Reverse Knowledge Acquisition in Emerging Market MNEs:

The Experiences of Huawei and ZTE

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Abstract

Based on case studies of leading Chinese MNEs' international operations in developed countries, this study develops a reverse knowledge acquisition model of emerging market MNEs through subsidiary-led reverse learning, knowledge sharing and integration processes. It unpacks MNEs' external learning process and contributes to the literature by exploring three mechanisms of learning, sharing and integration. It finds three reverse learning channels, a multi-level hub-spoke type of knowledge acquiring mechanism, and a two-tier three-step integration mechanism. The learning mechanism confirms knowledge acquisition driven by reverse learning behaviours; the sharing mechanism enriches the community perspective of capability building and sharing; the integration mechanism provides an effective way of knowledge integration within the MNEs.

Key words: Internationalisation, Reverse Learning, Knowledge Acquisition, Integration, Capability Upgrading.

1. Introduction

The penetration of emerging market multinational enterprises (EM MNEs) into developed markets (DMs) through internationalisation is a significant but relatively under-studied phenomenon. Previous studies that examine outward direct investment (ODIs) from emerging economies focus on its characteristics (Sauvant, 2005; Goldstein, 2007; Gammeltoft, 2007), determinants (Yamakawa, Peng & Deeds, 2008; Stoian & Mohr, 2016; Shi, Sun, Yan & Zhu, 2017), pattern (Jin, Wang & Vanhaverbeke, 2014), and performance (Buckley, Elia & Kafouros, 2010; Aulakh, 2007; Fu, Hou & Liu, 2018).

In fact, an important motivation of internationalisation is to access advanced knowledge available in DMs and to utilise it to improve the technological and innovative capabilities of the parent companies (Deng, 2009; Luo & Tung, 2007; Rui & Yip, 2008; Liu, Ghauri & Sinkovics, 2010; Meyer, Wright & Pruthi, 2009; Wang, Senaratne & Rafiq, 2015; Fu, Hou & Liu, 2018). Yet, little research has attempted to analyse this knowledge acquisition and capabilities' upgrading process. Moreover, knowledge acquisition includes three major dimensions: external sources of knowledge (Athreye, Batsakis & Singh, 2016; Castrogiovanni, Ribeiro-Soriano, Mas-Tur & Roig-Tierno, 2016), learning and pathways of knowledge sharing (Rabbiosi, 2011; Michailova & Mustaffa, 2012; McGuinness, Demirbag & Bandara, 2013; Tseng, 2015), and knowledge integration (Deng, 2012; Li & Kozhikode, 2011; Jonsson, 2012). Although there is considerable literature on internationalisation, learning, innovation and capability upgrading, it focuses on the impact of one of these factors on another factor (e.g. Chiva, Ghauri & Alegre, 2014). So far there is little research that elucidates the learning and capability upgrading mechanism in the internationalisation of EM MNEs.

First, with a background of EM MNEs' investments in DMs, previous studies have largely concentrated on the impact of host country technological resources on entry-related decisions (Buckley, Clegg, Cross, Liu, Voss & Zheng, 2007) and consequences (Buckley, Elia & Kafouros 2014). There is also a rapidly growing literature on EM MNEs' strategies and motivations for investing in advanced economies, focusing on descriptive investigations of specific host countries (e.g. Pietrobelli, Rabellotti & Sanfilippo, 2011; Liu & Tian, 2008). However, the sources of knowledge in host countries and pathways for reverse learning have not been studied thoroughly.

Second, in the broad context of MNEs and subsidiary knowledge sharing, some studies examined the impact of subsidiaries (Li & Lee, 2015), competence-building patterns (Rugman & Verbeke, 2001), the influence of interdependencies between the subsidiaries (Hotho, Becker-Ritterspach & Saka-Helmhout, 2012), accelerated internationalisation and resource leverage strategizing (Tan & Mathews, 2015), and headquarters–subsidiary relationships (Kostova, Marano & Tallman, 2016). However, our understanding of the overall knowledge acquisition, sharing and integration mechanisms is limited, especially through comprehensive studies that include both subsidiaries and headquarters, and integrating theories of learning, knowledge

management and capability accumulation, with a few exceptions e.g., Wang, Senaratne & Rafiq (2015), which focuses on parts of this full picture. Moreover, although the role of the parent firms has been emphasized (Ambos, Ambos & Schlegelmilch, 2006; Mudambi, Pedersen & Andersson, 2014), the mechanism in headquarters to absorb and integrate the knowledge transferred from subsidiaries is under-researched.

Thirdly, recent literature highlighted the importance of reverse knowledge transfer from the subsidiaries to their headquarters (Rabbiosi, 2011; Rabbiosi & Santangelo, 2013; Michailova & Mustaffa, 2012; Najati-Tavani, Giroud & Sinkovics, 2012; McGuinness, Demirbag & Bandara, 2013; Zhu, Zou & Xu, 2017), the model of knowledge transfer between sender-receiver (Martinkenaitė-Pujanauskienė, 2015) and the modes of knowledge sharing including both the vertical knowledge inflows from the headquarters and the horizontal knowledge inflows from other subsidiaries (Gupta & Govindarajan, 2000; Foss & Pedersen, 2002; Ambos, Ambos & Schlegelmilch, 2006; Martinkenaitė-Pujanauskienė, 2015; Tseng, 2015). However, subsidiaries as a source for reverse knowledge transfer back to MNE headquarters have been largely ignored.

Similarly, some studies also highlighted integration as a necessary step after acquiring and sharing for an MNE's continuous knowledge learning process (Li & Kozhikode, 2011; Deng, 2012; Jonsson, 2012). It is also an important part of the integrative framework in organisational learning (Minbaeva, 2007; Chang, Gong & Peng, 2012; Roth & Nigh, 1992). However, there is limited research exploring the integration mechanisms and their impacts on knowledge leveraging and renewing within organisations. In addition, while the studies on the learning, capability accumulation and internationalisation of a firm have increased during the past decades, the topics mainly focus on the management of internal and external sources of subsidiaries' learning (Athreye, Batsakis & Singh, 2016; Castrogiovanni et al., 2016), internationalisation serving as a learning and knowledge accumulation process (Fu, Hou & Sanfilippo, 2017; Sun, Xie, Tian & Wang, 2014), and how a firm's innovation is driven by international operations (Harris & Cai, 2002; Ghauri, Tarnovskaya & Elg, 2008; Ghauri, Elg, Wang & Rosendo, 2016). Systematic studies of learning mechanism, knowledge sharing and integration mechanism are scarce.

Therefore, this study contributes to the literature of learning, knowledge management and capability upgrading by exploring the learning mechanism driven by internationalisation, the sharing mechanism under the community perspective of knowledge management, the integration mechanism and systematic acting paths, combing the three of them within the MNEs. Specifically, our research focuses on the reverse learning and knowledge acquisition *mechanism* used by subsidiaries of EM MNEs. In this study, reverse learning and capability upgrading through internationalisation refer to a firm's knowledge acquisition activities in the international environment, communicating within an MNE for absorption and utilisation, and further integration of the learned knowledge for re-innovation and capability upgrading. Therefore, the research questions of this study focus on the following three areas:

Firstly, to understand the sources that improve both technology and non-technology knowledge in MNC subsidiaries, and identify knowledge sources and the

paths of a subsidiary's capability upgrading. Hence our *RQ1. What are learning sources and how do they influence capability upgrading?*

Secondly, we seek to address the sharing mechanism of organisational knowledge that explains the roles of headquarters, regional headquarters and subsidiaries. Hence our *RQ2. How is knowledge shared within MNEs?*

Finally, integration is necessary for subsidiaries to acquire and reconfigure knowledge and upgrade firm capability and competitive advantage. We thus examine the levels of integration using the vertical perspective to understand the integration and capability enhancement mechanisms. Hence our RQ3. *How are knowledge and capabilities integrated in sub-units in MNEs?*

To answer these questions, we have employed an exploratory case study of two Chinese MNEs operating in the telecommunications industries, Huawei Technologies Ltd. and ZTE, and their subsidiaries in the UK. The ICT industry plays a pivotal role in establishing firm competitiveness and firm innovation performance (Hall, Lotti & Mairesse, 2013) and driving economic growth (Ollo-López & Aramendía-Muneta, 2012). The fast-developing ICT enterprises are good research cases for the study of innovation, capability accumulation and business expansion. Huawei and ZTE were leading MNEs in the ICT industry. Huawei's annual revenue was up to RMB 521,574 million by 2016, ranked 83th in Fortune Global 500 List in 2017. Its overseas businesses are distributed over more than 170 countries and regions, serving over one-third of the world's population. ZTE's annual revenue amounted to over RMB 101.2 billion by 2016, it also entered the Global ICT Top 50 List in 2017. Its overseas services were provided in more than 160 countries. Both firms have extensive experiences in internationalisation over 30 years, and they have achieved remarkable successes in their overseas' business operations and knowledge accumulations. These two firms therefore present as good cases for the purpose of this study. In order to draw more generalisable conclusions with wider implications, we also validate the findings from these two cases, using evidences from another six Chinese MNEs.

