receiver often needs to adapt certain components of the knowledge from the sender to fit its context (Ansari et al., 2010). Its relationship with HQ attention has been paid rather little attention, especially in the context of RKT (Ambos et al., 2006). The tracing of the four EBS RKT events identified the evolution of technical fit of the subsidiary's technological knowledge with EBS HQ in consideration of not only the internal technological similarity but also the similarity of external knowledge networks, e.g. supply chain and regulatory standards, between the HQ the subsidiary. See Figure 14 for a summary of the technical fit evolution of the subsidiary's knowledge and its effect on HQ attention to RKT in the four RKT events over time. In RKT event A, the subsidiary's knowledge, i.e. low cost-based product development, had a moderate level of fit with EBS HQ before the new product technology was transferred to the HQ as the latter used to focus on high-end instrument technology, although core gas detection technology, i.e. gas sensing technology, was common. With the combination of both EBS HQ product knowledge and its subsidiary's local manufacturing and engineering expertise, the subsidiary's knowledge appeared compelling technically for EBS as a complementary technology for its global portfolio in response to the increasing competition in the low cost market. This slightly shaped recognition and exploitation of the knowledge at EBS HQ through its attention to synthesising the advantages of both and adopting the knowledge within the context (the regulatory requirement of the agency at the HQ), rather than duplicating the subsidiary's knowledge directly at the HQ. In the end, EBS HQ incorporated its Chinese subsidiary's new product knowledge into the global product portfolio, addressing not only

the Chinese but also worldwide markets. In RKT event B, the EBS China subsidiary persuaded its HQ to support a product redesign to address the global market although the idea was triggered by local customer demands. Despite the knowledge being fairly familiar to EBS HQ, the subsidiary's product redesign knowledge was not accepted and adopted by the HQ and the project was called off by the HQ. On the contrary, in RKT event D, the subsidiary's product enhancement knowledge for the multi-gas compliance instrument was also familiar (high technical fit) to EBS HQ. In this case, EBS HQ eventually adopted the subsidiary's product enhancement technology to enhance its global compliance product strategy. What differentiated B and D in terms of capturing different levels of HQ attention to RKT is associated with another important factor, knowledge legitimacy, through the different evolutionary path of the knowledge legitimation, which I explore below. This factor was also evidenced in RKT event C. Before EBS HQ recognised the value of the subsidiary's localised technology innovation in helping product modification to meet the new Chinese technology standard, the subsidiary's knowledge was kept locally, was ambiguous, and showed a low technical fit with EBS HQ's knowledge stock. Once the subsidiary's knowledge was legitimated, the HQ successfully exploited the subsidiary's localised innovation, working together with the subsidiary to integrate it into the product modification solution at the HQ, which helped EBS gain a first-mover advantage in the market. In summary, my empirical findings have revealed that the level of technical fit may influence the recognition and exploitation of knowledge; however, high technical fit does not guarantee occurrence of RKT without knowledge being legitimated through the legitimation process.

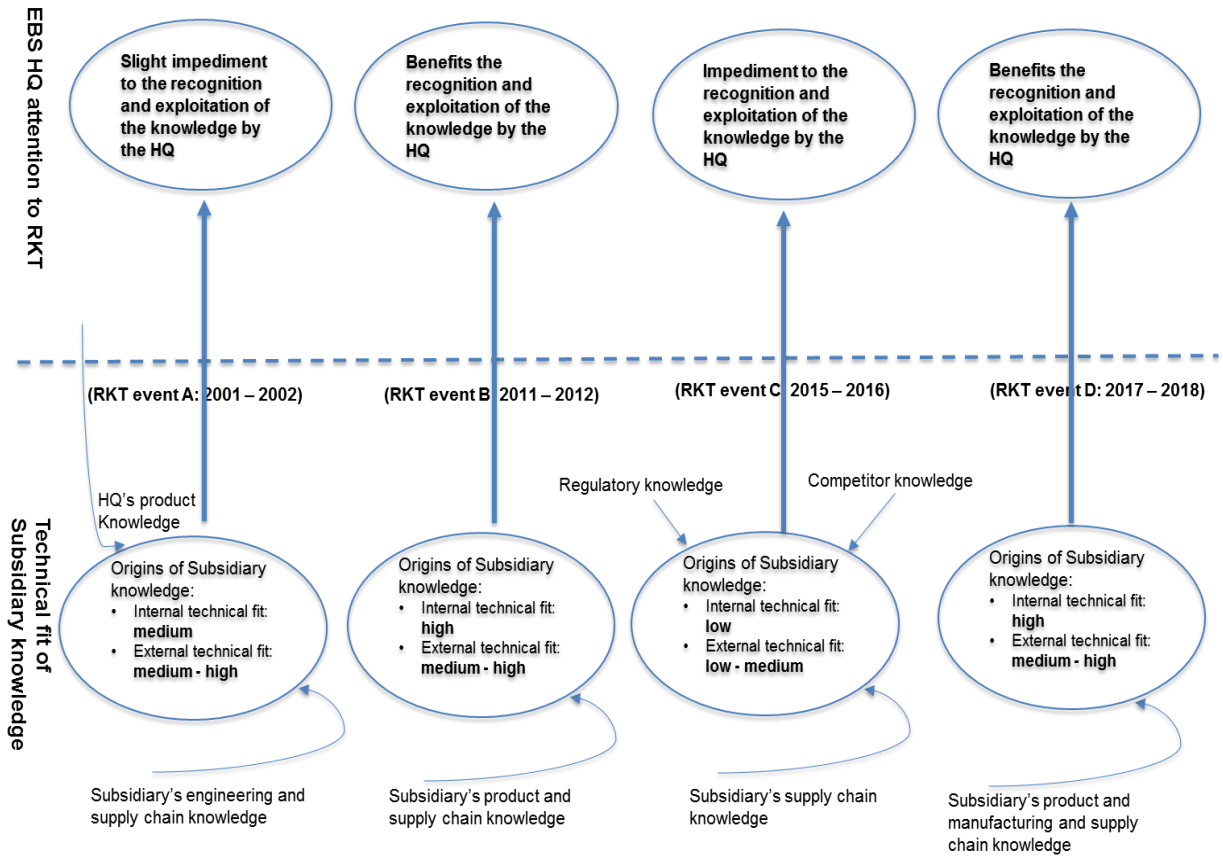


Figure 14: Technical fit evolution of the subsidiary's knowledge and its effect on HQ attention to the four RKT events over time

Legitimacy and HQ attention to RKT:

A high degree of legitimacy of a technology, i.e. one that is well understood, compatible with established norms and practices, socially accepted, and perhaps even endorsed by its broader institutional environment, has long been recognised as a crucial factor for resource mobilisation influencing the successful development and transfer of technology (Bergek et al., 2008). The existing literature has paid less attention to knowledge legitimacy in relation to HQ attention, especially in the context of RKT. In my study, the four RKT events have revealed different levels of legitimacy of the subsidiary's knowledge with EBS HQ. See Figure 15 for a summary of the

legitimacy evolution of the subsidiary's knowledge and its effect on HQ attention to RKT in the four RKT events over time (see Appendix 3 for the detailed coding with supporting quotes).

The product knowledge of the EBS subsidiary in RKT event A indicated a high level of legitimacy with its HQ once it was created and applied in the Chinese market. This benefited from both internal cognitive alignment between EBS HQ and its subsidiary through the expatriate Subsidiary Head A and the provenness of the practice in the market at that time of using China as the right place for a 'world factory' for low cost-based production and product development. The expertise of the local engineering team in the Chinese subsidiary R&D team, referred to as the 'four guardian warriors', was also well recognised by the HQ (a HR director at the subsidiary). The EBS HQ's engineering team at that time believed that "China should be the right place to generate such (low cost-based) technological knowledge for the firm" (a service manager at the subsidiary). Before the knowledge was transferred to EBS HQ, the new product developed at the Chinese subsidiary had been well perceived by the HQ as 'simple' but 'effective' technology (a global software engineer at the HQ) that could fulfil EBS global market needs. A global engineering director at the HQ said:

> Product A was successfully introduced into the global market, not only because of its low cost base, but also the 'simplicity' (simple but effective) of the product design through the local R&D team in China, for example using a very smart battery solution which helped EBS to obtain the global certifications quickly.

The success of the product in the Chinese market further increased the legitimacy of the subsidiary's knowledge and thus captured EBS HQ's attention towards the legitimation process to accept the subsidiary's new product development, to incorporate it into the global product portfolio and to eventually turn it into a saleable product in the global market.

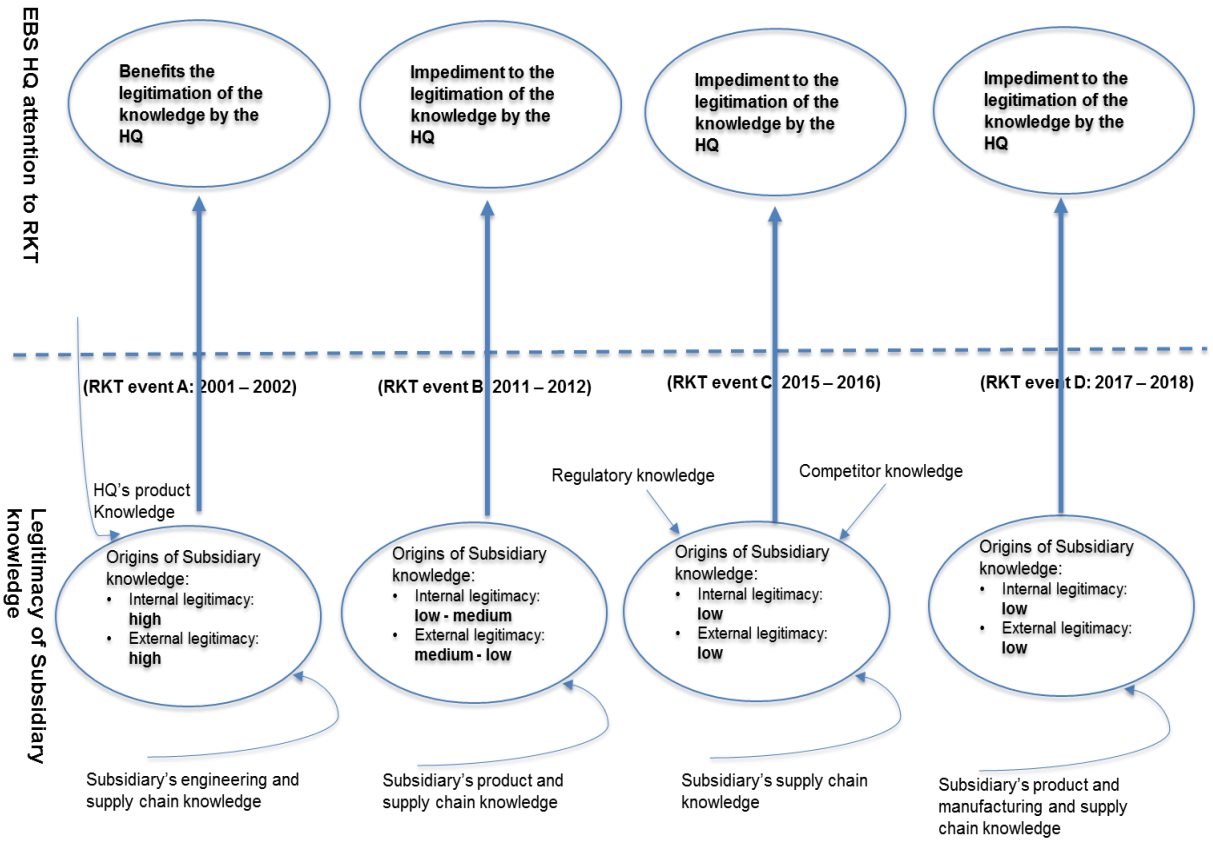


Figure 15: Summary of legitimacy of the subsidiary's knowledge and its effect on HQ attention in the four RKT events

In contrast to A, the subsidiary product redesign technology addressing the global market was not perceived as legitimate knowledge by the HQ in RKT event B. This involved both misalignment at the cognitive level and incompatibility of the subsidiary's product redesign with the established rule at the HQ. As a global COO stated: "*... the Chinese engineering team is traditionally good at creating Chinese products for China, rather than other markets. The Chinese team is well below average with connecting with the rest of world... as they do not have great experience or credibility in general...* " Along the way, there had been conflicts through the product development process between the HQ and the subsidiary related to time-to-market of new products and project management processes. As a project manager at the HQ stated: "*... five to six months of the project*

were spent not following the product management process… and without communicating with the leadership… that meant that the subsidiary team was often doing work ahead of sequence." The low legitimacy of the subsidiary's knowledge directed EBS HQ's attention towards suspecting the potential value of applying the subsidiary's technology at the HQ, which shaped EBS HQ's legitimation of the subsidiary. Eventually EBS HQ increased the monitoring of the product redesign process and called off the project.

