

Preliminary Evidence on the International R&D Strategies of Chinese Companies in Europe

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Abstract

While emerging countries are attracting increasing attention, the academia has somewhat neglected the phenomenon of international research and development (R&D) from emerging multinationals. This study investigates the international R&D motivations and organizational learning of Chinese companies to identify the different pattern of R&D internationalization of emerging multinationals. In this study, we use four cases of international R&D centers established by Chinese companies in Europe to provide preliminary evidence and theoretical support for international R&D from emerging countries.

Keywords:

Chinese companies, R&D internationalization, double-network, motivation, technology exploration, technology exploitation, organizational learning, cooperative learning, experiential learning, international R&D pattern, Europe.

Introduction

As globalization spreads, the ‘knowledge creation processes of technology-based companies have become increasingly global’ (Gassmann and von Zedtwitz, 1998). According to WIR (2005) data, in the past decades FDI into developing and transition countries has increased, and China has become the most attractive host country for FDI. On the one hand, in recent years China has worked hard to attract foreign investment in R&D with the aim of enhancing the technology capabilities of Chinese companies (Wu and Callahan, 2005). On the other hand, Chinese MNCs (Multinational Corporations) have also begun to expand overseas (Tung, 2005). In the dynamic global competitive environment, it is interesting to understand how the MNCs from emerging countries can find innovation opportunities and conduct their international R&D activities globally to obtain key resources or knowledge through their network organization. However, this topic has not been investigated in depth. This paper tries to explain this emerging phenomenon from a “double network perspective”.

During the last decade various scholars have adopted a macroscopic perspective to investigate the FDI from emerging countries (especially China) (Hong and Sun, 2006; Taylor, 2002; Xie and White, 2006). However, there are only a limited number of studies focused on R&D internationalization from emerging countries. As one of the biggest emerging countries, China is in the early stages of its R&D internationalization, but it has already deserved scholars’ attention (Chen and Tong, 2003; Deng, 2007; Gao et al., 2007; von Zedtwitz, 2005; Wong, 1999). Some of the studies take an “assert-seeking” perspective to emphasize that Chinese companies should build their competitive competence (e.g. Deng, 2007); some of the studies follow the “latecomer catch-up process” perspective to determine how Chinese companies can cultivate their innovation capabilities (e.g. Child and Rodrigues, 2005; Fan, 2006; Gao, et al., 2006; Liu, 2007); and some scholars consider the issue from the perspective of network organization theory to investigate the organizational arrangement of R&D internationalization (e.g. Chen and Tong, 2003; von Zedtwitz, 2005). Chen and Tong (2003) used a detailed case-study on Huawei to show the R&D internationalization pattern of Chinese companies but without comparing the different cases. Von Zedtwitz (2005) used a comprehensive database of R&D units of Chinese MNCs to classify the different patterns of R&D internationalization. Such studies, however, have not yet shown us how these units expand their international R&D to the local environment and how they interact with the external network.

In this preliminary and descriptive study, we aim to explore the R&D

internationalization of Chinese companies from a double-network R&D organization perspective on the basis of the evidence from 4 R&D centers of Chinese companies in Europe. More specifically, **why and how do Chinese companies internationalize their R&D activities? And what is the specific role played by the overseas R&D units of Chinese companies?**

Here, the double-network R&D organization structure includes both the ‘internal network’ and the ‘external network’ (Zanfei, 2000). The R&D units not only absorb information and knowledge but also generate and circulate new information and knowledge.

This paper is organized in eight sections. After the general introduction, the next section is a retrospect of the background of global FDI; the third section reviews the literature on double-network R&D organization; The fourth section focuses on the literature on the latecomer international R&D strategies of Chinese MNCs and puts forward the research questions; the fifth section introduces the research methodology and data collection of this study; the sixth section describes the first case studies; the seventh section provides an interpretation of case studies and puts forward the findings; and the eighth section is the conclusion of the study.