This research makes several contributions. First, this study develops a reverse knowledge acquisition model of EM MNEs through subsidiary-led reverse learning, knowledge sharing and integration process. Firms' innovation and capability upgrading mechanisms were explored through the reverse learning mechanism led by subsidiaries, and capabilities accumulated within MNEs, include understanding customers' values, selecting and testing innovative ideas, product concepts and product prototypes as well as management capability. It contributes to the domain of innovation management through unpacking the whole process of MNEs' external learning and identifying three reverse learning channels - customers, collaborators, and host economies; it also develops a multi-level hub-spoke type of knowledge acquiring mechanism and a two-tier three-step integration mechanism.

Secondly, a multi-level hub-spoke type of knowledge sharing mechanism and two-tier three-step integration mechanism were explored in the study, in which subsidiaries and headquarters play distinct roles. Thus, the innovation and capability upgrading

paths within MNEs, based on the roles of subsidiaries and headquarters, have been explored. It thus contributes to the literature on knowledge management in MNEs by discovering the role of the subsidiaries as sources instead of recipients of knowledge transfer (Riviera, Suder & Bass, 2018).

Finally, our study is among the first attempts to examine the reverse learning and capability accumulation in the internationalisation of EM MNEs' investments in DMs. It reveals that Chinese MNEs follow a technology and capability upgrading and development process driven by reverse learning from foreign customers, collaborators and subsidiaries. This is because, normally, superior economic performance is achieved by MNEs that can turn the knowledge they gain from international experience into a large endowment of internationally exploitable intangible assets and into a differentiated competitive strategy (Ahmed & Elshandidy, 2018). Empirically, it adds evidence from EM MNEs confirming that learning is an input of internationalisation (Petersen, Pedersen & Lyles, 2008) and that internationalisation also serves as a learning and knowledge acquisition.

2. The literature and *a priori* assumptions

Innovation processes are considered crucial activities for contemporary MNCs (Ciabuschi, Forsgren & Martín, 2012). As was said before, MNEs have the opportunity to absorb knowledge from different sources because they comprise a great variety of subsidiaries that operate with various customers, different co-operators and diverse markets, and MNEs have to pursue innovation by integrating and upgrading globally-acquired knowledge. In this context, knowledge learning, knowledge management in transferring, transmitting and integrating for upgrading capabilities have been shown as the crucial processes for the majority of the MNEs. Thus, based on learning theory and knowledge management, we predict subsidiaries'-driven learning and capability-upgrading mechanisms would constitute a reverse learning mechanism, a sharing mechanism and an integration mechanism in an MNE.

First, MNCs innovate by learning knowledge from local, global and intra-MNE networks from their geographically dispersed subsidiaries and by transferring and integrating it into their own core capabilities (Almeida & Phene, 2004; Athreye, Batsakis & Singh, 2016), hence, in this model, the first underlying notion is that a subsidiary should be able to assimilate knowledge from the connection experiences with customers and collaborators by virtue of belonging to this common host countries' background (Phene & Almeida, 2008). Therefore, the subsidiaries serve as the spokes absorbing and feeding knowledge to the hub.

Second, based on the knowledge management theory, the reverse knowledge transfer provides potential opportunities for headquarters to develop new products through the combination of existing and different complementary skills (Kotabe, Jiang & Murray, 2011), and the headquarters increase their innovative skills and capabilities through benefits from the use of knowledge transferred from foreign subsidiaries (Rabbiosi & Santangelo, 2013). Thus, we assume that headquarters act as a receiver, a

coordinator, and transferrer of knowledge from their internationally dispersed subsidiaries and act as a knowledge integrating institution within an MNE (Ambos, Ambos & Schlegelmilch, 2006).

Third, a multinational subsidiary can learn knowledge from both a unified corporate identity and from outside the firm's boundaries (Phene & Almeida, 2008). Consequently, a subsidiary can be expected to learn relevant knowledge from the customers, collaborators and host countries' environment MNCs, and this can be expected to enhance its innovativeness.

In addition, knowledge transfer can be understood as the process of a systematically organised exchange of information and skills between entities (Wang, Tong & Koh, 2004). It implies horizontal knowledge sharing between two subsidiaries within the MNC and vertical knowledge sharing between parents and subsidiaries. At the same time, the headquarters and regional centres serve as the hub and regional hubs respectively. Following this line, the ontological assumption is that the sharing mechanism is composed of multi-levels including MNE's headquarters and regional headquarters.

Last, the development of new knowledge in the organisation is linked to the learning that is required to assimilate, adapt and exploit the transferred knowledge (Jonsson, 2012). Although the parent company has to develop certain capabilities to benefit from the items of knowledge from different subsidiaries and thus ultimately create value (Ambos, Ambos & Schlegelmilch, 2006), the transfer of knowledge is often associated with modification of the existing knowledge to fit the specific context (Foss & Pedersen, 2002). Thus, an integration process including leveraging, renewing and releasing resources and capabilities is necessary. In this process, knowledge integration takes place across multiple dimensions (space, time, language, culture etc.) as well as in multiple directions (forward, backward and lateral), thus the integration mechanism not only deals with the specialized tasks according to the primary activities of the value chain (named low-level integration), but also includes high-level integration referring to wide-ranging cross-functional integrative activities.

Thus, the subsidiaries'-driven learning and capability-upgrading mechanism framework of *a priori* assumptions in this research is used to shed light on how the upgrading of the MNE's innovative capabilities is driven by reverse knowledge learning, sourced by the subsidiaries through effective knowledge sharing and a successful integration mechanism. Its development and use in this study encompasses three aspects: (1) the absorption mechanism (subsidiaries as the starting points learn knowledge from organisations in host countries); (2) the sharing mechanism, including vertical sharing and horizontal sharing; (3) the integration mechanism, which includes two level integrations supported by the intranet system, rewarding system, knowledge encapsulation system and strategic direction.

2.1. The roles of subsidiaries

A literature review reveals that subsidiaries have been largely ignored regarding their potential for reverse knowledge transfer (RKT) to MNE headquarters, as they have been mostly viewed as knowledge recipients and strategy implementers (Leposky, Arslan & Kontkanen, 2017). What is more, some studies showed how local headquarters improve their innovative skills and capabilities, and they benefit from the use of reverse knowledge transferred from foreign subsidiaries (Rabbiosi & Santangelo, 2013). Our paper further explores this topic by identifying multi-reverse learning resources in a subsidiary and knowledge transfer from DM subsidiaries to the headquarters of MNEs in EM.

Specifically, subsidiaries are regarded as knowledge recipients and strategy implementation units (Leposky, Arslan & Kontkanen, 2017) because subsidiaries are simultaneously embedded in two knowledge contexts, the internal MNE comprised of the headquarters and other subsidiaries, and an external environment of regional or host country firms (Almeida & Phene, 2004). On the one hand, under the external environment, the subsidiaries serve as the spokes absorbing knowledge to the hub in the reverse learning and capability-upgrading mechanism, because the subsidiaries of multinationals abroad understand the local market demand and find it easy to hit on what local customers like. This phenomenon was confirmed by Criscuolo (2003), who showed that 21% of the total patents in the chemical and pharmaceutical sector assigned to European multinationals were registered by their US subsidiaries in the period from 1980 to 1999.

On the other hand, within an MNE, the subsidiaries also are viewed as the spokes feeding knowledge to the hub, because subsidiaries can develop intensive activities for applied research for the development of new products, and new processes for the development and prototyping of new products aimed at creating innovations for the corporation as a whole (Boehe, 2008). For example, in 1979, 47% of the expenditure on R&D laboratories of American multinationals abroad resulted in technologies transferred to the United States (Mansfield & Romeo, 1984). Hence, the first *a priori* assumption is as follows,

APA1: The subsidiaries serve as the spokes absorbing and feeding knowledge to the hub in the reverse learning and capability-upgrading mechanism.

2.2. The learning resources

Scholars' interest in the learning sources of MNE subsidiaries has increased during the past decades (e.g. Athreye, Batsakis & Singh, 2016; Castrogiovanni et al., 2016), however, the studies of learning resources and learning mechanisms under the perspective of comprehensive analysis consisting of MNEs' subsidiaries, headquarters, and knowledge sharing and integration mechanisms are scarce.

MNCs innovate by acquiring knowledge from local, global and intra-MNE

networks from their geographically dispersed subsidiaries and by transferring and integrating it into their own core capabilities (Schmid & Schurig, 2003; Almeida & Phene, 2004; Athreye, Batsakis & Singh, 2016), and a multinational subsidiary can learn knowledge from both a unified corporate identity and from outside the firm's boundaries (Phene & Almeida, 2008). The role of different internal and external network partners for capability development varies according to the international activities under consideration. Thus, subsidiaries benefit from various internal and external network actors with very different resources (Schmid & Schurig, 2003).