Similarly, in RKT event C, EBS HQ initially organised the prototype and product modification by itself because, at the time, the EBS China subsidiary was not perceived as a legitimate source of a technical solution. As a product development director at the HQ suggested to the EBS leadership team: "*The plan is to complete the prototype here at the HQ in the US and then create a certification project to submit it to CCCF… by doing that, the HQ will learn about the test requirement and criteria…*" This indicated the 'HQ-centric' orientation at that time of the philosophy behind product development for its international market, following the 'one-size-fits-all' strategy in RKT event B as mentioned above. In RKT event D, even though the subsidiary's product enhancement proposal was well recognised by the HQ through its social interactions, the knowledge was not legitimated by the HQ at the beginning due to conflict over the perceived value of the knowledge, which focused on cost reduction, with the belief of the HQ focusing on innovative and high-quality technology to serve customers in the safety industry. As a result, little progress had been made through years of issue-selling by the subsidiary in terms of adopting its technological solution for addressing EBS global compliance markets, even though the subsidiary's knowledge was technically well understood and greatly needed by the HQ in practice.

While legitimacy of organisations has received much attention in the literature (Suchman, 1995), comparably few scholars have looked into legitimacy of knowledge in the context of knowledge

transfer (Markard et al., 2016). My empirical findings advance our theoretical understanding of a more important role for knowledge legitimacy than the technical fit aspect of knowledge characteristics in shaping how HQs make sense of knowledge and exploit it in the context of RKT. This supports the idea that organisational attention is selective in nature in the context of RKT, that illegitimate knowledge may be selected out by the HQ, and is therefore unlikely to be exploited, even though there may be a high fit technically between the subsidiary and the HQ (Monteiro, 2015). However, what differentiated D from B, was not only the end result of knowledge legitimacy, but also the evolutionary path of the knowledge legitimation through the two RKT events, despite the subsidiary knowledge being perceived as 'illegitimate' at the beginning. My second set of findings regarding interactional factors presents a more promising picture shaping HQ attention from the top-down perspective in affecting the legitimation of the subsidiary's knowledge during RKT and in helping MNCs to exploit their subsidiaries' knowledge for wider use at the HQ. In the following section, I focus on how knowledge characteristics combine with these interactional factors to influence HQ attention to RKT.

5.3.4 How knowledge characteristics combine with interactional factors to influence HQ attention to RKT

As described in previous sections, knowledge characteristics, especially the legitimacy of the subsidiary's knowledge, shapes HQ attention to RKT, while my empirical findings reveal that the HQ itself, as an 'internal agent' evolving over time, plays a critical role affecting the recognition, legitimation and exploitation of knowledge in the context of RKT. What are the interactional factors that shift the role of the HQ as an 'agent of legitimacy'? HQ attention to the ideas, suggestions, or knowledge of the subsidiary is neither the source of pure rational judgement nor is it the sole result of emotional reactions, but is a socially constructed process between the HQ and

the subsidiary (Kumar & Demir, 2013). My empirical findings have identified several interactional factors, such as use of an expatriate subsidiary head, and co-practice, as well as the social interactions between the HQ and the subsidiary, which combine with knowledge characteristics to shift the processes of recognising, legitimating and exploiting the subsidiary knowledge at the HQ explaining the distinctive outcomes from RKT.

In RKT event A, the expatriate Subsidiary Head A, playing the role of 'boundary spanner', fostered the recognition of the subsidiary's new product development knowledge. Once the knowledge was recognised by the HQ, the high degree of legitimacy of the low cost-based but effective product knowledge captured the HQ's attention in supporting its transfer and exploitation for wider scope beyond China. Eventually, the subsidiary's new product development became a globally saleable EBS product incorporated into its global product portfolio. In this scenario, the success of RKT was a result of both the high legitimacy of the subsidiary's knowledge and the EBS HQ's attention through its expatriate Subsidiary Head A in recognising the potential of its subsidiary's knowledge. On the contrary, in RKT event B, although the high technical fit of the subsidiary's knowledge helped EBS HQ recognise it through the subsidiary's issue-selling, the loss of legitimacy of the subsidiary's knowledge when the external institutional environment changed shifted EBS HQ's attention to a HQ-centric orientation in terms of its product development philosophy for the global market. As a result, the project was called off. The failure of RKT in this scenario was a result of the loss of legitimacy through the knowledge legitimation process, although the subsidiary's knowledge was technically fairly familiar to the HQ's.

In RKT event C, the subsidiary's knowledge was very locational and context specific, with a high degree of ambiguity for EBS HQ, which impeded the knowledge being recognised at the initial stage of the problem solving. The search for a technological solution for a production modification

fostered a proactive approach by EBS HQ in joint working with the subsidiary on the knowledge creation. Through this co-practice under the lead of the co-project managers, EBS HQ played the role of institutional entrepreneur in facilitating the setting up of a favourable context for adopting the subsidiary's knowledge – *right* people, *right* place and *right* time. Eventually, EBS HQ successfully leveraged its subsidiary's localised innovation in terms of a global product modification and turned the crisis into a first-mover advantage in the market. The success of this knowledge exploitation for EBS HQ was a result of HQ attention towards purposely legitimating the knowledge through a 'learning-by-doing' process, although the legitimacy and technical fit of the subsidiary's knowledge were fairly low initially. Similarly, in RKT event D, high technical fit benefited knowledge recognition through the social interactions between the HQ and the subsidiary. Even though the low legitimacy of the subsidiary's knowledge impeded RKT at the beginning, HQ attention was captured through the legitimation process towards purposely setting up a favourable policy environment by changing the audience and reframing the purpose of the technology. In the end, EBS HQ harvested its subsidiary's knowledge and incorporated it into the global product strategy for compliance markets and distributors. Figure 16 provides a comparative summary of the mediating role of HQ attention in the four RKT events.

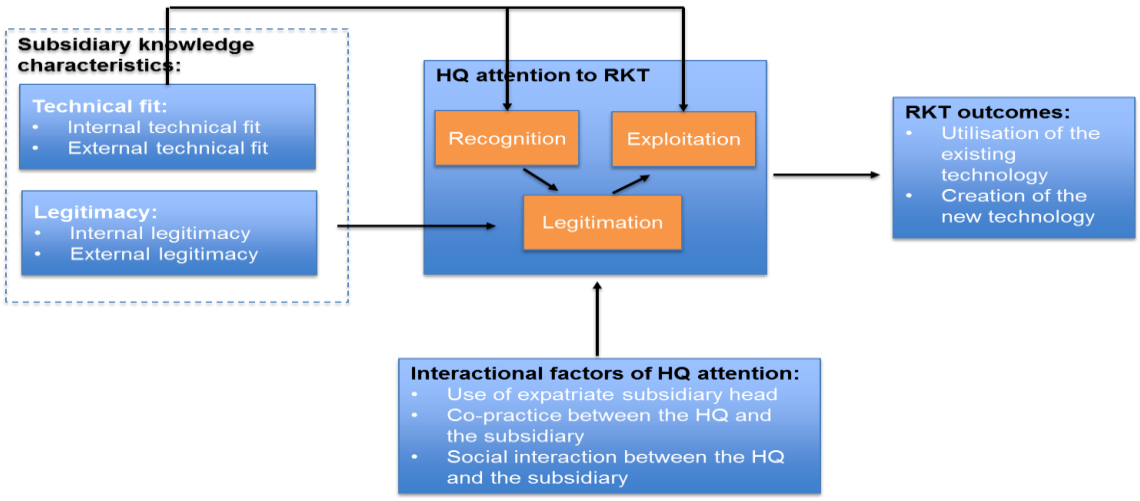


Figure 16: HQ attention mediating between knowledge characteristics and RKT outcomes

5.3.5 How do MNCs benefit from HQ attention in leveraging knowledge over time?

In this subsection, I turn to focus on my third research question – how an MNC benefits from HQ attention in its ability to leverage its subsidiary's knowledge over time. By tracing the four RKT events in EBS across time, my empirical findings indicate the evolving nature of HQ attention to RKT, which has benefited the MNC's ability in leveraging knowledge for creating and maintaining its competitive advantage in the international markets. Figure 17 provides an overall summary of the dynamics of HQ attention to RKT over time at multiple levels through the tracing of the four RKT events in EBS.

My empirical case study has illustrated the evolving nature of HQ attention to RKT, shaping its ability to leverage the subsidiary's knowledge over time through integrating the HQ's and the subsidiary's advantages, preventing the HQ from being distracted by the subsidiary's knowledge, and seeking an innovative solution to harvesting knowledge from its subsidiary. Over time, EBS HQ has moved from being a single attention provider to being a multiple attention provider. Further, my empirical findings suggest that both conventional knowledge transfer and RKT may be apparent across the different development stages of a subsidiary, and may occur simultaneously, which is not a linear but a 'spiral' process. This finding has also challenged the assumption of the either/or dichotomy between conventional knowledge transfer and RKT in the IB literature underpinning the different internationalisation logic for a MNC (Buckley et al., 2003).

During RKT event A, the Chinese subsidiary represented EBS's initial period in China. The level of interdependence between the HQ and EBS China was relatively low, and the primary role of the Chinese subsidiary was sensing and exploring local opportunities. When EBS HQ recognised the

potential opportunity to leverage the subsidiary's advantages by developing a new low cost-based product in response to external competition, it focused on synthesising the advantages of both through its attention, on the one hand by granting a high level of autonomy to the subsidiary for the new knowledge creation and, on the other hand, by supporting the core technology transfer from the HQ to the subsidiary. By doing this, EBS HQ successfully synthesised its subsidiary's new product development and the HQ's technology advantage, and consequently closed a critical gap in its global product portfolio (see Appendix 4 for a summary of RKT outcomes across the four RKT events).

As the Chinese market became more mature and EBS China developed more sophisticated competences, the role of the subsidiary in EBS, especially in terms of knowledge management, ventured into unknown territory. On the one hand, the subsidiary widened its ambition in taking more initiatives and selling these to the HQ in order to capture the HQ's attention and support; on the other hand, the HQ needed to choose which aspects of the subsidiary's knowledge and initiatives to enact on a global scale. In contrast to RKT event A, EBS HQ in RKT event B did not exploit the subsidiary's knowledge but purposely postponed the decision through a 'wait-and-see' approach until the external institutional environment had been clarified. By doing that, EBS HQ prevented its core competence from being distracted by the subsidiary's knowledge, while not ignoring the opportunity of leveraging its subsidiary's knowledge at a very early stage when the external institutional environment was ambiguous. Such capability could have played a value-creating role at that time, as EBS HQ needed to focus its limited resources on improving its existing competences, i.e. a software-based service development and a significant quality improvement in its existing products, rather than being distracted by the subsidiary's new knowledge and thus becoming too diversified and unmanageable. Although the RKT failed, EBS HQ shifted its

attention to taking on a global orientation with centralised HQ-controlled R&D management of the challenge of maintaining high quality and efficiency in new product development.