2. The background: global FDI, global R&D and Chinese companies

international R&D behavior

In this section we will briefly summarize the relevance of MNC foreign investments for the global economy, and we will focus in particular on the impact of MNC investments on developing countries. We will also suggest that we find greater evidence of foreign direct investment originating from emerging nations. We will then review China's Zouchuqu (going out) policy, endogenous innovation strategy, and the relevance that FDI, both in China and from China, has gained on the political agenda. Finally we will conclude focusing on the relevance of R&D FDI.

2.1 Global FDI trends

Global foreign investment (FDI) flows are increasing in both developed countries and developing countries. We can find evidence from the WIR (2006) that not only some developed countries, but also many developing and transition countries, have a high growth rate in global inflow FDI: "Inward FDI in developed countries started to increase in 2004, after three years of significant decline between 2000 and 2003, and inward FDI in developing countries rose by another 22% to \$334 billion, following a 57% growth in 2004." Global FDI outflows show something different that declined by 4% in 2005 compared to FDI outflows from developing countries. We could cite some data from the WIR (2006) as evidence: "Developing countries, as emerging sources of FDI, strengthened their global position further in 2005, investing \$117 billion in 2005- 4% more than in 2004."

The role of MNCs in global FDI is very prominent. As stated by the WIR (2005), "By 2004 the number of MNCs had risen to some 70,000 with at least 690,000 foreign affiliates, almost half of which are now located in developing countries", and most of the MNCs are based in developed countries. Along with the FDI, foreign investments by MNCs in particular are expanding to developing countries, with both positive and negative impacts on the latter. The FDI from developed countries can increase employment opportunities, trade expansion, economic growth, and can have various spillover effects, such as technology, management and marketing skills spillover to the developing countries. In particular, technology diffusion through FDI in developing countries has been emphasized by many scholars (e.g. Cheung and Lin, 2004; Feinberg and Majumdar, 2001; Young and Lan, 1997; Borensztein et al., 1998), and outward FDI by MNCs is considered as "a major channel for the access to advanced technologies by developing countries" (Borensztein et al., 1998). However, some empirical evidence shows that the spillover effect is fairly limited for the

developing countries (e.g. Young and Lan, 1997, Haddad & Harrison, 1993). In the academia, apart from the differences in the empirical methods, the limited spillover effect is believed to depend on two main reasons. One is the “crowding-out effect”, which means inward FDI might drive the host country to buy technologies from abroad as “a substitute for innovating on one’s own” (Cheung and Lin, 2004). The other one is the “absorptive capabilities” of the host country (e.g. the stock of human capital) (Borensztein et al., 1998) to digest more advanced knowledge. Obviously, both interpretations stress the importance of endogenous innovation and learning capabilities of developing countries and the requirement for the latecomers from developing countries to enhance their competitive strengths in a more global environment.

Anyway, global FDI accelerates global economic competition and brings much pressure to the local firms in developing countries. “If we don’t go outside, we cannot survive”¹, these words reflect a typical mental attitude of the local firms in developing countries and also explain the prominent growth of FDI from developing countries.

2.2 Chinese “going out” (*zouchuqu*) strategy and “endogenous innovation” strategy

Without doubt, China has become a popular destination not just for low-cost manufacturing but for research and development as well (Tung, 2005). WIR (2006) also reveals that in the FDI recipient countries, China’s ranking goes up from the fourth place in 2004 to the third place in 2005. Moreover, China has become the world’s largest FDI destination among all the developing countries in 2005.

Outward FDI from China has been taking off since the mid 1990s (Tung, 2005). Chinese MNCs can be separated into two generations (see WIR, 2006). According to the report, the first generation of Chinese MNCs was dominated by large state-owned enterprises, which were controlling monopolies such as financial services, shipping, and natural resources. Many of the MNCs ‘hitched a ride’ from the open door policy in the late 1970s and started to expand their operations abroad. The second generation of Chinese MNCs emerged in the early 1990s and has diverse ownership structures² that are different from the first generation of Chinese MNCs. This generation of MNCs is focused in sectors where international competition is higher such as electronics, ICT³ and other high-tech manufacturing industries.