We will first elaborate on the customer as a potential source of knowledge absorbing for a business unit. Customers are the final arbiter of value and the firm's role is to explore, interpret and deliver the value based on what they believe customers are seeking (Cass & Ngo, 2011). The absorption of knowledge from customers includes understanding subdivided markets and diverse customer requirements, selecting and testing innovation ideas, product concepts and product prototypes, transforming customer needs and innovative ideas into product concepts and product prototypes. It also includes controlling and managing the distribution network, monitoring the situation of the market and customer preference, how to communicate with customers, how to create value for customers, how to establish long-term customer relationships, and how to control and manage intangible assets. Hence,

APA2-1: The customer database is the first source of subsidiaries' knowledge acquisition.

Besides, the subsidiaries can acquire knowledge by learning from collaboration experiences (Phene & Li, 2015), can access and assimilate advanced technologies and upgrade technology competence by interacting with local technological and innovative leaders such as scientists and engineers in local companies, research labs, and universities (Almeida & Kogut, 1999). They can build a global brand via collaborations with famous local firms, and also can gain opportunities to access information in local business environments. General alliance experience has a positive effect on collaborative know-how and knowledge acquisition. For Chinese firms, the more the collaborative know-how is derived from alliance experience, the more knowledge acquisition from their international partners (Chen, Shi & Zhang, 2010). Hence,

APA2-2: The co-operation with local firms is a source of subsidiaries' knowledge acquisition.

In fact, the performance of the target firm is influenced not only by its own network, but also by the national and international network of the acquiring company (Buckley, Elia & Kafouros, 2014). In their internationalisation activities, local knowledge from host countries can help MNEs to coordinate and upgrade a global strategy, and improve the supporting network for new product and market development (Ambos, Ambos & Schlegelmilch, 2006).

In terms of knowledge flows within MNEs, this usually implies transfers from the more developed nation to the less developed nation (e.g. Gupta & Govindarajan, 2000), especially, knowledge originating from subsidiaries located in DMs will contribute to

enhanced corporate capabilities (Ambos, Ambos & Schlegelmilch,2006). Thus, we then elaborate on the subsidiaries' geographic location as an important source of learning (Foss & Pedersen, 2002) before turning to the role of feeding knowledge to the headquarters in the MNC network (Gupta & Govindarajan, 2000; Tsai, 2001). In the host countries, subsidiaries can access the strategy management philosophy, operating vision and systematic operation ability, and can transform them as types of innovative resources in the MNCs. For example, Europe is an attractive market for Chinese firms and they are exploring this by making several strategic alliances (Söderman, Jakobsson, & Soler, 2008) with western companies to speed up the learning process (Zhang, Duysters & Filippov, 2011). Hence,

APA2-3: The host country background is also an important source for subsidiaries' knowledge acquisition.

2.3. Sharing mechanism

Recent literature highlights the importance of reverse knowledge transfer from the subsidiaries to their headquarters (Rabbiosi, 2011, Rabbiosi & Santangelo, 2013, Michailova & Mustaffa, 2012, Najati-Tavani, Giroud & Sinkovics, 2012, McGuinness, Demirbag & Bandara, 2013), and reverse knowledge transfer from the subsidiaries in DMs to their headquarters in developing markets is considered an emerging area of increasing interest to researchers. In fact, knowledge transfer is a systematically process-organised exchange of information and skills between entities (Wang, Tong & Koh, 2004). Specifically, the knowledge inflows include both the vertical knowledge inflows from the headquarters and the horizontal inflows from other subsidiaries (Tseng, 2015).

Therefore, we provide a multi-level hub-spoke type of knowledge sharing mechanism which includes vertical sharing and horizontal sharing. In the vertical sharing perspective, the headquarters and subsidiaries, as the upper and lower units, play their own roles. The subsidiary serves as the starting point of technology, or the knowledge producing point, while the headquarters and regional offices perform the duties of the knowledge gatekeeper, integrator and mediator between subsidiaries in a multi-level structure. In the horizontal sharing perspective, subsidiaries share the information based on an equal and friendly relationship. Additionally, both vertical sharing and horizontal sharing act at multiple levels because the headquarters and regional headquarters serve as the hub and regional hubs respectively. Thus, this study assumes that sharing mechanism is multi levels including MNE's headquarters and regional headquarters. Hence,

APA3: A multi-level hub-spoke type of knowledge sharing mechanism is present in the MNEs. The sharing mechanism includes vertical sharing and horizontal sharing. Vertical sharing is the knowledge sharing between parents and subsidiaries while horizontal sharing occurs among subsidiaries.

2.4. Integration mechanism

Overall, MNEs have to concentrate on the overall benefits of the entire organisation instead of only those of a local subsidiary, because a portion of the benefits stem from integrating subsidiaries' activities and transferring knowledge existing in the subsidiaries, such as economies of scale and scope (Dunning, 1994; Håkanson & Nobel, 2001). Also, the knowledge integration within an MNE is a continuous process, as knowledge is constantly being acquired, transferred and finally integrated (Deng, 2012; Li & Kozhikode, 2011). Hence, in order to transform the knowledge into applicable knowledge rather than it staying in the original form, knowledge not only has to be learned and shared properly, but also integrated (Jonsson, 2012).

Specifically, the integration of the knowledge of the MNC on a worldwide basis is what enables MNCs to reap the "incremental value of being multinational" (Schulz, 2003) and the knowledge can be acquired and upgraded by operating in the foreign environment and becoming closely connected to the market (Elango & Pattnaik, 2011). For example, Borini, Fleury & Fleury (2009) show that initiatives of subsidiaries of Brazilian multinationals are strongly correlated with the integration of headquarters and subsidiaries.

In its broadest sense, systematic integration within MNEs can be defined as the capabilities which enable subsidiaries, externally related sectors, and a range of other actors to define and combine together all the necessary inputs for a system and agree on a path for future development (Hobday, Davies & Prencipe, 2005). In other words, the systematic integration in this broadest sense can be viewed as high-level integration.

In a narrower sense of knowledge sharing within MNEs, the integration mechanism is concerned with the way in which headquarters and subsidiaries bring together high-technology components, subsystems, software, skills, knowledge, engineers, managers and technicians to produce competitive advantages and upgrade firm capability. This integration in the narrower sense can be considered as low-level integration. Hence,

APA4-1: In the integration, the low-level deals with specialized tasks according to the primary activities of the value chain, while high-level integration means wide-ranging cross-functional integrative activities.

According to previous studies, a resource base can be altered through four paths: leveraging existing resources, creating new resources, accessing external resources, and releasing resources (e.g. Eisenhardt & Martin, 2000; Danneels, 2010). In this perspective, leveraging and releasing are two basic paths to integrate resources and capability within MNCs, while creating and accessing resources and capabilities establish the basic modes of renewing. Leveraging resources enables a company to integrate and rearrange itself by drawing on its existing resources, and applying them to new uses, such as new product categories (Danneels, 2002). For example, the brands, the distribution, the customer understanding, are the resources that a firm can draw upon in attempting to renew and upgrade itself. The shedding or dropping of resources is a negative mode of changing capability (Eisenhardt & Martin, 2000). Renewing

resources is concerned with the ways in which headquarters and subsidiaries upgrade high-technology components, subsystems, software, skills, knowledge, engineers, managers and technicians to produce new products and business capabilities. Releasing resources means dropping existing unsuitable resources and capabilities. Hence,

APA4-2: The integration process includes leveraging, renewing and releasing resources and capabilities.

2.5. The role of headquarters

In the increasingly complex and differentiated MNCs (Nohria & Ghoshal, 1994), headquarters engage in mandated transfers of knowledge (Verbeke, Bachor & Nguyen, 2013) and also aim to get closer to value creation processes by learning, knowledge flows and knowledge integration among peer subsidiaries and other MNC units (Dellestrand, 2011; Geppert & Dörrenbächer, 2014). Hence, corporate headquarters' involvement in innovation processes becomes a major issue because MNEs are largely context specific, and operate at the subsidiary level while making rational choices about their own involvement and integrate resources at the entire firm level (Ciabuschi, Forsgren & Martín, 2011).

Specifically, Ambos, Ambos & Schlegelmilch (2006), drawing on an empirical sample of 294 intra-MNE knowledge transfers, indicated that the efficiency of the MNE as a knowledge integrating institution is being driven by changes in both the subsidiary's context and its capabilities to process knowledge. In this process, the traditional role of headquarters as a prime source of knowledge and competencies is changing. Increasingly, headquarters acts as a receiver of knowledge from their internationally dispersed subsidiaries, a screener and disseminator of knowledge. The headquarters' change of role is closely linked with the development of MNEs. As the MNE evolved, headquarters played three expected roles, that of a decision-maker, a coordinator, and as a transferer of knowledge on local operations and markets to the MNC. In the meantime, the headquarters and regional headquarters form a multi-level hub, they have headquarters' function and build connections between headquarters and subsidiaries. Hence,

APA5: In the reverse learning and capability upgrading mechanism, the headquarters and regional headquarters act as a multi-level hub, screener and disseminator of knowledge.