In the period of RKT event C, the centralised strategy impeded local responsiveness in the fast-developing local Chinese market. When the local regulations on technology standards of safety products became an issue, EBS recognised that its one-size-fits-all R&D practice was no longer effective in the global market when searching for a technological solution for a global product modification. Through joint working with its subsidiary on solving this technological problem, EBS HQ purposely created a favourable institutional context (right people, right place and right time) for exploiting knowledge as a unique solution for the complex technical problem at the HQ. The ability of EBS HQ, through its attention towards knowledge seeking, benefited it in terms of adopting the localised technological innovation from its subsidiary, and eventually turning the crisis into a first-mover advantage in the market.

In RKT event D, with the shift of EBS HQ's focus to the new technology and software-based service, the Chinese subsidiary's compliance product technology faced barriers in being adopted into EBS's global product strategy for addressing the compliance market, even though this technology was fairly familiar to the HQ. The NIH syndrome (Katz & Allen, 1982), as well as the increasing cognitive misalignment over time between the HQ and the subsidiary in terms of compliance technology, caused some managers at the HQ to resist accepting ideas from the Chinese subsidiary, as they believed EBS should design a brand new multiple gas instrument as a high-quality safety product. Through intensive social interactions (site visits, face-to-face meetings) between the HQ and the subsidiary over a period of years, EBS HQ still recognised that the Chinese subsidiary had the potential to contribute to developing the solution. Thus, EBS HQ deliberately created a favourable policy environment for accepting the subsidiary's knowledge at the HQ by

changing the audience and re-forming the purpose of the technology. The ability of EBS HQ, through its attention towards not only the knowledge per se, but also the audience for that technology, benefited EBS in harvesting its subsidiary's product enhancement technology, incorporating it into the global product strategy for addressing the compliance markets.

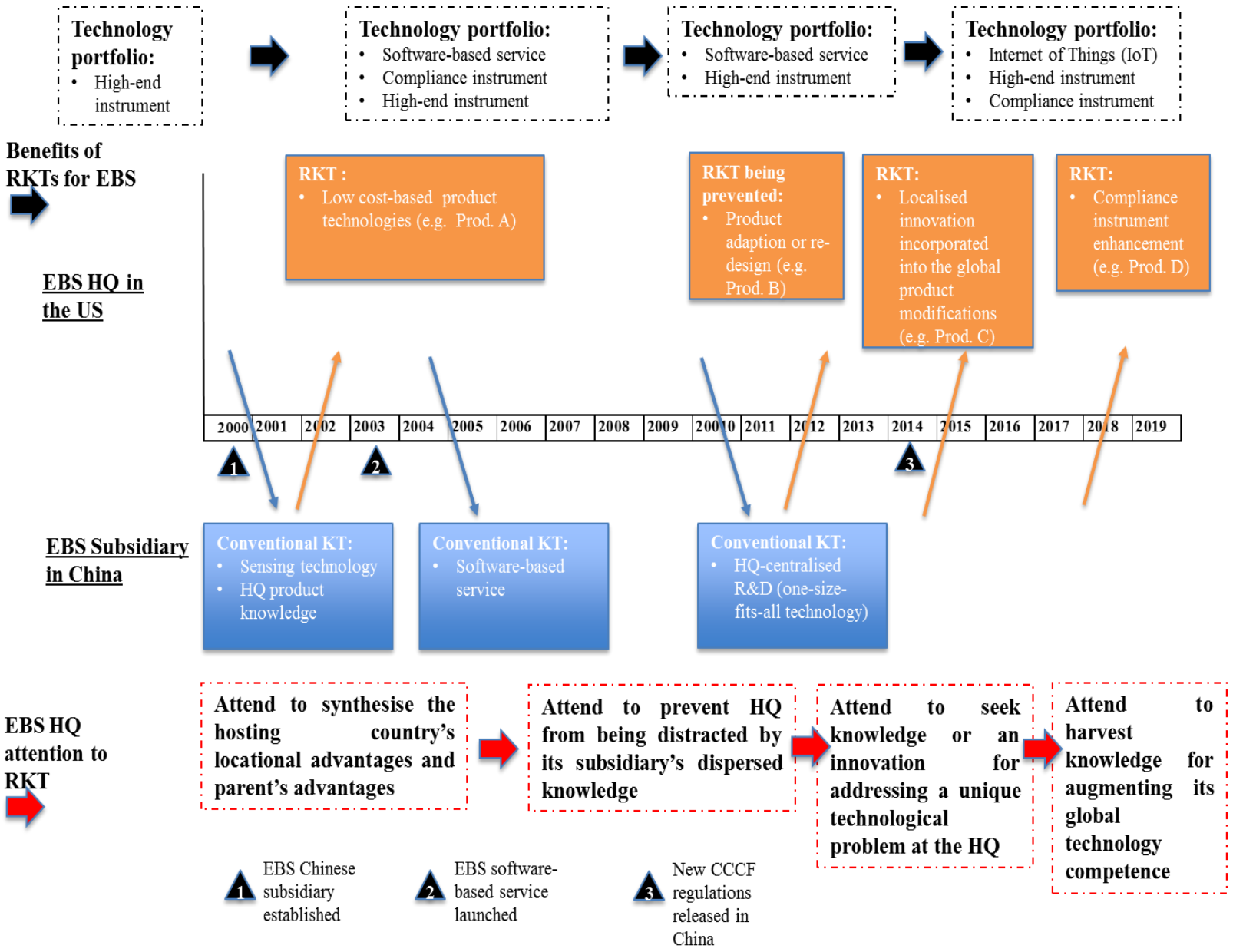


Figure 17: The dynamic of knowledge transfer between the HQ and the subsidiary over time

Chapter 6: Discussion

Drawing on attention theory (Bouquet & Birkinshaw, 2008; Ocasio, 1997; Yaniv, 2011) and using the lens of process, my research has sought to better understand a practical problem in managing RKT from developing economies to developed economies, which has received scant attention in IB. The discussion of RKT centres on the recognition, legitimation and exploitation processes applied to the subsidiary's knowledge through HQ attention, which has offered a new theoretical lens for the RKT literature and has enhanced the conceptualisation and adoption of the construct of HQ attention in the context of knowledge management. Building on previous research in relevance theory (Yang et al., 2008) and absorptive capacity (Cohen & Levinthal, 1990), my research integrates technical fit and legitimacy as two critical dimensions of knowledge characteristics, while also explicating the difference between technical and social characteristics of subsidiary knowledge that influence HQ attention to RKT. More specifically, my empirical findings reveal that a high degree of technical fit of the subsidiary's knowledge with the HQ does not guarantee that the knowledge will be accepted and used at the HQ. Rather, many subsidiaries' knowledge may be noticed and discovered by the HQ but, due to a lack of legitimacy, the deployment and exploitation of that knowledge at the HQ is impeded. Further, my empirical longitudinal case study of EBS suggests the distinctive roles that HQ attention plays in RKT in close association with the subsidiary's knowledge characteristics in terms of technical fit and legitimacy. In order to benefit from RKT, the HQ should pay attention not only to the subsidiary's knowledge per se, but also to the institutional environment at the HQ for leveraging its subsidiary's knowledge. In addition, my research also emphasises the importance of the mechanisms that increase the ability of the HQ to recognise, legitimate and exploit the knowledge, such as use of

expatriate subsidiary heads (Canestrino & Magliocca, 2010), co-project managers at both the HQ and the subsidiary (Frost & Zhou, 2005) and social interactions (Noorderhaven & Harzing, 2009) between the HQ and the subsidiary. Through these mechanisms, MNCs can increase their ability over time to manage and leverage their global dispersed knowledge.

6.1 Knowledge legitimacy and legitimation in RKT

6.1.1 Knowledge legitimacy

The RKT literature has highlighted that knowledge characteristics are more important for RKT than for conventional knowledge transfer due to the credibility issues with the knowledge source, given the shift of relational context (Millar & Choi, 2009). The construct of 'relevance' is adopted to capture the characteristics of the knowledge link between the HQ and the subsidiary, and involves both cognitive and technical aspects in RKT studies (Yang et al., 2008). Building on the socio-technical framework (Chai & Kim, 2009; Trist, 1963), I adopt the constructs of technical fit and legitimacy to explicate the difference between the technical and social characteristics of a subsidiary's knowledge to further the understanding of how the socio-technical characteristics of knowledge combine with the interactional factors to influence the dynamics of HQ attention to RKT. My research has focused on the technical and social characteristics of knowledge transferred from the subsidiary in a developing country to the HQ in a developed country, and how the socio-technical characteristics of the subsidiary's knowledge connect with HQ attention to RKT. My empirical findings have revealed that technical fit and legitimacy of the knowledge often do not coincide, and that legitimacy is more important than technical fit in the context of RKT.

Legitimacy remains an important but largely ignored subject in the context of knowledge transfer (Liao & Yu, 2012). A high degree of legitimacy – knowledge that is well understood, compatible

with established norms and practices, socially accepted and perhaps even endorsed by its broader institutional environment – has long been recognised as a crucial factor for the mobilisation of resources influencing successful knowledge creation and transfer (Bergek et al., 2008). Illegitimacy of knowledge impedes knowledge transfer despite a high degree of technical fit in the context of RKT, which is illustrated in EBS in every one of the four RKT events across time. My research provides an understanding of how a subsidiary's knowledge "wins acceptance" (Suchman, 1995) in the context of RKT beyond its technical fit with the HQ, which is crucial for success of RKT from a developing economy to a developed economy (Yang et al., 2008). The empirical findings imply that the dynamics of knowledge legitimacy in the context of RKT are related to: 1) knowledge stock at the subsidiary (micro-level); 2) institutional context at the HQ (macro-level); 3) institutional entrepreneurship (meso-level).

Knowledge stock at the subsidiary:

Despite the rise of the emerging economies, such as China and India, affecting global innovation (Govindarajan & Trimble, 2013), technology from subsidiaries in the developing economies confronts very substantial challenges in being legitimated by HQs in developed economies, as they are at a significant cultural and geographic distance from each other (Ambos & Ambos, 2009). Existing RKT literature has focused on acquiring advanced and unique knowledge from subsidiaries in developed economies, whereas emerging markets are generally seen as laggard markets with little influence on the adoption of new technological innovations compared to their developed counterparts (Vernon, 1966). Further, subsidiaries are embedded in MNC knowledge networks; they are also embedded in the host country's external knowledge network (Almeida & Phene, 2004). Such dual embeddedness means that knowledge created at subsidiaries is often tacit and context-specific in nature, which may not conform to the institutionalised practices or rules at

the HQ (Suchman, 1995). My empirical case study implies that the knowledge created at a subsidiary must include characteristics that are already considered as 'taken-for-granted' practices or must be known to increase understanding and acceptance at the HQ (Cohen & Levinthal, 1990). Three micro-level characteristics of knowledge have been observed:

Simplicity:

Rather than focusing on 'superiority' or 'cutting-edge' technology, the simplicity of knowledge from the emerging country highlights the *low cost-based* but *effective* character of the technological knowledge, as for the new product development in RKT event A. This improved the compatibility of the knowledge created at the subsidiary in a developing economy with the HQ in a developed economy, and eventually increased the acceptance of the knowledge so that it was adopted and expanded on a global scale. For example, the new product development at the subsidiary in RKT event A, despite its compact size, included features usually found only in high-end products, including a large liquid crystal display (LCD), internal vibrating alarm, audible / visual alarms and simple push-button operation. Further, this was a very simple design using a standard component, the changeable battery, which benefited EBS in quickly achieving global certification.