3. Methodology

3.1. Research design

Case study methods are well suited to study the dynamic issues, and are particularly suitable for in-depth study of a phenomenon (Ghauri & Gronhaug, 2010; Elg, Ghauri, Child & Collinson, 2017), such as the knowledge learning process, knowledge

communication and integration process within MNEs in the dual operating contexts of both emerging economies and DMs. Though exploratory case study research suffers from low external validity (Bryman, 2001), it better enables us to understand how constructs are related and what extends relationships among constructs in a specific setting (Eisenhardt, 1989; George & Bennett, 2005). The goal of this study is to understand the connecting mechanisms among the knowledge sender, receiver and learner, and capabilities' accumulation paths including knowledge learning, sharing, integration and upgrading over time in the context of knowledge transfer from subsidiaries in DMs to headquarters in EMs.

Firstly, exploratory case studies allow researchers to construct theories in a relatively new research area with rather limited literature. Secondly, the learning mechanism and corporate capability-upgrading of MNEs are complex and dynamic. Hence, the case study is necessary for an in-depth analysis of the phenomenon. Thirdly, the interviews with key decision makers can enhance our understanding of the problems and issues occurring in daily operations (Yin, 2009).

The case study process consists of the following four steps:

(1). Single case study. Each case was analysed separately, and then the cross-case analysis was carried out (Ghauri, 2004). In the first step, each case is analysed separately, the most frequent words and key words suggested by theory are identified. The relationships of these words are also identified to provide a primary evidence for the assumptions. We try to find the common connections and upgrade to the theory through case analysis which is performed according to the research objectives.

(2). Comparative case study. A comparative case study design was used where the methodological approach to theory-building from cases of Eisenhardt and colleagues (Eisenhardt & Graebner, 2007) was applied. We try to find the common answers and upgrade to the theory through comparative case analyses which are performed according to the research objectives.

(3). Robustness check based on the comparison with other cases. In this step, the cases' information from different industries was compared to our key findings. We try to provide further tests for the assumptions (Eisenhardt, 1989) and the evidence for validity and generalisation of the results.

(4). Robustness check based on comparison to the previous studies. More than 20 similar research topics and study results are discussed in this study, compared with the findings of this study, and finally we try to verify the findings of this study. Through this comparison, we not only improve the validity and generalisation of the results, but also introduce the contribution of this study.

3.2. Case selection and background

Our case sampling procedure was opportunity and theory-driven (Patton, 1990; Eisenhardt & Graebner, 2007). Theoretical sampling implies a purposeful selection of information-rich cases where the research phenomenon could easily be revealed

(Dubois & Gadde, 2002). We finally selected two cases: Huawei and ZTE. The following qualification criteria were applied to explore the learning mechanism and corporate capability-upgrading in the two cases. The tremendous successes achieved by these two companies in less than 30 years provide a rich research field and also are well worth investigating for the benefit of companies that are striving for internationalisation. Secondly, they were built up after the Chinese Economic Reform and Opening Up to the outside world. Starting their internationalisation in the 1990s, they have become two of the leading firms in the ICT and computer industries in China and the world. Hence, a cross-cases analysis between them can strengthen the conclusions drawn from each case.

Huawei's first internationalisation push started from 1996. Following successes in Russia and a number of developing markets, Huawei started to turn its attention to DMs. In 2001, Huawei made its first major sales in Europe, to the Netherlands and Germany. The wireless station product sold to the Dutch enabled multiple communications' standards to be run, and upgrades were done by software rather than hardware (Pomfret, 2010). The product was a good example of "cost innovation", in that it provided advanced features at low cost, while saving the carrier money on hardware (Zeng & Williamson, 2007, p. 9). Huawei then made sales to Neuf, the French operator, United Arab Emirates, a Danish company (in Portugal), British Telecoms (BT) and Vodafone. By 2014, most of Huawei's high-technology products were developed, designed and released in Europe and the U.S.A. Approximately two-thirds of its revenues came from international markets. Europe has become the main revenue source of Huawei's overseas sales.

The internationalisation strategy of ZTE was characterised by strategic partnerships especially in Europe and North America. In 2005, ZTE started collaborations with Alcatel, Ericsson, France Telecom and Portugal Telecom. In 2007, ZTE had already started partnerships with over 150 operators in over 60 countries around the world, and Europe was an important collaborative area. The result of this continuous internationalisation strategy is reflected in ZTE's revenue stream where international operations accounted for 60 percent of the company's total revenue in 2011. Moreover, ZTE rose to be the 4th biggest smartphone manufacturer in the world during the third quarter of 2012.

3.3. Data collection and analysis

The study relied on interviews as the main source of data, with secondary data including non-participant observations, annual reports, financial statements, presentations for external and internal audiences, press releases and company web site texts serving as important triangulation and supplementary sources (Miles & Huberman, 1994). These multiple data sources are common in case study research (Yin, 2009) and are necessary to trace and contextualize the events and map actors, structures and relationships (Pettigrew, 1990; Langley, 2007).

In each company, we interviewed senior managers, at the headquarters of the

MNEs and at their subsidiaries, who had been involved in the MNEs' market expansion into Europe, assuming that they were the most competent to inform about the corporates' strategies, learning processes, and, most importantly, the knowledge sharing and integration behaviours (Such as Huawei UK, ZTE UK, Huawei China, ZTE China). After interviewing the first informant, snowball sampling was employed to identify other key respondents. Interviewing several informants enabled us to obtain a holistic view and mitigated subjective bias (Golden-Biddle & Locke, 2007; Ghauri & Firth, 2009).

After interview, a more detailed description of data collection processes is presented in Table 1. The study took detailed notes after each interview, audio-recorded them and had them transcribed verbatim. The authors listened to every recording and reviewed all transcripts several times. This robust and time-consuming process ensures high-quality transcripts.

In addition to primary data, following Ghauri (2004, p.109), secondary data were used for identification and corroboration purposes. The major sources of secondary data included company websites, company reports, financial statements, articles from newspapers, magazines and journals, videos of presentations by executives (e.g. press conferences or speeches) and company web site texts. In total, 20 interviews were conducted, 18 with managers of MNEs and two with scholars and policy makers (see Table 1 for the details of interviews). An interview guide was developed with semi-structured questionnaires based on our theoretical framework. In the semi-structured interviews, three questions form our key points: (1) What are the learning sources and how do they influence capability upgrading? (2) How is knowledge shared within MNEs? (3) How are knowledge and capabilities integrated in sub-units in MNEs? Open questions starting with "what", "how", or "why" were used, to allow the respondents to express their own opinions and experiences and prevent them from being influenced by the interviewer's opinion. In order to reduce interviewer bias, we attempted to obtain trust with the respondents (Eisenhardt & Martin, 2000).

Insert [Table 1] here

4. Findings: Mechanism of reverse innovation and capability accumulation

4.1. Reverse learning mechanism

Instead of beginning with core proprietary technologies and exploiting them in the process of internationalisation, our study reveals that case firms followed a technology and capability upgrading and development process driven by reverse learning from foreign customers, collaborators and subsidiaries. In the reverse learning process, customers, host context and co-operators are three main knowledge learning sources (Interview finding). Learning knowledge contains declarative organisational knowledge as well as procedural organisational knowledge. Declarative organisational knowledge is knowledge of explicit facts such as data and factual information, while procedural knowledge is knowledge of how something occurs or is performed (Cohen, 1991). After single case and cross-cases study, we identified the key words, key

activities, key ideas and key topics which are listed in Table 2.

Insert [Table 2] here

a) Learn from customers

According to interviews, we found that the customer database is the first source for Huawei and ZTE's learning of declarative knowledge (Findings from interview). Understanding customers' value through direct and indirect communication with them is the first accumulated capability. In order to achieve competitive advantages, a firm must provide value for customers that is superior to the value provided by competitors. Managers or firms gain some understanding of customers through indirect means such as analysing sales data and sales call reports. They can also gain the deepest insights from direct interaction with customers with a research mentality, observing their operations and meetings and listening openly to their views, their market environment interpretations, and their strategic discussions through open-ended in-depth interviews. As the CFO of Huawei UK commented, *"Everything we do is to understand consumers. Now, customers want more from Huawei, our customers tell us what happens next, what they want to buy, so 4G, 5G, 6G comes".*

Selecting and testing innovative ideas, product concepts and product prototypes, improving management capability and customer relationships, and building brand name and firm reputation are the other capabilities accumulated by our two cases. For example, in China, people do not use a technology product with point-to-point connection, but this is very popular in Europe. Hence, Huawei developed and provided differentiated new products for the European market. Similarly, ZTE also changed the colour, model and even appearance of the products to appeal to consumers in the European market. This kind of capability for selecting innovative product concepts stems from totally understanding the customers. As the Chief of User Research Department of ZTE said*, "through interaction with customers, we understand the user needs, drive product design and R&D, thus promoting the product improvement and iteration".*

b) Learn from co-operation

Huawei and ZTE gained external markets and technology capability through many forms of co-operation. Building a global brand, building technology competence, improving management capability and communication are their main accumulated capabilities from co-operation. Firstly, building a global brand via collaborations with local famous firms is a short-cut to upgrade firms' reputations and competitive power. As we discussed, Huawei set up many joint R&D labs with renowned firms like Texas Instruments and IBM, and built strategic alliances with multinational giants like Siemens. In a joint venture with Siemens, it acquired knowledge about innovative marketing strategies and branding. Thus, collaborative branding proved successful; contract sales of Huawei were already $8.2 billion of which nearly 58 percent came

from foreign markets in 2005. For ZTE, the strategic alliance with international communication leaders Alcatel and Nortel laid a firm foundation to ‘‘strive to build-up CDMA[1] as number one global brand’’.

Secondly, building technology competence through taking advantage of technological complementarity among different collaborators is another accumulated capability. Zhengfei Ren, the founder of Huawei, stated that advantages of co-operation include exploring new technology, quickly transferring technology into products and sharing high-end technologies when Huawei collaborates with other firms in the communication industry who have some advantages in the specific areas. For instance, collaborators providing retail services are more familiar with markets, while partners operating in network development layers are more powerful in regulation and infrastructure.

Thirdly, collaboration is helpful to firms’ management capability. Through continuous contact with local firms in developed countries, ZTE UK not only learnt how to regulate their operations’ management in product standards; they also could feed back the related information to headquarters. Both Huawei and ZTE benefited a lot in establishing project targets, products’ standard and project managing regulations, adjusting the organisation structure flexibly from previous collaborations.

Lastly, collaborations also facilitate communication among R&D personnel, harmonise basic research, development and commercialising, and promote information flow and interconnection between different function departments, and perfect production regulations and systems. *As documented in ZTE news, ZTE partners with Sevilla Football Club to become official smartphone of the team in Mobile World Congress 2016. This program establishes a forum for user feedback in order to improve existing devices or for future product developments.*

c) Learn from the host country

A potentially important source of competitive advantage for multinational firms is the capacity of their foreign subsidiaries to generate innovations based on stimuli and resources resident in the heterogeneous host country environments in which they operate (Frost, 2001; Wu, Wang & Hong, 2016; Yuan, Pangarkar & Wu, 2016; Ho, Ghauri & Larimo, 2017). According to case interviews, Chinese companies that set up subsidiaries in DMs can acquire some valuable capabilities. *As Huawei Terminal Chief Marketing Officer said, European market is a critical environment to look for a better solution because of customers’ high-level need in the standards for the appearance of the product, material, technical aspects*. Similarly, *in the initial stage of international exploration, the first task of ZTE is to learn international rules, understand the local business language (Board Chairman, ZTE).*

[1] Code Division Multiple Access, is a competing cell phone service technology to GSM, which is the world’s most widely used cell phone standard.

Firstly, the firm's strategy management philosophy obviously was improved. Strategic capability normally includes a connection between technological strategy and business strategy, advanced decision systems, entrepreneurial spirit and intense innovation environment, adjusting innovation strategy accordingly and so on. For example, DM enterprises look to make something different from developing country firms and in the process, they become the market leader, while firms in developing countries look for solutions and introduce services into their respective countries. Both Huawei and ZTE said that they had learnt some advanced strategic management ideas from the European market, and most of these have become the norms for the Chinese headquarters and other subsidiaries in developing counties. Therefore, the firm's long-term development strategy of management capability will be improved when the subsidiaries in developed countries have absorbed and shared this investment philosophy with other subsidiaries.

In addition, learning a new operating vision in DMs, such as social responsibility, is an obvious advantage. In order to obtain the trust of customers, Huawei is extremely careful to obey local laws in the country where it operates, to accept social responsibility for its actions, and to promote good collaboration with local partners. All of this is good for Huawei not only in its market extension, but also in its future business activities. Similarly, in the case of ZTE, advanced operational thinking is regarded as a short-cut for operating their business in the future. For example, CFO (Huawei UK) said, *"in order to be trusted by customers in UK, Huawei needs to obey laws, to display social responsibility, to collaborate, and in establishing trust, Huawei has become a full trust partner of the UK". "ZTE also have some managers and some work focus on various types of community activities, and the community cultural construction makes ZTE get a good reputation and establish a good public image" (introduced by CEO, ZTE US).*

Besides, the ability to co-ordinate resources among subsidiaries has been accumulated. Since a DM and a developing market play different roles in the firm's internationalisation and development, their different preferences and the market orientation of products can cause synergy. For example, ZTE's battery storage technology utilising solar energy was the result of solving the question of a lack of charging power in Africa, but provides huge market profit worldwide. As mentioned by CFO (Huawei UK)*, "the UK is the first developed country where Huawei UK develop brand and reputation, Huawei learn advanced technology, the entire process, product specifications, network security, customer service, service operation, these are not the same as in China, we learned a lot from UK and transferred to other subsidiaries in other DMs and EMs, which is helpful to create ability".*

4.2. Multi-level hub-spoke type of knowledge sharing mechanism

Our study further develops a multi-level hub-spoke type of knowledge sharing mechanism. The sharing mechanism includes vertical sharing and horizontal sharing.

Vertical sharing is the knowledge sharing between parents and subsidiaries while horizontal sharing occurs among subsidiaries. In this exchange mechanism, the subsidiary is the starting point of technology, or the knowledge producing point which creates or acquires a new technology. The headquarters is the hub in this mechanism while the regional offices are the hub in the local distribution mechanisms. The headquarters and regional offices form a multi-level structure, and they serve as a knowledge gatekeeper, integrator and mediator between subsidiaries in a multi-level structure. Normally, there is a management sector in MNEs that acts as the mediating unit which collects and selects knowledge reverse transferred back to the headquarters, integrates it with the company's existing capabilities, and then disseminates the new or integrated knowledge to other branches of the company group.

This sharing mechanism of organisational knowledge in Huawei was provided, where a subsidiary as technology- or knowledge-providing unit is a point, and the headquarters and regional headquarters are the multi-level hub (Figure 1). Solid lines represent the knowledge transfer between headquarters and subsidiaries while dotted lines denote the knowledge transfer from a subsidiary to another subsidiary. The knowledge flows between the subsidiaries and their regional headquarters and then the headquarters are the main channels of internal knowledge exchange.

Insert [Figure 1] here

The hub at the headquarters of Huawei is called the Centre for Capabilities Development. This Capabilities Centre is responsible for 1) assessing the capabilities of the company and identifying areas to improve; 2) collecting knowledge and information from its subsidiaries all over the world, identifying the relevant knowledge that is needed by the company, and integrating it with the company's existing technologies; and 3) diffusing the newly acquired or integrated knowledge to the departments or branches that are in need of these technologies. Corresponding units in the regional headquarters serve to select and transmit the relevant knowledge from the headquarters to the subsidiaries and at the same time select and report useful knowledge back to the Capabilities Centre in the headquarters. The learning paths included unconscious absorption and planned learning behaviours. On the one hand, as we have already discussed, subsidiaries are the starting points and provide technology or knowledge in the process of learning. They move their information back to headquarters and achieve information exchange via the MNE's network. These are planned learning behaviours. On the other hand, some informal information flows and interconnections between different functional departments create opportunities for unconscious learning, absorption and capability upgrading. As Deputy COO (Huawei UK) said*, "Huawei UK provide the customers' feedback back to the centre (Huawei China) through multi-level branches.* Similarly, *ZTE US understands the company's globalization strategy and requirements through the internal communication, while it ensures the progress and needs of the US market and from regional headquarters through communication".*

4.3. Two-tier three-step integration mechanism

Based on a comprehensive analysis of cases and literatures, we developed the two-tier three-step integration mechanism (Table 3). Under the vertical perspective, the activities that need to be integrated can be classified as both low-level integration activities and high-level integration activities. At the low-level integration, the integration mechanism mainly deals with specialized tasks according to the primary activities of the value chain including inbound logistics, operations, outbound logistics, marketing and sales, and service. High-level integration means wide-ranging cross-functional integration, such as new product development, and involves extraordinarily wide- ranging integration among different units.

For the integration process, there are three steps to integrate the sources and capabilities within MNEs: leveraging subsidiaries' resources, recreating resources and releasing resources. First, leveraging subsidiaries' resources means putting a subsidiary's resources to new uses or deploying them in a new area. For example, resources embedded in products such as brands, distribution access, and manufacturing facilities may be leveraged by applying them to other products, as the battery storage technology utilising solar energy has been applied to other products by ZTE. Second, renewing resources is concerned with the way in which headquarters and subsidiaries bring together high-technology components, subsystems, software, skills, knowledge, engineers, managers and technicians to produce new products and business capabilities. Third, the alteration of a firm's set of resources involves dropping existing resources, such as by selling assets or reducing the workforce to support losing operations or to foster renewal.