Market-provenness:

When knowledge is market-proven, such as being 'well-regarded technology' or 'market practice', the adoption of this knowledge may be judged by the HQ as "the right thing to do" (Suchman, 1995), which also represents the tendency of MNCs to copy successful knowledge or practices in the market as the pressure to 'mimic' increases (Kostova & Zaheer, 1999). In my case study, leveraging the cost advantages from the subsidiary in China for new product development (in RKT event A) and compliance product enhancement (in RKT event D) was perceived by EBS HQ as a

well-regarded market practice. Isomorphism has been well discussed at inter-organisational (meso-)level (Kostova & Roth, 2002). In the conventional knowledge transfer situation, a subsidiary may gain legitimacy when it undergoes 'isomorphic' change to reflect the HQ (Ando & Naoki, 2015; Deephouse & Suchman, 2008; Kumar & Demir, 2013). I found no discussion of reverse isomorphism at a micro-level – where a HQ morphs to its subsidiary's knowledge for wider use in a MNC – in the RKT literature. My research advances insight into this.

A unique combination of localised knowledge addressing a global complex problem:

Developing markets have distinctive features compared to the developed countries, with challenges involving underdeveloped infrastructure, changing regulatory environments and increasing competition (Govindarajan & Ramamurti, 2011). A MNC in a developed economy may fail to spot and respond to these challenges for its business in a developing economy. EBS RKT event C is a good illustration that the 'one-size-fits-all' technology strategy at the HQ did not work in the crisis it faced related to regulatory change in China. Once the subsidiary's localised technological innovation emerged, it represented a unique combination of knowledge involving the local regulatory framework, competitors and engineering expertise to tackle EBS HQ's complex technological problems, and promoted a unique and favourable context in which to gain cognitive alignment between the subsidiary and EBS HQ (Suchman, 1995) to incorporate the solution into the global product modification plan.

Institutional context at the HQ:

Although the conformity of the subsidiary's knowledge with the HQ as it emerges and is created influences the legitimacy of the knowledge and thus HQ attention to RKT, the internal and external institutional environment of a MNC at a macro-level also increases or decreases the legitimacy of

knowledge (Kostova & Zaheer, 1999). A subsidiary's knowledge embedded in the host country's knowledge network may be in conflict with beliefs, norms and practices at the HQ or even with external formal regulations. Misalignment weakens the effect that institutions at the HQ have on the legitimation of the subsidiary's knowledge, while alignment corresponds to a strengthening of institutional force (Markard et al., 2016). For example, in RKT event B, with EBS HQ shifting its philosophy on new product development through the 'one-size-fits-all' approach to its global markets, the subsidiary's knowledge (product redesign technology) lost its legitimacy to apply on a global scale. Further, the change of external regulatory context, i.e. providing an expansion of the international certificate for a product, expedited the loss of the subsidiary's knowledge legitimacy. Macro-level issues have been discussed in the context of a host country (Kostova & Zaheer, 1999), but particularly in the context of developing economies, they should also be considered in terms of knowledge legitimacy in RKT (Gao et al., 2017).

Institutional entrepreneurship:

Institutional theory has focused on the role of institutional entrepreneurship as an important component in the institutionalisation of knowledge in a new context (Cantwell et al., 2010; Markard et al., 2016; Suchman, 1995). The literature highlights the role of "agents of legitimacy" (Dacin et al., 2002), who have the interest and resources to support the development of knowledge and to engage in knowledge transfer through purposeful and continued actions. My empirical findings reveal the presence of such 'institutional entrepreneurs' as a necessary condition for success in gaining legitimacy of the subsidiary's knowledge in the context of RKT, especially when the original knowledge created at the subsidiary has a low level of compatibility with the HQ, or the institutional context has changed internally or externally. My empirical findings suggest that institutional entrepreneurship of the HQ in the context of RKT involves the (meso-level) social and

political processes which shape the institutional relationships between the subsidiary's knowledge and the context at the HQ (Markard et al., 2016). I elaborate on this in Chapter 7. The relationship may evolve and change as a consequence of manipulation of the institutional environment (e.g. RKT event C), or of changing the audience (e.g. RKT event D) through re-forming the purpose of the knowledge (Suchman, 1995).

In sum, the literature highlights that technical fit is an important factor influencing knowledge transfer depending on the alignment between knowledge characteristics and organisational characteristics (Ansari et al., 2010). This is based on the assumption that organisations aim to reduce the costs of implementation of new knowledge, building on theories related to transaction cost (Teece, 1977) and absorption capacity (Cohen & Levinthal, 1990), regardless of the original reasons for adoption. My empirical case study tracing the four RKT events in EBS has indicated that the success of RKT is more related to legitimacy beyond its technical fit. This also furthers 'relevance' (Yang et al., 2008) and socio-technical theory (Trist, 1963) by highlighting that knowledge legitimacy should play a more important role than technical fit in the unique asymmetry of RKT.

However, knowledge transfer is evolutionary and path dependent in nature in the context of MNCs (Liu & Chen, 2016; Winter & Nelson, 1982). This implies that it is not enough to pay attention only towards the subsidiary's knowledge per se in order to drive RKT for a MNC, but also towards knowledge legitimation – a process of developing the appropriate institutional environment for adopting the knowledge at the HQ.

6.1.2 Knowledge legitimation

Knowledge legitimacy deals with the compatibility of knowledge with the HQ's established practices, norms and beliefs. Legitimacy is described as "a generalized perception or assumption" by Suchman (1995) that is linked with multiple level (macro-, meso- and micro-) factors in the context of RKT, as stated in the previous subsection. While I treat knowledge legitimation as the process whereby the HQ 'justifies' that the wider use of its subsidiary knowledge is 'right' in the context of RKT as the result of interplay between socio-technical characteristics of knowledge at the micro-level, the internationalisation of institutional norms and beliefs at the macro-level, and collective practices of groups in an organisation at the meso-level. The knowledge legitimation process has both a cognitive and an evaluative side (Suchman, 1995). On the cognitive side, knowledge legitimation occurs when the knowledge and its creation process becomes congruent with the HQ's broader beliefs, norms and practices – that is, recognisable. On the evaluative side, knowledge legitimation is gained through a highly subjective interactive process whereby the subsidiaries 'sell' to the HQ the value and relevance of their knowledge against the initial negative position of the HQ as to the 'credibility' challenge for the knowledge source (Millar & Choi, 2009), while the HQs 'buy' the potential and value of the knowledge for wider use in the MNC through giving its attention (Barnett, 2008). As such, knowledge 'legitimation' in the context of RKT may involve some form of initial judgement by the HQ of the 'legitimacy' or 'illegitimacy' of the knowledge. However, that evolves into the HQ, as the institutional entrepreneur, taking a proactive approach through the legitimation process (Cantwell et al., 2010; Markard et al., 2016), such as by manipulation of the institutional environment or by changing the audience through re-forming the purpose of the knowledge. I argue that HQ attention to RKT centres on the knowledge legitimation process whereby the HQ plays distinctive roles to engage in RKT.

6.2 The distinctive roles of HQ attention to RKT

The existing literature has highlighted the important role of the subsidiary in the RKT process in a MNC in persuading the HQ that its knowledge has potential for wider use (Yang et al., 2008), through bottom-up influencing mechanisms such as issue-selling (Dutton et al., 2001) or the voicing process (Bouquet & Birkinshaw, 2008). However, the importance of the subsidiary does not mean a less important role for the HQs in RKT (Ambos et al., 2006), yet theory development on the latter is much scarcer. My fieldwork has revealed that RKT is more likely to take place when the HQ pays attention. This implies that it is not enough for a MNC to push only the subsidiary to take the initiative and wait for it to sell to the HQ; conversely, the initiative being taken by the subsidiary may be perceived as 'over-selling' and dismissed (Conroy & Collings, 2016). Through my empirical case study of EBS, I have identified a number of typical scenarios for RKT through which HQ attention plays the distinctive role. By mapping technical fit and legitimacy as two dimensions in a matrix, as shown in Figure 18, I have devised a framework for managing the trade-off between the technical and social characteristics of knowledge in the RKT process, and show how HQ's could add value to the process as 'attention providers'. Excelling on both dimensions of knowledge characteristics may prove difficult for the HQ in RKT, as the antecedents of technical fit and legitimacy are not always compatible. Indeed, prior research has pointed out that technical fit and legitimacy do not necessarily coincide in knowledge transfer, and that misalignment in either of these two dimensions may lead to high transfer risks or low acceptance at HQs (Zajac et al., 2010). Specifically, I argue that the HQ should not play the sole role of a passive knowledge receiver in the context of RKT, but should also be a *gatekeeper*, a *facilitator*, a *legitimator* and a *learner* in order to increase the benefits from RKT (Ambos et al., 2006). The distinctive roles of

HQ attention to RKT are related to HQ ability to recognise, legitimate and exploit knowledge, which makes a difference between MNCs in terms of benefiting from RKT.

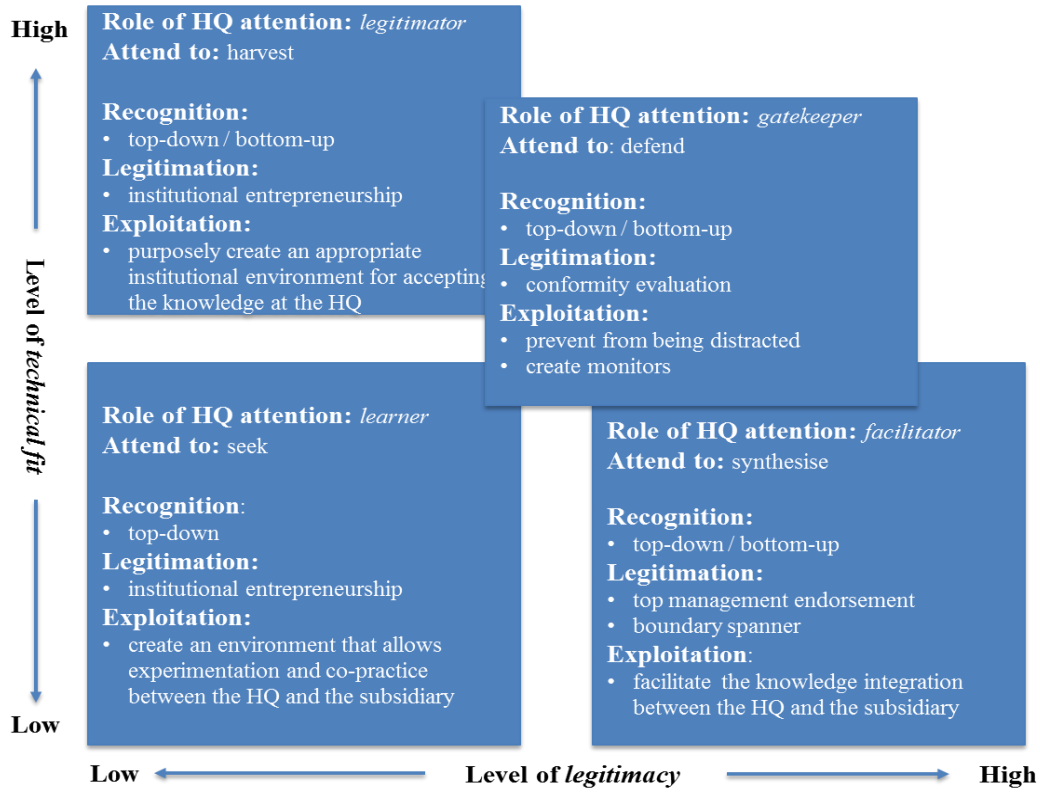


Figure 18: The role of HQ attention and the strategy for RKT

Attend to synthesise

Under the scenario of low technical fit but high legitimacy, the potential of the subsidiary's knowledge may be noticed and recognised by the HQ for wider use through ways that can be top-down or bottom-up. Even though the degree of legitimacy of the subsidiary's knowledge stock may be high initially, the HQ still needs to devote its time and effort to maintain this knowledge legitimacy and organise knowledge exploitation in order to associate and connect the HQ's and the subsidiary's advantages. The strategy for RKT under this scenario is to attend to synthesise. The role of HQ attention is a facilitator for maintaining knowledge legitimacy and integrating the

knowledge held by both the HQ and the subsidiary. HQ attention has been viewed as a primer for synthesising knowledge between HQ and subsidiary (Ocasio & Joseph, 2005). With the shift of locational context of knowledge transfer in RKT, the subsidiary becomes the knowledge source for the MNC and the HQ cannot drive the subsidiary to transfer its knowledge through its power, although it can do this in conventional knowledge transfer (Mudambi et al., 2014; Yang et al., 2008). HQ attention provides a 'soft' mechanism (Ambos & Birkinshaw, 2010) to connect the 'home country's advantage' (Cantwell & Mudambi, 2005) and the 'hosting country's advantage' (Rugman & Verbeke, 2001) and turn them into a competitive advantage for the MNC. To pay attention to synthesise, the HQ sends a positive signal that also affects its subsidiary's commitment to engage in RKT while the cognitive connection between HQ and subsidiary is maintained.