Insert [Table 3] here

In the process of integration, the supporting system, consisting of knowledge encapsulation, intranet, rewarding, strategic location and strategic linkages, ensures an integration mechanism and hence ensures a capacity upgrading mechanism. Firstly, knowledge encapsulation is a routine process of encoding, storing and converting knowledge into a retrievable and sharable form. Learning from UK firms, Huawei and ZTE significantly advanced their capability for knowledge encapsulation and hence directly benefited from knowledge transfer and recombination. Secondly, the intranet infrastructure can promptly access and smoothly share peer member knowledge, facilitating knowledge sharing and integration. Further, an incentive infrastructure can create a learning culture and maintain a learning environment within the firm. Huawei and ZTE provide institutionalised rewards to encourage the exchange of ideas such as best practices and international experience (declarative knowledge) and stimulate sharing of problem-solving techniques, such as building relationships with the business community and winning competitions with local rivals (procedural knowledge). The institutionalised incentives not only come in the form of financial rewards, but also focus on spiritual encouragement and promotion. In addition, the strategic location and strategic linkages concern the navigation of integration. As Service Director (Huawei

UK) said, *"HUAWEI's organisational structure includes customer line, product line and delivery line, we call the triangle supporting each other, and HUAWEI's program information is shared globally, similar programs' information can be directly used for reference by subsidiaries, also can be stored and integrated by headquarters and regional headquarters".*

5. Robustness check

To validate our findings from the two case studies, we carried out a robustness analysis of 6 additional companies. A brief summary of these cases is reported in Table 4. Among these cases, Lenovo, Zoomlion, Chery and Haier are used to verify the model of subsidiary-led knowledge and capability acquisition through reverse learning and knowledge integration processes in their international operations in developed countries. The two failed examples, TCL and SAIC, are given to show that the value of internationalisation will be lost if there is no appropriate knowledge learning, sharing and integration management.

Insert [Table 4] here

Firstly, our finding that the subsidiaries serve as the spokes absorbing and feeding knowledge to the hub is also supported by the following cases. In the internationalisation of Lenovo, we found reverse knowledge acquisition from subsidiaries in DMs. After Lenovo acquired IBM's Personal Computing Division, Lenovo (US) served as a spoke absorbing and feeding knowledge to Lenovo (China) through a series of new technologies, including the industry's thinnest, lightest and most secure Tablet PC, the ThinkPad X41 Tablet, the first widescreen ThinkPad with embedded wireless WAN, the ThinkPad Z60 (Sun, et al., 2014). Similarly, Haier's subsidiaries also served as a spoke in its globalisation strategy to absorb knowledge in design, marketing, product purchasing and capital operations and feed the information to the headquarters and other branches. The subsidiaries of both Zoomlion and Chery also absorb and feed knowledge regarding sales, technology, culture and information to the hub. On the other hand, TCL and SAIC were not able to acquire knowledge from their target firms and hence were not able to feed knowledge to the hub and share within the group. They suffered significant losses after mergers and acquisitions (M&As).

Secondly, similar to our findings, customers, collaborations with local firms, and host country eco-systems are three important learning resources for an MNE. For example, Haier's continuous innovation is driven by zero-distance interaction between global users, creative customers and innovative resources under the guidance that users are always right, therefore, in the innovation and internationalisation operations, Haier not only tries its best to meet users' requirements, but also to create a variety of choices for users. Chery developed its capabilities in design and R&D as well as the manufacture of engines in cooperation with technologically advanced firms. In the case of Lenovo, the acquisition gave its PC business a boost through the sales channels and operations' teams in the host country (Zhou, 2012) and provided a global collaborative,

efficient innovation system. In contrast, an important factor behind the failure of the internationalisation of TCL and SAIC is that they did not learn from their new markets or collaborators because of the lack of knowledge learning and information sharing mechanisms.

Thirdly, Haier regularly hold interactive meetings in order to realize both horizontal learning between subsidiaries and vertical sharing of knowledge between (regional) headquarters and subsidiaries. Lenovo, both before and after M&As, also stressed that learning from diversifying operations among different subsidiaries is good for the firm's development and capabilities' accumulation.

Fourthly, the integration process includes leveraging, renewing and releasing resources and capabilities. Integration activities in each process not only deal with specialized tasks according to the primary activities of the value chain, but also include wide-ranging cross-functional integrative activities. For example, after Lenovo acquired IBM PC, in order to integrate existing resources, the company made substantial efforts to leverage, create, absorb and release resources and capabilities (Sun, 2012). (1) The company leveraged the internal resources such as enterprise culture, finance, marketing, ERP, technology, manpower and operations management, and coordinated the external environment to avoid the political obstacles and to protect the interests of customers. The most prominent example is the transfer of the IBM brand advantage to Lenovo and the retention of the original IBM technical staff. (2) The company cooperated with international investment banks, and introduced strategic investment and SCM management systems in order to access external resources and capacity. (3) Lenovo dropped existing unsuitable resources and capabilities. This includes replacing executives, laying off staff, cutting spending, and so on. In each step, integration activities not only deal with specialized tasks in a department, but also refer to multi-functional integrative activities. Conversely, insufficient integration was one of the important reasons for the failure of both TCL and SAIC's M&As at the beginning of their internationalisation.

Finally, in the reverse learning and capability upgrading mechanism, the headquarters and regional headquarters indeed served as a multi-level hub, screener and disseminator of knowledge in all the 6 cases. The (regional) headquarters served as a middle-level hub to absorb, integrate and upgrade the knowledge transferred from subsidiaries. As a screener, not only did they choose, classify and store the helpful knowledge, but also, as a disseminator of knowledge, they integrated, reproduced and exported it to the subsidiaries and other branches within the MNEs.

6. Conclusions and discussions

This study developed a reverse innovation and capacity acquisition model consisting of a reverse learning mechanism, a multi-level hub and spoke type of knowledge sharing mechanism and a two-tier three-step integration mechanism (Table 4). In this model, reverse learning, knowledge sharing, and knowledge integration build up the basic frame of capability accumulation. The learning mechanism reveals three

reverse learning and capability upgrading processes including learning from customers, collaborators and host economies. The study also suggests a multi-level hub and spoke type of knowledge sharing mechanism, including vertical exchange between parents and subsidiaries and horizontal sharing among subsidiaries. A two-tier three-step knowledge integration process including leveraging, renewing and releasing resources is also explored.

Insert [Table 5] here

Specifically, firstly, the main finding of this study is the identification of the reverse innovation and capability upgrading mechanism with respect to the functions of the subsidiaries and headquarters of EM MNEs. Previous studies, for example, Borini, Moacir, Silveira, & Concer (2012) identified that the influencing factors of traditional multinationals' reverse transfer include strategic R&D orientation, entrepreneurial orientation and integration between parent and subsidiary. This study further reveals that the reverse learning mechanism led by subsidiaries, and capabilities accumulated within MNEs, include understanding customers' values, selecting and testing innovative ideas, product concepts and product prototypes as well as management capability.

In this reverse innovation and capacity acquisition model, subsidiaries and (regional) headquarters are necessary elements playing different roles in the capability acquisition process. Subsidiaries serve as the learners, the spokes, and both sponsors and beneficiaries, while (regional) headquarters act as a receiver of knowledge, a hub, screener and disseminator of knowledge, and a co-ordinator.

In support of this view, recent evidence suggests a strong link between the involvement of headquarters and subsidiaries in the innovation network of the MNE system and the knowledge management mechanisms they develop (Johnston & Paladino, 2007; Mudambi, Pedersen & Andersson, 2014). For example, subsidiaries are mostly viewed as knowledge recipients and strategy implementers (Leposky, Arslan & Kontkanen, 2017), while headquarters improve innovative skills and capabilities, and benefits from the use of reverse knowledge transferred from foreign subsidiaries (Rabbiosi & Santangelo, 2013; Schmid & Schurig, 2003; Almeida & Phene, 2004; Athreye, Batsakis & Singh, 2016).

In the learning process, we verified three learning resources including customers, collaborators and host countries' background. This finding means MNEs have the ability to source knowledge from local, global and intra-MNE networks (Athreye, Batsakis & Singh, 2016). The first potential source of knowledge is customers because they are the final arbiter of value (Cass & Ngo, 2011). Besides, co-operative activities (Harris & Cai, 2002; Enderwick & Buckley, 2017) and host countries' environment (Almeida & Phene, 2004; Yang & Deng, 2017) affected learning opportunities and results.

Secondly, we found that the knowledge inflow is a strategic process, it not only includes horizontal flows among subsidiaries but also refers to the vertical knowledge

inflows between headquarters and subsidiaries (similar to the studies of Tseng, 2015; Gupta & Govindarajan, 2000; Foss & Pedersen, 2002; Ambos, Ambos & Schlegelmilch, 2006; Martinkenaitė-Pujanauskienė, 2015). We further point out that both vertical sharing and horizontal sharing acted at multiple levels because the headquarters and regional headquarters served as the hub and regional hubs, respectively.

In addition, we provided a two-tier three-step integration mechanism. Under the vertical perspective, the activities are classified as either low-level integration activities or high-level integration activities. Three steps to integrate the sources and capabilities within MNEs are provided; these are based on the process view, and comprise leveraging subsidiaries' resources, creating new resources and releasing resources. This finding supported the notion that knowledge integration within an MNE is a continuous process as knowledge is constantly being acquired, transferred and finally integrated (Deng, 2012; Li & Kozhikode, 2011).

Some fundamental conclusions should be further emphasised. Firstly, the connection between any two sub-mechanisms is bidirectional. Subsidiaries first pursue external knowledge sources through learning from customers, co-operation and the host environment, where knowledge flows in reverse from the external MNEs to the internal MNEs. Along with internal knowledge accumulation, the knowledge is disseminated and integrated within MNEs. Meanwhile, the integrated knowledge can in turn be shared and be learned within MNEs. Finally, bidirectional and circulating paths are utilised simultaneously by MNEs in a capability acquisition mechanism.

Moreover, the developed markets as the host country context provide the breeding ground to learn, transfer and integrate knowledge. Europe is a popular host country destination with a superior investment environment as well as the availability of advanced technology and management methods. Chinese MNEs in Europe developed their strategic management philosophy, new operating visions and systematic operational ability to coordinate resources among subsidiaries (Zhang, Duysters, & Filippov, 2011). Acquired capabilities from the DM improved economic benefits and management ability, and facilitated the knowledge sharing and integration in the company.

Lastly, internationalisation is the driver of capability acquisition (Ling-Yee, 2004; Ghauri, Elg, Wang, & Rosendo, 2016); more international activity causes more knowledge utilisation and exploitation. In turn, learning and capability accumulation deepen internationalisation because learning changes a firm's way of seeing and interpreting the world.

7. Theoretical and managerial implications

This study makes several contributions. First, it contributes to the strategic management of MNEs by building a bridge between three streams of research on MNEs: (1) knowledge acquisition, (2) knowledge transfer among intra-firm networks, and (3) integration of knowledge for MNEs' capabilities' improvement.

Secondly, this study enriches learning theories based on the internationalisation process view. It confirms that learning acts as an input of the internationalisation process (Petersen, Pedersen & Lyles, 2008) and that internationalisation is a learning and knowledge acquisition process (Ling-Yee, 2004; Ghauri, Elg, Wang & Rosendo, 2016). It further provides a reverse learning mechanism in which customers, collaborators and host country environment are the three primary sources and thus augments the theory of the *Knowledge Based View*.

Thirdly, this study also confirms the market driving approach, which states that firms are innovative in restructuring the activities in international operations (Harris & Cai, 2002; Ghauri, Tarnovskaya & Elg, 2008). Instead of beginning with core proprietary technologies and exploiting them in the process of internationalisation, our study reveals that Chinese MNEs followed a technology and capability upgrading and development process, driven by reverse learning from foreign customers, collaborators and foreign country eco-systems with the help of subsidiaries.

This study also contributes to capability upgrading theories in internationalisation and explores three mechanisms of learning, sharing and integration, in which the sharing mechanism enriches the community perspective of capability building and sharing (Kogut & Zander, 1992; Martinkenaitė-Pujanauskienė, 2015), while the integration mechanism is a good attempt at knowledge integration within the MNEs (Monteiro, Arvidsson & Birkinshaw, 2008).

Our research also has useful managerial implications. First, it confirms that the managers of MNEs can build up technological and overall capabilities of firms through operations in foreign countries and acquire knowledge and capabilities through subsidiaries abroad. Second, the customers are the primary source of Huawei's and ZTE's learning. Huawei's and ZTE's first success can arguably be attributed to their efforts to master and understand customer needs before investing significantly in R&D. Third, a firm can acquire different capabilities through various means: for example, through communicating with customers, collaborating with a partner and learning among subsidiaries. Fourth, subsidiaries and (regional) headquarters play different roles in the capability accumulation process. Subsidiaries can serve as the learners, the spokes, and as both sponsors and beneficiaries in the learning, sharing and integration mechanisms respectively. Also, (regional) headquarters act as a receiver of knowledge, a hub, screener and disseminator of knowledge as well as a coordinator. Fifth, the host country environment can be a breeding ground to learn, transfer and integrate knowledge. Overall, internationalisation serves as a driver of the capability acquisition.

This research carries some limitations, which emanate from its qualitative exploratory nature, while it offers new avenues for future studies. First, findings of this study are based on Chinese MNEs in European markets and are limited in their generalisability to other developing and DMs. Future research should examine MNCs originating from other countries, as well as those investing in developing markets, and compare their learning mechanisms and impact with those of EM MNEs investing in DMs. Secondly, this study was conducted in two MNEs in the communications industry.

While the case-study approach enabled an in-depth exploration of the capability accumulation of MNEs, future research should examine firms in different industries so as to provide more generalisable insights. Thirdly, given data limitations, we could not distinguish between types of subsidiary. Overseas subsidiaries may be set up through either greenfield investment or merger & acquisition. Future research could also examine the routines of knowledge learning and capabilities' accumulation driven by the different types of subsidiaries.

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Table 1
Interview Coverage.

Resources	Date	People interviewed	Main topics
Face-to-face interviews in UK	From Feb2013 to Jan2014	CEO; Deputy COO; CFO for network & carrier business units; Director of Services of Huawei (UK& I)	Huawei UK's development, product solution paths and technology upgrading strategies
	From Feb2013 to Jan 2014	Senior Product Managers (ZTE, UK)	ZTE's strategy, production solutions, technology upgrading strategies in European, Chinese and African markets
	Feb 2016	Huawei HIRP team	Knowledge source and co-production
	Oct 2016	Author of Huawei Story; Senior Vice President of Huawei	Huawei's internationalisation and innovation strategy, incentive structure for innovation.
Face-to-face interviews in China	From June to Sept 2014	Head of Global Technology Collaboration of Huawei; Head of Early Stage R&D of Huawei	Huawei's global technology collaboration, knowledge integration and global development.
	From Aug to Sept 2014	Chinese government officials in the Ministry of Science and Technology; Chinese scholars in CAS and universities	Chinese firms' internationalisation paths and capability upgrading
	Sep 2015	Huawei 2012 Lab manager and staff	Huawei knowledge integration
	April & Sep 2016	Huawei global cooperation CEO; Huawei HIRP staff	Huawei's learning and co-innovation with host country partners and universities
Network Video Interviews	From Jul 2011 to May 2013	CEO; CMO; Vice President of Huawei Technologies; CEO of Huawei (UK & I)	Huawei Story, the worldwide operation of Huawei Huawei's internationalisation and global R&D activities
	From July to Nov 2011	CEO and President; CMO; Chief of User Research Department; Senior Director of Wireless Product Operation, Product R&D System; CEO of ZTE (US)	Internationalisation distribution, firm strategy, technology development and ZTE's growth and future

Note: Thanks to Victor Zhang, Haibo Lin, Chao Ai, and the ZTE and Huawei staff for support of the field interviews.

Table 2

The key information about reverse learning.

Key topics	Key ideas	Key activities	Key words
Learn from customers	Understanding customers' value	(1) Analysing sales data and sales call reports (2) Observing, meetings and listening openly to their views (3) Market environment interpretations (4) Strategic discussions through open-ended in-depth interviews	Communication; customers; value for customers; competitors; understanding of customers; analyse sales data; analyse sales reports; direct interaction with customers; observe customers' operations; meet customers; listen openly to customers' views; market environment; interpretations; customers' strategic discussions; interviews etc.
	Selecting and testing innovation	(1) Select and test innovative ideas, innovative product, innovative concepts, innovative product prototypes (2) Change colour, model and even appearance of the products	Selecting; testing; innovative ideas; product concepts; product prototypes; differentiated; European market; changed colour; model; appearance; appeal to consumers; understanding the customers, etc.
	Management capability	(1) Understanding subdivided markets (2) Fulfilling diverse customer requirements (3) Monitoring the situation in a market (4) Monitoring the customer preferences	Controlling ability; managing distribution networks; customer relationships; subdivided markets; customer requirements; monitoring; customer preferences; competitive goals, etc.
	Intangible assets	(1) Providing good service and technological assistance (2) Shortening the time from trial-manufacturing to commercialising (3) Forming a virtuous circle in communication with dominant customers and suppliers	Intangible assets; good service; technological assistance; brand name; reputation; trial-manufacturing; commercialising; circle; customers; suppliers; brands; distribution systems, etc.
	Building a global brand	Building a global brand via collaborations with local famous firms	Global brand; collaborations; local famous firms; reputations; competitive power; joint R&D labs; strategic alliances; joint venture; strategies; branding; successful; leading firms, etc.