Attend to harvest

RKT involves a legitimation process for the subsidiary's knowledge. Under the scenario of high technical fit but low legitimacy, HQ attention plays a role as a legitimator. Through legitimating the subsidiary's knowledge, the HQ enables that knowledge to become a corporate priority which may be leveraged for wider use globally, while maintaining the power relationship vis-à-vis the subsidiary in RKT (Ambos et al., 2010). By doing so, a MNC may benefit in harvesting its subsidiary's knowledge (Pak et al., 2015). The 'principal-agent' relationship between HQs and subsidiaries implies that the conventional 'top-down' transfer is legitimate and necessary (Chung, 2014), particularly in knowledge-exploiting foreign direct investment (Dunning, 2000). RKT has to go through a legitimation process in order to win acceptance for the subsidiary's knowledge at the HQ (Markard et al., 2016). To legitimate a subsidiary's technological knowledge in the context of the HQ, the new knowledge needs to acquire widespread acceptance and become part of the routines of the HQ (Johnson et al., 2006). When the technological knowledge is not immediately

accepted by people, HQ attention to legitimation of the subsidiary can be perceived as a cumulative process that unfolds across time (Johnson et al., 2006). HQs can purposely drive the creation of legitimacy for their subsidiaries' knowledge by changing the audience or reframing the purpose of the knowledge (Suchman, 1995).

Attend to seek

The scenario of low technical fit and low legitimacy is the most challenging situation for both the subsidiary and the HQ in which to engage in RKT because of the low likelihood of the subsidiary's knowledge being recognised and accepted initially. A purposely top-down search for a solution to a problem by a HQ may trigger the discovery or creation of knowledge and its transfer from a subsidiary to the HQ. In contrast to the previous scenario (attend to harvest), the HQ should pay attention towards not only the subsidiary's knowledge per se but also the development of an appropriate institutional environment which allows the trial-and-error and experimentation needed to solve a problem by adopting the knowledge gained (Cantwell et al., 2010). By doing that, the HQ not only creates knowledge legitimacy but also increases its absorptive capacity through a joint problem-solving process with the subsidiary. The strategy for RKT under this scenario is to attend to seek. The role of HQ attention is as a learner creating knowledge legitimacy and working jointly with the subsidiary on the knowledge creation and transfer. This process of HQ attention is related to the conscious character of attention (Kumar & Demir, 2013) and also to the notion of 'institutional innovation' (Regnér & Edman, 2014). The mechanisms underlying the attention process of seeking are motivated and intentional (Ocasio, 2011; Ocasio & Joseph, 2005). This process involved both EBS HQ's cognition that provided incentives for it to pay attention to seeking the knowledge from its subsidiary, and its attention structure through learning by doing that enabled the new knowledge to be jointly created and the RKT to take place. As a result, MNCs

may benefit from leveraging localised innovations from subsidiaries and win first-mover advantage in the market (Marvin B. Lieberman & Montgo, 1988), like RKT event C for EBS.

Attend to defend

Last but not least, I have also identified one scenario in the context of RKT: attend to defend. Compared to the aforementioned scenarios, the HQ plays the role of gatekeeper in this scenario, and does not attempt to drive the occurrence of RKT but to prevent its existing competences from being distracted by a subsidiary's knowledge that does not align and would thus become too diversified and unmanageable (Monteiro, 2015). This is also related to the selective nature of attention due to finite organisational attention capacity and infinite external information (Ocasio, 1997; Yaniv, 2011). The selectivity of organisational attention is not necessarily a bad thing for a firm, especially under a stable environment (Monteiro, 2015). For example, in RKT event B at EBS, the HQ called off the transfer project through the sense-making process applied to its subsidiary's knowledge and thus prevented EBS HQ from being distracted by its subsidiary's product redesign knowledge, rather than continuing to focus on the core software-based service and product technology at the HQ. In sum, the strategy of attending to defend may apply in various contexts of the two knowledge characteristics dimensions of technical fit and legitimacy, depending upon the cognitive ability and motivation of the HQ (Monteiro, 2015). HQ attention to defend also plays an important role in RKT given that not all RKTs will benefit a MNC equally (Ambos et al., 2006).

6.3 Attentional mechanisms for RKT

My empirical findings suggest that HQ attention to RKT through recognition, legitimation and exploitation of a subsidiary's knowledge plays a central role in explaining the differences between

RKT outcomes. Without HQ attention, a subsidiary's knowledge, even though it is relevant to the HQ, may go unnoticed, not legitimated or impeded from being exploited (Yaniv, 2011). RKT is more complicated with its reverse direction of knowledge flow between the HQ and the subsidiary compared with conventional knowledge transfer (Yang et al., 2008). Conflict among different teams between HQ and subsidiary over technology transfer and information asymmetries is inevitable (Kaufmann & Roessing, 2005). Apart from the knowledge characteristics, institutional theory has highlighted the importance of institutional entrepreneurship in influencing the adaptation of new knowledge and innovation (Suchman, 1995). My research indicates that a HQ may play a critical role as 'agent of legitimacy' (Dacin et al., 2002) in RKT through continually devoting purposeful time and effort not only to provide the resources to support the knowledge transfer but also to maintain and even create the legitimacy of the subsidiary's knowledge that could be exploited at the HQ. My empirical findings reveal that the locus of HQ in influencing knowledge legitimation does not derive from the formal decision-making power of top management, such as the global CEO (in RKT event A) and global operations vice-president (in RKT event D), but results from the abilities to sense and associate the knowledge between HQ and subsidiary and to develop an appropriate institutional environment for the knowledge to be understood, accepted and adopted at the HQ. HQ attention is crucial not only in the scenarios in which knowledge is not well accepted or appreciated initially, but also in the scenarios with knowledge stock that is perceived as legitimate, in order to maintain this legitimacy and organise the exploitation of the knowledge at the HQ through the RKT process.

Importantly, I emphasise the importance of use of an expatriate subsidiary head, and co-practice, as well as the social interactions between the HQ and the subsidiary as the more effective

mechanisms for fostering and developing HQ ability to recognise, legitimate and exploit the subsidiary's knowledge. My empirical case study provides nice illustrations (see Appendix 3).

Use of an expatriate subsidiary head:

In addition to top management endorsement, an expatriate subsidiary head is another important internal agent that may shape HQ attention to RKT. Using an expatriate subsidiary head has been extensively studied in the MNC literature (Björkman et al., 2004). The role of the expatriate subsidiary head as a 'boundary spanner' (Beamish & Berdrow, 2003) has been highlighted as influencing knowledge transfer in the context of IB (Canestrino & Magliocca, 2010). However, most of the literature on expatriate subsidiary heads tends to highlight this as a static organisational mechanism (Sajadirad et al., 2015). My empirical findings suggest that an expatriate subsidiary head is a means, from the behaviour perspective, to facilitate knowledge integration and cognitive alignment between the HQ and the subsidiary in the RKT process.

On the one hand, the dual embeddedness of a subsidiary means that knowledge created at subsidiaries is often tacit and context-specific in nature, which challenges HQs in recognising its value and potential for application, especially when the technical fit of the knowledge is low (Andersson et al., 2002). An expatriate subsidiary head, as a mediator, might initially be helpful for the HQ in associating and connecting the subsidiary's knowledge with the HQ, which consequently improves the HQ's absorptive capacity. On the other hand, tacit and context-specific knowledge often involves a process of negotiation and cognitive alignment between the HQ and the subsidiary, especially with the shift in the relational context of knowledge transfer in RKT (Carlile, 2004). Expatriate subsidiary heads can be expected to bridge the cognitive alignment between HQ and subsidiary in RKT because he or she is more likely to be socialised into the

subsidiary while being significantly influenced by the HQ (Petison & Johri, 2008). In sum, my empirical findings suggest that an expatriate subsidiary head could be an effective means to promote the ability of the HQ to recognise, legitimate and exploit knowledge in the context of RKT.

Co-practice between the HQ and the subsidiary:

I adopt the term co-practice to capture the collaborative activities in knowledge creation and transfer between HQ and subsidiary by means of a co-project (Frost & Zhou, 2005). This may involve formal collaborative R&D projects that take a longer time, or joint problem solving between HQ and subsidiary in the MNC. My empirical case study suggest that co-practice under co-project managers created by the management team increases the capacity of HQ attention (Brock & Yaniv, 2007) to recognising, legitimating and exploiting the subsidiary's knowledge in the context of RKT. This often involves strong collaboration, alignment and teamwork between HQ and subsidiary.

On the one hand, co-practice increases absorptive capacity by creating a shared understanding of the potential of the subsidiary's knowledge for wider use at the HQ. It provides a mechanism through which capabilities of the HQ to recognise and understand the new knowledge are developed dynamically (Frost & Zhou, 2005). RKT event C in the EBS case study is a good example. A challenge at the beginning of the project was that the risks were being misunderstood as issues. When this gap was realised by the co-project managers through their conversations with other team members, a risk assessment on the project and training in risk assessments were conducted as a tool or process for the subsidiary. Once the teams were synchronised on the meaning of 'risk', it became much easier to have every stakeholder in the project on the same page. Technical collaboration in problem-solving through experiments (Cantwell et al., 2010) leads to

learning for both HQ and subsidiary and thus to a tendency towards convergence on a joint knowledge creation and transfer process. In addition, co-practice over time facilitates the development of skills and experience at the HQ in leveraging its subsidiary's knowledge.

On the other hand, co-practice also facilitates cognitive alignment between HQ and subsidiary, and therefore enhances knowledge legitimacy in the RKT process. Most directly, co-practice creates a context that allows experimentation and joint working on knowledge creation by both the HQ and the subsidiary. By carrying out problem-solving jointly, the subsidiary and the HQ inevitably engage in various forms of exchange (not just of knowledge) in the process creating trust (Tsai & Ghoshal, 1998). Eventually, co-practice helps to establish common values and collective goals within the context of RKT, not only at the individual level but also at the organisational level (Carlile, 2004).

Social interaction:

Social interaction among managers from different units in an MNC has been shown to be an important factor in stimulating intra-MNC knowledge transfer (Noorderhaven & Harzing, 2009). This may involve face-to-face meetings and site visits, which form a communication channel that is particularly conducive to the transfer of tacit, non-codified knowledge (Gupta & Govindarajan, 2000). Although the importance of social interaction for knowledge transfer has been generally accepted, the previous literature has mainly highlighted the moderating effect on the communication channels for knowledge transfer based on the sender-receiver model (Gupta & Govindarajan, 2000; Szulanski, 2000). My empirical findings reveal that social interactions between HQ and subsidiary create a context that may promote the recognition and legitimation of a subsidiary's knowledge in the context of RKT.

On the one hand, intensive social interactions, such as face-to-face communication, informal interaction and teamwork between HQ and subsidiary, increase exposure to the subsidiary's knowledge and thus the likelihood of it being recognised as having potential for wider use at the HQ (Noorderhaven & Harzing, 2009). Over time, this increases the HQ's attentional 'bandwidth', its ability to notice and recognise external knowledge sources that it could use for its own benefit (Yaniv, 2011). On the other hand, social interaction may not only facilitate knowledge creation and transfer through conversations and interactions (Nonaka et al., 2000), but also create a social environment for the acceptance and adoption of knowledge, which eventually benefits the legitimation and exploitation of knowledge at the HQ in the context of RKT. This is the essence of the social-communities-of-practice view (Brown & Duguid, 1991). RKT in social communities is collective knowledge and shared sense-making that requires substantial time and effort (attention) in translating, interpreting and adapting to the context at the HQ (Kogut & Zander, 1992). My empirical case study (RKT events C and D) provided a nice illustration of social interaction as an effective mechanism that may promote the ability of the HQ to leverage its subsidiary's knowledge through the processes of attention to RKT.

Chapter 7: Conclusions

My research aimed to shed light on the role of HQ attention to RKT. Historically, MNCs have made foreign direct investments to exploit firm-specific advantages abroad through transferring knowledge from their HQs to the subsidiaries (Dunning & Lundan, 2009; Hymer, 1976). Yet today, with knowledge being one of the main sources of competitiveness for MNCs (Kogut & Zander, 1993), the ability to manage and benefit from RKT becomes crucial for MNCs in sustaining their competitive advantages by leveraging their global dispersed knowledge networks (Ambos et al., 2006). Despite RKT increasingly gaining attention, prior RKT research has highlighted the importance of knowledge characteristics but has focused on the role of the subsidiary as a 'persuader' in selling its knowledge to the HQ (Yang et al., 2008) while little is understood about the role played by HQ attention in the RKT process.

Taking attention theory (Ocasio, 1997; Yaniv, 2011), from a process perspective, and integrating it with the knowledge-based view (Grant, 1996), my thesis has expanded attention theory in the context of RKT. Specifically, I have sought to explore how socio-technical characteristics of knowledge (technical fit and legitimacy), interactional factors and HQ attention combine to explain RKT outcomes, and how MNCs benefit over time from HQ attention to RKT. My empirical study findings show that HQ attention to RKT is not an object that a MNC can obtain but is a managerial process that centres on the processes of *recognition*, *legitimation* and *exploitation*. Building on that, I argue that knowledge legitimacy is more important than technical fit, given the nature of RKT with shifts in both locational and relational context of the knowledge transfer between HQ and subsidiary. Further, I argue that the HQ plays an active role in RKT, rather than being a passive knowledge receiver, as a *gatekeeper, facilitator*, *legitimator* and *learner*, in consideration of the

knowledge characteristics. Lastly, my thesis suggests that the HQ may increase its ability to leverage its subsidiary's knowledge over time, as well as its benefits from doing so, through mechanisms such as use of an expatriate subsidiary head, co-practice and social interaction between HQ and subsidiary, all of which shape HQ attention towards not only the knowledge per se but also the development of an appropriate environment for exploiting the knowledge. Through a single longitudinal case study tracing four RKT events in an American multi-national company over 18 years, my study contributes to knowledge management and attention theory, and aids their practitioners by providing 'guidance' for HQs in how to attend to RKTs.

7.1 Implications for theory

Firstly, I have integrated technical fit and legitimacy as two critical dimensions of knowledge characteristics that apply in the study of technology transfer, and have discussed how these impact on HQ attention to RKT. As such, the thesis builds on previous research in relevance theory (Yang et al., 2008) and absorptive capacity (Cohen & Levinthal, 1990) but explicates the difference between the technical and social characteristics of subsidiary knowledge. It contributes to Nonaka's knowledge theory (Nonaka, 1991) in terms of knowledge creation and transfer, not only at the individual level but also at the collective level, by showing the importance of knowledge legitimacy in RKT beyond its technical fit for every single RKT event in my empirical case study. My empirical findings indicate that the dynamic nature of knowledge legitimacy in the context of RKT is related not only to the characteristics of the knowledge stock at the subsidiary, but also to the legitimation process at the HQ. Knowledge legitimacy and legitimation has not received much attention in the international business research, which has emphasised that knowledge is created and transferred through exchanges underpinned by the transactional costs (Teece, 1977). My thesis

addresses a deficiency in this regard and emphasises that RKT is a social learning process in nature (Noorderhaven & Harzing, 2009), through which a HQ should proactively pay attention to the legitimation process of the knowledge in order to benefit from RKT.

Secondly, I have further extended the attention-based view of RKT. This complements previous studies (e.g. Ambos & Birkinshaw, 2010; Bouquet & Birkinshaw, 2008; Bouquet et al., 2009) of attention building in the 'structural' paradigm by focusing primarily on the quantitative and positive aspect of HQ attention. My study suggests a process-based view of HQ attention in the context of RKT. More specifically, I argue that HQs should not solely play the role of passive knowledge receiver, but also proactively play the roles of gatekeeper, facilitator, legitimator and learner, in consideration of the knowledge characteristics in terms of the technical fit and legitimacy between HQ and subsidiary. Building on this, I have not only developed a theoretical link between knowledge characteristics (technical fit and legitimacy), interactional factors, HQ attention and RKT outcomes, but also empirically proved an active role for HQs as attention providers to enable RKT through a detailed case study in a single organisation over 18 years. This implies that MNCs in developed countries will benefit more from RKTs from their distant subsidiaries in developing countries when their HQs develop their attention capabilities over time. This complements the existing literature, which takes RKT to be a 'persuading' process from the bottom-up perspective (Yang et al., 2008), by suggesting HQ plays an active role in RKT from the top-down perspective.

Thirdly, my research has also gained new and unexpected insights to enhance my preliminary theoretical framework featured in Figure 2. First, while the HQ tends to attend to knowledge that fits into its technology and practices, the subsidiary tries to seek the HQ's attention by selling its knowledge legitimacy. I have found that such a *mismatch* in the perception of knowledge strongly

explains the process of and outcomes from RKT. The second new insight is that I have found evidence (RKT event D) for the role of subsidiary leaders in RKT in attracting the HQ's attention. This complements the argument that RKT is a persuading process on the part of the subsidiary (Yang et al., 2008), and my study has shown how successful RKTs have involved subsidiary leaders 'persuading' the HQ by promoting both the *technical fit* and *legitimacy* of the subsidiary's knowledge. Managing HQ attention is ultimately a dynamic process involving not only technological but also social competences (Cantwell et al., 2010), which subsidiaries still need to learn over time.

Fourthly, from a methodological perspective, my adoption of critical realism contributes to theory building in the fields of cross-border knowledge management and international business strategy. The 'abductive' based approach (Timmermans & Tavory, 2012), combined with a number of process-based data analysis strategies, such as narrative, temporal bracketing and visual mapping (Langley & A., 1999), has generated diverse and rich primary data spatially, temporally and relationally at multiple levels (macro-, meso- and micro-) specifically for my research objectives. The research has utilised multiple RKT events in a single organisation with a single subsidiary over a period of 18 years. Multiple events have enabled us to conduct a close and comparative examination of the intricate and evolving relationships between relevant actors, events and factors. By following an organisation over time, I have collected rich process data to explore HQ attention to RKT using the lens of process and capability, which has not been achieved by previous research. Moreover, by collecting the data from both the HQ and the subsidiary, this provides different perspectives on RKT across hierarchical and locational boundaries, which has been largely overlooked in the study of knowledge transfer across borders for MNCs.

7.2 Implications for practice

My thesis starts with an empirical problem: how does a multinational corporation (MNC) manage knowledge transfer from its subsidiaries in developing economies to its headquarters (HQ) in a developed economy and thus benefit from the creation and sustaining of a competitive advantage in the international market? Despite its strategic importance, RKT is severely under-performed, in particular from subsidiaries in developing economies to HQs in developed economies.

On the one hand, the HQ has a limited capacity to recognise the potential and value of the subsidiary's knowledge, not only because of its absorptive capacity (Cohen & Levinthal, 1990) but also because of its cognitive limitation (Monteiro, 2015), so the existing knowledge at the subsidiary may inevitably be undervalued even when this knowledge is relevant or valuable to the HQ (Chung, 2014). Historically, developed countries are often considered as the lead markets and the source of innovation that could influence the willingness of HQ to pay attention to the RKT from its subsidiary in the developing countries, whereas the HQ in the developed countries must go out of its 'comfort-zone' and go against its 'dominant mindset' that it 'knows best' (Chung, 2014) in order to learn from its subsidiary. My thesis offers the important implications for the MNC managers by suggesting the HQ attention as a 'soft' mechanism of leveraging knowledge and co-creation of knowledge between the HQ and the subsidiary in the context of RKT. It is noticeable that the previous literature (e.g., Ambos et al., 2010; Ambos & Birkinshaw, 2010; Birkinshaw et al., 2007; Bouquet & Birkinshaw, 2008) has highlighted the importance of HQ attention in MNC by focusing on the structural and relational determinants to certain subsidiaries. However, it does not help to practically guide HQs on how to attend to a specific RKT. By reconceptualising HQ attention as a process and recognising its tacit, contextual and evolutionary natures in close association with knowledge characteristics (technical fit and legitimacy) and the international

factors, my thesis provides a clear practical guidance to MNCs on how to manage RKT and how to benefit from it through HQ attention.

On the other hand, RKT is socially complex (Millar & Choi, 2009), the initiative being taken by the subsidiary may be perceived as 'over-selling' and dismissed at the HQ as the HQ and the subsidiary have a mixed-motive relationship (Ghoshal & Nohria, 1989). Capturing HQ attention in RKT is ultimately a dynamic process where subsidiaries need to learn through the interactions between the HQ and the subsidiary over time. Awareness of the subsidiary managers of the HQ attention to a specific RKT in relation to both technical fit and knowledge legitimacy according to my research may help subsidiary managers to improve their overall strategy for 'issue-selling' and 'persuading' in the context of RKT, and thus benefit to enhance the subsidiary's influence and autonomy in MNCs through the RKT activities (Najafi-Tavani et al., 2015). The existing RKT literature has highlighted the important role of subsidiary in issue-selling and persuading in RKT (Yang et al., 2008), my thesis complements these literature by offering the direct implications for guiding the subsidiary managers how, when and through whom to sell the knowledge involving not only their technological but also social competences.

RKT is essential for achieving and sustaining international competitiveness for MNCs (Yang et al., 2008), my research suggests that a HQ needs first to learn how to pay attention to RKT in order to benefit from RKT in its international market, and a subsidiary needs to learn how to seek attention from its HQ to RKT in order to gain more influence and autonomy with the MNC through the RKT activities. This thesis offers valuable guidance for MNC managers between the HQs and the subsidiaries engaging in RKT in several aspects.

7.2.1 The managerial recommendations to the HQs

Pay attention to attention. Despite the unique bundle of opportunities and challenges, and the increasing talent pool in developing economies that has been recognised as a source of innovation and knowledge for MNCs (Jha et al., 2016), knowledge transfer from subsidiaries in developing economies to HQs in developed economies has not been well practised. My thesis reveals that it is not enough to sorely rely on the persuading or issue-selling of the subsidiary in a developing economy, the HQ in a developed economy has to purposely allocate time and effort (attention) in the RKT process in order to exploit and benefit from its subsidiary knowledge. Further, my research argues that only recognising the potential of the knowledge of a subsidiary in a developing economy, or "attending in words" (ul Haq et al., 2017), is *not* sufficient to help a MNC transform the subsidiary's advantage into the firm-specific advantages at the HQ. Specifically, my thesis recommends that HQ has a much more granular focus of its attention in the context of RKT, not only to a subsidiary unit as a whole, but the level of a specific subsidiary's knowledge. Previous attention literature focuses on organisational level factors, such as the entry mode, locational advantages and the role of subsidiary as strategy to guide the allocation of HQ attention in RKT. My empirical case study indicates that RKT may take place regardless the role of subsidiary. My conceptual framework brings in exogenous elements beyond the organisational level factors such as knowledge socio-technical characteristics (technical fit and legitimacy), which could be more useful in helping the HQ management decision making in a RKT context.