Learn from co-operation	Building technology competence	Accumulating capability through technological complementarity	Advantages of co-operation; explore new technology; transfer technology; share technology; advantages; retail services; network; development layers; powerful; regulation; infrastructure, etc.
	Building collaboration	Upgrading management capability including phases' standard and project managing regulation	Contact local firms; learn; operation management; product standards; feedback; headquarters; project targets; phases' standard; project managing regulations; organisation structure flexibility, etc.
	Collaborations facilitate communication	Facilitating communication between different units	Facilitate communication; R&D personnel; basic research; development; commercialising; promote information flow; interconnection; function departments; production regulations; systems, etc.
Learn from the host country	Firm's strategy management philosophy	Enterprises in developed markets (DMs) look to make something different while firms in developing countries look for solutions and introduce services	Strategic capability; connection; technological strategy; business strategy; advanced decision systems; entrepreneurial spirit; intense innovation environment; innovation strategy; market leader; solutions; services; strategic management; European market; development strategy; investment philosophy, etc.
	Learning a new operating vision from DMs	Huawei and ZTE learnt a new operating vision in DMs, such as social responsibility	New operating vision; DMs; social responsibility; trust of customers; obey local laws; advanced operational thinking, etc.
	Systematic operation ability	The systematic operation ability can coordinate resources among subsidiaries	Systematic operation ability; coordinate resources; different; internationalisation; development; preferences; market orientation synergy, etc.

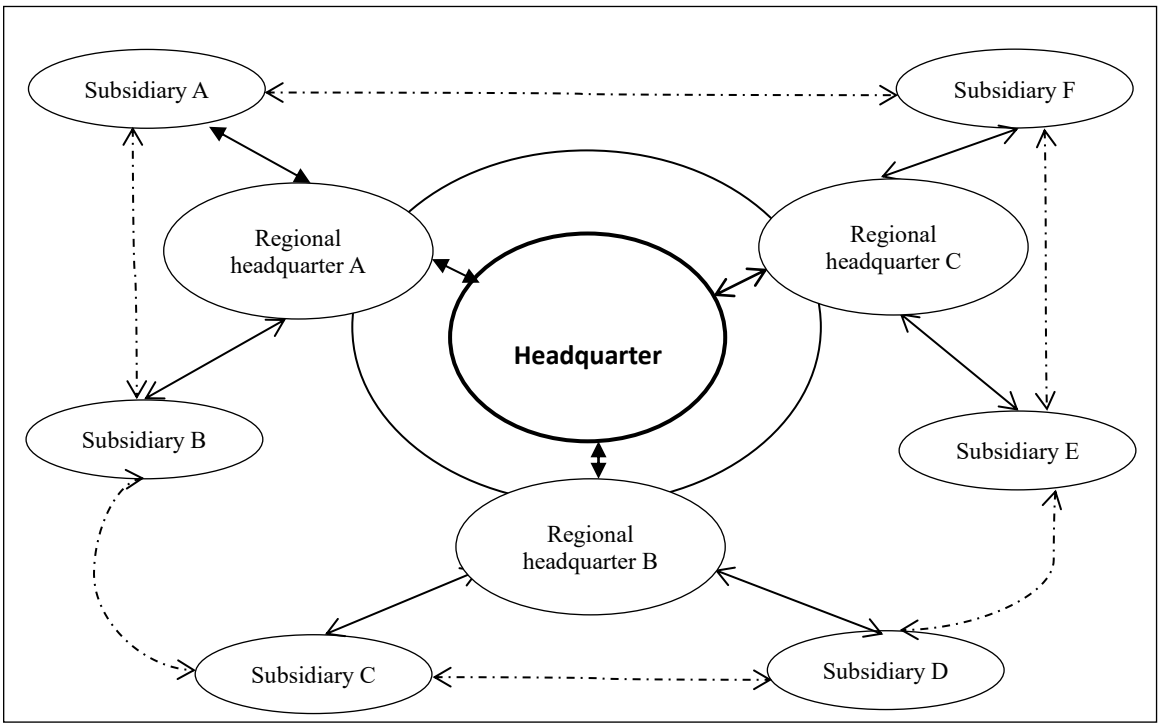

Fig. 1. Knowledge sharing mechanism within an MNE

Notes: Solid lines represent the knowledge transfer between headquarters and subsidiaries while dotted lines denote the knowledge transfer from a subsidiary to another subsidiary.

Table 3
Huawei and ZTE integration activities

			Huawei mini cases	ZTE mini cases
MNE activities	High level	Cross-functional integration	GSM in 1991 began to enter the field of business in Germany, in 1994 began to enter China, in 2000 GSM network coverage to every corner of China	V3 equipment in WCDMA System was first applied in the green competitiveness of the United States and Europe, and later was applied to Hong Kong and the mainland of China
	Low level	Specialized tasks	Such as inbound logistics, operations, outbound logistics, marketing and sales, and service	Such as Global Contract management system, ERP and information system
Integration steps	Sub-mechanism 1	Leverage subsidiaries' resources	Brands, distribution access, and manufacturing facilities	Battery storage technology utilising solar energy
	Sub-mechanism 2	Renew new resources	NGN (Next Generation Network) application in more than 50 countries and regions in the world from 1998 to 2008	Upgrading products in GSM System (GPRS, EDGE, 2.5G, WCDMA, 2.75G, 3G products)
	Sub-mechanism 3	Release resources	In 2001, Avansys, Huawei's non-core subsidiary, sold to Emerson	In order to concentrate, focus on the main industry, ZTE sold three subsidiaries in 2013

Notes: GSM: Global System for Mobile communication; WCDMA: Wideband Code Division Multiple Access; GPRS: General Packet Radio Service; EDGE: Electronic Data Gathering Equipment; ERP: Enterprise Resource Planning; NGN: Next Generation Network

Table 4

Brief summary of cases used for robustness check

Firm	Introduction	Beginning of Internationalisation	Main host countries (this study)
Lenovo Group (Lenovo)	A US$30 billion technology company and the world's second-largest PC vendor	In 2005, Lenovo acquired the former Personal Computer Division of IBM	USA, Japan
Zoomlion Heavy Industry Science & Technology Co., Ltd (Zoomlion)	China's leading manufacturer of construction machinery equipment with registered capital amounting to RMB 7.664 billion and a workforce of over 22,000 employees in 2010	In 2001, Zoomlion acquired Powermole (England)	Europe Market
Chery Automobile Co., Ltd. (Chery)	The first China passenger automobile brand exceeding six million units in sales, with 79.2 billion RMB assets, and 16,721 employees in 2016	In 1996, learnt & bought Ford engine production line (UK). In February 2003, Chery International Department was established	Collaborate with leading technology companies in developed market
Haier Group (Haier)	A global leading provider of household Solutions, positioned as No. 1 brand in global white household appliance market for six consecutive years (by 2014)	In the late 1990s, Haier Group entered "Internationalisation Strategy Stage", in an effort to tap into overseas markets	Haier has entered the top ten chain channels in Europe and USA with its markets across over 100 countries and regions (by 2017)
TCL Group (TCL)	A global enterprise for intelligent product manufacturing and Internet application services, its TV sales ranked third in the world in 2015	Its internationalisation began in 1999 and has some M&As including TCL acquired Alcatel (France) in 2003 and jointly established TTE together with Thomson in 2004	In 2015, TCL's overseas revenues accounted for 46.5% of its main revenue.
Shanghai Automotive Industry Corporation （SAIC）	The largest production volume of any Chinese automaker in 2014 making more than 4.5 million vehicles and sales hit 6.489 million units in 2016.	It participates in the oldest surviving sino-foreign car making joint venture since 1985	Subsidiaries and research centres are mainly distributed in the USA, Europe, UK.

Note: data sources combined the interview with secondary data including non-participant observations, annual reports, financial statements, presentations for external and internal audiences, press releases and company web site texts.

Table 5

Mechanisms for bidirectional circulation of knowledge

Bidirectional circulation			
Supporting mechanism	Knowledge encapsulation, intranet, incentive, strategic location and strategic linkages		
Sub mechanisms	Reverse Learning mechanism	Multi-level Hub-spoke type of knowledge sharing mechanism	Two-tier three–step integration mechanism
Main contents	Learning from customers, from collaborators, and from host economies	Vertical sharing between parents and subsidiaries and horizontal sharing among subsidiaries	Leveraging, recreating and releasing resources in both low-level and high-level integration.
The role of subsidiaries	Learners	Spokes to absorb and feed knowledge to the hub	Sponsors and beneficiary
The role of Headquarters and regional headquarters	Receiver of knowledge	Hub, screener and disseminator of knowledge	Coordinator
Developed market background	Firms can accumulate their strategy management philosophy, new operating vision and the systematic operation ability, and improve economic benefits and management ability		
Internationalisation	The driver of the capability accumulation		