Pay attention to RKT differently. HQ attention could be a double-edged sword for a subsidiary in the context of knowledge transfer (Ciabuschi et al., 2012). Considering 'both' sides of HQ attention has important implications for guiding HQ attention to RKT. My research suggests that, prior to acting on a subsidiary's knowledge, the HQ has to evaluate the nature of that knowledge in

consideration of its knowledge characteristics in order to define an appropriate role through which to engage in RKT. In order to provide a 'guideline' to practitioners, I have developed a 2 × 2 matrix by distinguishing two dimensions of knowledge characteristics, technical fit and legitimacy. The product of this 2 × 2 matrix provides four typical combinations. I understand that there may be some scenarios that reside between these four typical combinations in a real knowledge transfer context. However, these should be more or less close to one of the scenarios I have highlighted here. By investigating the levels of technical fit and legitimacy, it provides HQs with a good understanding of not only how much attention should be paid but also *how* and *when* they should attend and withdraw their attention to specific knowledge through the recognition, legitimation and exploitation processes. In general, my empirical study suggests the distinctive roles that HQs should proactively play for adding value in RKT in close association with the socio-technical characteristics of knowledge: gatekeeper, facilitator, legitimator and learner. This implies that it is not the quantity of attention but the *quality* of attention (Yaniv, 2011) from the HQ that makes a big difference in affecting RKT. By operationalising the construct of HQ attention to RKT and proving its viability through empirical application, my study offers strong guidance for practitioners and policy makers in the field of knowledge management in the IB context.

Pay attention to the attentional capability development. RKT is socially complex and tends to occur simultaneously with the knowledge creation (Najafi-Tavani et al., 2015). My research reveals that HQ attention is tacit, processual and evolutionary in nature in the context of RKT. HQ attention to some knowledge may not exist at the beginning, but may emerge as the outcome of co-practice and social interactions over time between the HQ and the subsidiaries. I argue that a MNC can develop and hone its attentional ability over time to recognise, legitimate and exploit the subsidiary knowledge for wider use in the international market. My study has recommended several

mechanisms that may foster the development of a HQ's attentional ability in RKT over time, such as use of an expatriate subsidiary head, co-practice and social interaction between the HQ and the subsidiary. Specifically, I emphasise that having an expatriate subsidiary head as an internal agent of legitimacy is not related to level and power within an organisation, but is because of their ability to sense, associate and create legitimacy by attending to knowledge and adopting it in the context of the HQ. In addition, in contrast to the previous literature on co-practice and social interaction, which highlights their moderating roles or their use as a form of organisational mechanism affecting the communications channel for knowledge transfer, my research highlights the importance of these two mechanisms from the behavioural perspective in helping to create a context or environment that eventually benefits the ability of a HQ to recognise, legitimate and exploit its subsidiary's knowledge.

7.2.2 The managerial recommendations to the subsidiaries

My research has also direct relevance for subsidiary managers in MNCs. Subsidiaries are embedded in MNC knowledge networks; they are also embedded in the host country's external knowledge network (Almeida & Phene, 2004). Engaging in RKT activities benefit a subsidiary to gain more power and influence over time within the context of MNC (Najafi-Tavani et al., 2015). However, some knowledge at the subsidiary may be undervalued or perceived as 'overselling' in the eyes of HQ, resulting in negative attention by the HQ (Conroy & Collings, 2016). Managing HQ attention to RKT is ultimately a dynamic process from subsidiary perspective involving not only technological but also social competences (Cantwell et al., 2010), which subsidiaries still need to learn over time through repeated interactions with the HQ. The subsidiary leaders need clearly

understand what knowledge to sell, when to sell them and through whom to sell before initiating a specific RKT.

Promote knowledge legitimacy beyond technical fit. Previous attention literature focuses on broader issues of how certain subsidiary units capture HQ attention to RKT regardless of the knowledge characteristics in terms of technical fit and legitimacy. My empirical findings reveal that HQ attention in RKT is closely associated with knowledge characteristics in terms of technical fit and legitimacy regardless the role of subsidiary. Previous literature highlights importance of technical fit of knowledge in RKT underpinned the assumption that the similarity of knowledge between the subsidiary and the HQ is positively associated with the attractiveness of the knowledge (Yang et al., 2008). My thesis implies that subsidiary managers should pay attention to knowledge legitimacy beyond its technical fit which is necessary but not a sufficient condition to capture HQ attention in the unique asymmetry context of RKT. Knowledge legitimacy is dynamic through the knowledge legitimation process in the context of RKT. This may involve some form of initial judgement by the HQ of the 'legitimacy' or 'illegitimacy' of the knowledge that is related to the form and the purpose of the knowledge in the eyes of the HQ, but evolves through a highly subjective interactive processes of issue-selling by the subsidiary and issue-buying by the HQ. The subsidiary managers' efforts, my thesis recommends, notably to evaluate the context of the HQ for receiving the knowledge, to match the knowledge to not only the existing technology base but also the awareness and the practice at the HQ, and to promote with both technical fit and legitimacy of the knowledge at right time and to right audience in order to 'win' the acceptance of the subsidiary knowledge at the HQ.

Sell knowledge at the right time. HQ attention in the context of RKT is tacit and evolutionary in nature. HQ attention to some knowledge may not exist at the beginning, but may emerge as the

outcome through the interaction between the HQ and subsidiary. Selling too earlier may be perceived by the HQ as 'over-selling', resulting in negative attention by the HQ (Conroy & Collings, 2016), while the knowledge may be missing the time window being accepted at the HQ if selling too late. My empirical case study provided the nice illustrations of importance of time and timing in issue-selling in the context of RKT. In RKT event B, the EBS subsidiary included global market demand beyond its Chinese customers in the initial business case in order to obtain support from the HQ. Consequently, this captured the substantial HQ attention to the RKT initiative at the beginning by providing excessive support and intervention which was actually detrimental for the knowledge creation and transfer from the subsidiary perspective. In the contrast, the stepped approach in RKT event A, with the new product being introduced first to China, then transferred to the HQ, further enhanced the legitimacy of the subsidiary's knowledge through its adoption in the global markets. Similarly, in RKT event C, EBS HQ initially organised the prototype and product modification by itself because, at the time, the EBS China subsidiary was not perceived as a legitimate source of a technical solution. The subsidiary started promoting its technical solution when the HQ had no solution on the issue. At the end, the subsidiary's locaslised innovation was endorsed and accepted by the HQ. Managing HQ attention and knowledge legitimacy in the context of RKT is a dynamic process where the time and timing play an important role. My thesis argues that subsidiaries' managers should not focus solely on selling issues but pay attention to the time and timing to sell which is largely ignored in the previous RKT literature.

Sell knowledge through the right agent. My thesis reveals that RKT is not a full replication of the subsidiary knowledge at the HQ, indeed, RKT is typically associated with modification and transformation of subsidiary knowledge through political interactions and even the co-creation of knowledge between the HQ and the subsidiary. An interesting finding from my empirical case

study is that the subsidiary can deliberately sell its knowledge through the internal change agents as 'boundary spanner' (Beamish & Berdrow, 2003) or 'legitimacy brokers' (Conroy & Collings, 2016) for promoting its knowledge being recognised and legitimated at the HQ, such as the expatriate subsidiary head in RKT event A, the project manager at the HQ in RKT event C and the vice operations president in RKT event D. Importantly, the effect I observe does not result from the formal power of the spanner or brokers to decide on and impose a course of actions, but from their ability of the internal change agents to foster the cognitive alignment on the technology between the HQ and the subsidiary and to support the setting up of an environment that allowed repeated experimentation and working together on the knowledge creation and transfer. The implication, therefore, is that the subsidiary managers may sell the knowledge effectively by leveraging the proper internal agents that are not based on their formal control and decision power, but are directly related to their ability to increase the likelihood of the knowledge being recognised and to create legitimacy for HQ attending the knowledge in the context of RKT.

7.3 Limitations and future research opportunities

I set out to study the role of HQ attention in the context of RKT by integrating attention theory and knowledge theory. In the process of my study, I have discovered how HQ attention to RKT, in close association with knowledge characteristics and a number of interactional factors, has impacted RKT outcomes to benefit MNCs. Obviously, large steps can be taken by further research when designing studies to investigate this phenomenon more specifically. My main recommendation for future research is therefore to further develop the concepts of knowledge legitimacy and different types of HQ attention to RKT based on my findings in terms of their impact on the ability of MNCs to benefit from leveraging their global dispersed knowledge.

A common critique of case studies is their lack of generalisability. The purpose of my research is not to develop generalisable findings in the positivistic sense but to achieve in-depth understanding of a particular phenomenon. The first limitation of my research is that only four RKT events over 18 years within a single organisation are examined here. However, I feel that this was a necessary compromise during the early stage of theory development, as this approach has allowed the study to gain a comprehensive description of the case and to explore in depth the dynamic interaction between HQ and subsidiary in HQ attention to RKT over time. In addition, I conducted a longitudinal study focusing on the evolution of the HQ's attention using the lens of process and capability and on how the MNC benefits over time from its HQ's attention to RKT. Further research could expand the framework to other settings through a quantitative study to test for the presence of the mechanisms and patterns of HQ attention to RKT that are identified here.

Appendices:

Appendix 1: Summary of RKT literature emphasising the influencing factors of characteristics of knowledge, subsidiaries and HQs

Characteristics of Knowledge

Knowledge stock / base / relevance:

(Gupta & Govindarajan, 2000), (Yang et al., 2008), (McGuinness et al., 2013), (Nair et al., 2016), (Zhu et al., 2016)

Inimitability / complexity/ tacitness:

(Håkanson & Nobel, 2000), (Nair et al., 2015), (Piscitello & Rabbiosi, 2004)

Sources of knowledge:

(Foss & Pedersen, 2002), (Piscitello & Rabbiosi, 2006), (Hsu & Iriyama, 2016)

Type of knowledge:

(Napier & Hoang, 2011)

Characteristics of Subsidiaries

External embeddedness / network:

(Andersson & Forsgren, 2000), (Håkanson & Nobel, 2001), (Frost et al., 2002), (Yamin & Otto, 2004), (Andersson et al., 2007), (Thory, 2008), (Meyer et al., 2011), (Najafi-Tavani et al., 2012), (Kafouros et al., 2012), (Bezerra et al., 2013a), (Najafi-Tavani et al., 2014), (Filippov, 2014)

Subsidiary performance / innovativeness / attractiveness:

(Frost et al., 2002), (Kumar, 2013), (Mudambi et al., 2014), (Costa et al., 2015), (Park & Vertinsky, 2016)

Size and/or age:

(Håkanson & Nobel, 2001), (Rabbiosi & Santangelo, 2013), (Yang et al., 2013)

Entry mode:

(Håkanson & Nobel, 2001), (Cantwell & Mudambi, 2005), (Rabbiosi & Santangelo, 2013), (Mudambi et al., 2014)

Subsidiary evolution / initiatives / knowledge creation / development:

(Phene & Almeida, 2003), (Dobosz-Bourne, 2006), (Bouquet & Birkinshaw, 2008), (Bontis et al., 2009), (Criscuolo, 2009), (Ambos et al., 2010), (McGuinness et al., 2013), (Filippov, 2014), (Najafi-Tavani et al., 2014), (Pak et al., 2015), (DE CICCO, 2015), (Driffield et al., 2016)

Subsidiary role / mandate:

(Cantwell & Mudambi, 2005), (Piscitello & Rabbiosi, 2006), (Ambos et al., 2006), (Manolopoulos et al., 2007), (Rabbiosi, 2011), (Kumar, 2013), (Filippov, 2014), (Nair et al., 2015), (Costa et al., 2015)

Autonomy:

(Foss & Pedersen, 2002), (Frost et al., 2002), (Bontis et al., 2009), (Hadengue et al., 2015)

Motivation / willingness to transfer:

(Mudambi, 2002), (Holm & Sharma, 2006), (Najafi-Tavani et al., 2012), (McGuinness et al., 2013), (Zorska, 2013), (Mudambi et al., 2014), (Peltokorpi, 2015)

Expatriation / repatriation / returnee / international migration / human mobility:

(Lazarova & Tarique, 2005), (Kale, 2009), (Canestrino & Magliocca, 2010), (Liu et al., 2014)

Ability / capability / capacity:

(Andersson et al., 2007), (Song et al., 2011), (McGuinness et al., 2013), (Zorska, 2013), (Mudambi et al., 2014), (Peltokorpi, 2015), (Nair et al., 2016)

Characteristics of HQs

Motivation / willingness to transfer / learn:

(Frost et al., 2002), (Mudambi, 2002), (Holm & Sharma, 2006), (Ambos et al., 2006), (Mahnke et al., 2006),(Najafi-Tavani et al., 2012), (McGuinness et al., 2013), (Kumar, 2013), (Yang et al., 2013), (Mudambi et al., 2014), (Hadengue et al., 2015)

International / entry strategy:

(Buckley et al., 2003), (Mathews, 2006), (Luo & Tung, 2007)

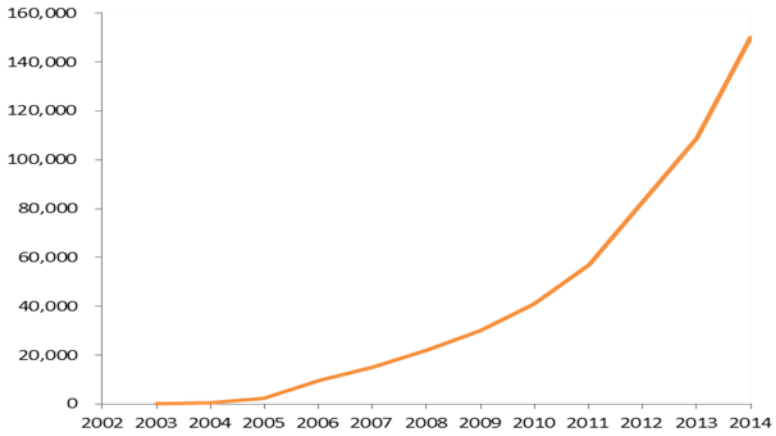
Absorptive capacity / organisational learning / cross-culture adaption:

(Feinberg & Gupta, 2004), (Holm & Sharma, 2006), (Ambos et al., 2006), (Napier, 2006), (McGuinness et al., 2013), (Mudambi et al., 2014), (Yamin & Otto, 2004), (Hsu & Iriyama, 2016), (Nair et al., 2016)

Technological and market share positions / multinationality:

(Berry, 2006), (Belderbos et al., 2008), (Song & Shin, 2008), (Manlio Del Giudice et al., 2014)

Appendix 2: EBS instruments sold by volume (number of instruments) through the software-based service from 2002 to 2014



Source: Archived EBS internal document

Appendix 3: The legitimacy of the subsidiary's knowledge with supporting quotes

	Internal legitimacy		External legitimacy
	Congitive alignment between HQ and Sub	**Compatibility with the established rules**	**Provenness in the market**
RKT event A	"China is the right place for designing product A...because China has great talent...These two engineers hired locally who were very experienced, together with another local sensor engineer and Subsidiary Head A, were recognised and named by the HQ as 'four guardian warriors' in the Chinese subsidiary R&D team" (A HR director at the subsidiary)	" …Subsidiary Head A knows both the safety industry and the product technology which is important for new safety product development.." (A HR director at the subsidiary) "…the simplicity of the new product A benefited significantly achieving the global certifications...and it could be quickly introduced into the global market..." (A quality director at the HQ)	"…the new product development (Prod A) took advantage of China as the "world factory" at that time…" (A HR director at the subsidiary) "…the new product A is not transferred immediately to the global market but positioned first for the Chinese market. Once the product A proved to be a successful compliance product, it was then transferred to the HQ…and thus it was well accepted by the HQ" (A R&D engineer at the subsidiary)
RKT event B	"While it does not mean that the Chinese engineering team became incapable, it was more the fact that it really takes time to build and accumulate the ability and confidence. I believe the ability of the Chinese engineering team is not weaker than the global engineering at an individual level. It is not fair if the (Chinese engineering) team was blamed and challenged for project B because of their ability..." (A R&D engineer at the subsidiary) "...the Chinese enginering team is traditionally good at creating Chinese products for China, rather than other markets. The Chinese team is well below average with connecting with the rest of the world...as they do not have great experience or credibility in general..." (A global COO at the HQ) "...we all understand that HQ has a different philosphy like "Apple" design one product at the HQ for the global market (one-size-fits-all)..." (A project manager at the subsidiary)	"The project failed not because of the product redesign per se but more because the subsidiary was perceived by the HQ to 'sell' to HQ that we needed to rebuild the Chinese engineering team and do R&D in China, which was not aligned with the HQ's philosophy and priority, that we were almost out of control on our product quality and product design. " (An operations vice president at the HQ) "Several times during the course of the project, documents would be added or modified in the doc system without other team members being aware. It is suggested that teams utilise the Subscription feature of the system to ensure automatic email updates are sent to team members when documents are updated..." (A project manager at the HQ)	"The new configuration with the redesign of the product is primaririly addressing the needs of the Chinese market, while it is not strongly endorsed by the customers in the rest of world. We scoped the project for the global market at the beginning because we needed a strong business case..." (A product manager at the subsidiary)
RKT event C	"The plan is to complete the prototype here at the HQ in the US and then create a certification project to submit it to CCCF…by doing that, the HQ will learn about the test requirement and criteria…" (A product development director at the HQ)	"EBS used to centralise new product development and modification at the HQ… so we had to rely on the HQ to build the prototype at the beginning…" (An engineering director at the subsidiary)	"… based on the requirement of the CCCF, we have evaluated a product of our competitor… we do not believe even their product, the same as our product C battery…can pass the CCCF requirement. We need to learn more about options at the HQ… " (A global product management director at the HQ)
RKT event D	"The long term option is the start from scratch option with a desire to have highly innovative design for the multi-gas instrument…rather than through the product enhancement based on a legacy product…" (EBS internal archival file: Compliance product strategy follow-up, September 2016)		"... for the North America market, we need a much longer life instrument for the compliance market. With product D, we are competing with "7-year-old" instruments. Even with the product D enhancement, the compliance instrument does not align with EBS's value of safety first and highest quality... " (A commerical vice president at the HQ)

Appendix 4: The RKT outcomes across the four RKT events with supporting quotes

Measure of RKT outcome	RKT event A	RKT event B	RKT event C	RKT event D
Knowledge changes at the HQ	Closure of gap in global product portfolio	N/A	Incorporated the localised technological innovation into a global product modification	Incorporated the subsidiary's product enhancement technology into the global product strategy for the compliance markets
HQ's performance impact by adopting the subsidiary's technology	Revenue generation over time (see Figure 7)	" … we are a small company, we need to focus on the core business with the limited resources… " (EBS global CEO)	" … A year ago, we had no clear path to compliance. Now we are positioned to be a market leader **(first-mover advantage)** versus other international companies on CCCF compliance. Tremendous progress. Great job…" (A global operations vice president at the HQ) " ... this is a good example of when the cross global challenges are removed, the Chinese subsidiary can execute extremely well (**changed EBS "HQ-centric" logic in serving the local market**)... " (A project manager at the HQ)	"Product D enhancement is official go-to-rollout with the target being fully achieved (i.e. **20 percent cost reduction and an overall improvement** of the product performance)" (EBS internal archival file: Roadmap meeting minutes in January 2019) " … this is a first successful enhancement project for the compliance product for EBS..., not only the cost reduction but how to achieve "cheaper but better" for a product designed ten years ago" (A manufacturing director at the subsidiary) " ... this technology **improved the HQ's awareness** of the value of the compliance product...and also generated more business opportunities in the Middle East and North African markets" (An engineering director at the subsidiary)
Satisfaction with the knowledge adoption at the HQ	"Product A was designed and manufactured in China, and became a 'hot' global product for more than ten years" (Subsidiary Head B) "Product A is great, very simple but very stable for our safety customers worldwide. It is amazing that this product was designed more than ten years ago in China...without any major change over the last ten years... " (An engineering director at the HQ)	"…I do not believe any new knowledge in this project has been transferred to the HQ… my perception is that they (HQ) do not care too much about that with their attention focusing on the software-based service in North America…" (A project manager at the subsidiary)	"The marketing team at the HQ created a graphic to celebrate the success of the project C that was shown in the display in the atrium at the HQ" (See Figure 10) "Congratulations on the completion of the CCCF project! This is an incredible milestone and accomplishment that you have delivered. You have done this under tremendous pressure and difficulty..." (EBS global CEO)	"Great work, everyone! This is an important project (for EBS) and I appreciate the great work you are all doing on this. This further enhances our position to offer a competitive compliance product… not only in China but also in the global market." (EBS global CEO)

Appendix 5: Mechanisms of HQ attention to RKT with supporting quotes

Use of expatriate subsidiary head	Co-practice between HQ and subsidary	Social interaction
"Subsidiary Head A is a great contributor to the success of the project A development and transfer to the HQ particularly due to her background… She is the ideal candidate for the Chinese subsidiary head who knows both China and the US as an American Chinese. She was leading the global R&D before moving to China with strong trust from our CEO…" (A HR director at the subsidiary in RKT event A) " ... Subsidiary Head A said to our CEO that she could lead the project A (new product development) in China, Our CEO then agreed" (A quality director at the HQ in RKT event A) "I remember that Subsidiary Head A has to spend as much as half of her time at that time at the HQ to work with the cross-functional teams on the new product development" (A service manager at the subsidiary in RKT event A)	" … communicating and coordinating the project globally was not a simple risk…regular meetings and specific meetings facilitated by the co-project manager…not only updated the project, but also clarified the requirements as well as aligned them to make sure the same language was being used...such as the definition of "project risk" (A project manager at the HQ in RKT event C) " … we are not only preparing for happy path, but for multiple cycles of testing…it is important for running a global project across the teams… " (An engineering director at the HQ in RKT event C) " … it is an iterative process of learning…since the beginning of the project...it took a while for the HQ to understand a holistic technical requirement of CCCF regulations" (A project manager at the HQ in RKT event C) " ... the technical solution from the subsidiary was not invested overnight...especially without trail and error round and round with the different options learnt from competitors and suppliers as well as the discussions with the HQ" (A project manager at the subsidiary in RKT event C)	" … through a face-to-face conversation at the HQ…a product re-design project has been taking place… " (A project manager at the HQ in RKT event B) " ... a visit to the Chinese site by global engineering director with the two senior product engineers helped EBS HQ to better understand the rationale of simultaneously achieving cost reduction and product performance improvement for product D in more detail as well as the approaches that the subsidiary may adopt." (An engineering manager at the subsidiary in RKT event D) "In January 2017, a mock-up of product D enhancement was built up at the subsidiary . This was an important milestone for the subsidiary ... This mock-up was shown and presented to the global operations vice president and global CFO when they visited the Chinese site. The site visit and face-to-face interaction with the subsidiary team further improved the corporate leaders' confidence that the product D enhancement makes sense for EBS global." (A product developmet manager at the subsidiary in RKT event D)

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