¹ Said by Haier’s CEO-Ruimin Zhang (von Zedtwitz, 2005)

² The ownership structures include private ownership, local government ownership and foreign participation [WIR,2006]

³ ICT: Information and communication technologies

Table-1 Leading Chinese Companies Investing Overseas, Jan. 2003 to Mar. 2006

Parent company	Industry	Origin city	NO. of Projects
ZTE	Telecom	Shenzhen	31
Huawei Technologies	Telecom	Shenzhen	21
Lenovo	Personal Computers	Beijing	14
China National Petroleum (CNPC)	Oil	Beijing	12
China Petroleum and Chemical	Oil	Beijing	11
TCL	Consumer electronics	Huizhou	9
Haier Group	White goods	Qingdao	9
Shanghai Technology Property Exchange	Financial Service	Shanghai	6
China Telecommunications	Telecom	Beijing	6
Weihai Textiles GROUP	Textiles	Weihai	6

Source: LOCOmonitor (2006), OCO Consulting Ltd

As Table 2 shows, today several of the leading Chinese companies investing overseas belong to the high-tech industry. Some of the boldest moves by these companies have gained significant international attention, such as Lenovo's acquisition of IBM's personal computer (PC) business, and TCL's acquisition of Schneider Electronics.

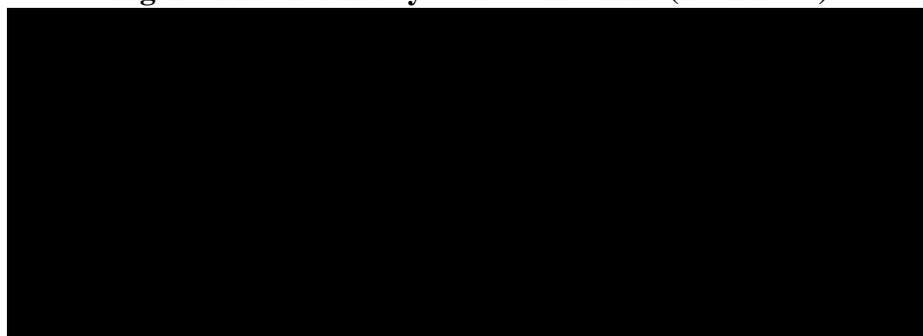
To a large extent, Chinese enterprises going abroad are encouraged to do so by the Chinese government. The Chinese government not only retains great influence in the Chinese market (Wu and Callahan, 2005) but it also has a great policy influence on the international orientation of Chinese firms. The "going out" (*zouchuqu*) strategy was introduced by the Chinese government in 2000, and the goal of this policy was to amend China's Foreign Economic Development Strategy that emphasized the priority to 'attract foreign direct investment'. The new policy underlined the importance of both 'attracting foreign direct investment' and 'going out' strategies. In the Third Plenary Session of the 16th Central Committee of the Communist Party of China in 2003, the Chinese government once more definitely claimed that the government would encourage the development of Chinese MNCs.

The latest policy priorities support the claim that the Chinese government has realized the importance of developing core technologies and technological capabilities as well as national brands (Gu and Lundvall, 2006). The first transformation of China's innovation system, initiated in 1985, was criticized for its inability to create interactive learning between local Chinese companies and foreign MNCs (Gu and Lundvall, 2006). In other words, the new innovation policy was unable to support a coherent absorption of foreign technology and there was little assistance for domestic innovation. Between 1999 and 2005, Chinese R&D expenditure increased

dramatically from 678.9 hundred million Yuan to 2450 hundred million Yuan⁴. During the tenth Five-Year Plan, the government's R&D expenditures increased from 2.9916 billion Yuan in 2000 to 6.454 billion Yuan in 2005. At the same time, the average annual growth for that period was 17%, which was much higher than the average 5% of OECD countries. In 2006, the Chinese government included 'Strengthening Innovation Capacity and Building up Innovation-Typed State' as an essential step of the National Medium and Long-Term Science and Technology Plan. The strategy of endogenous innovation (independent innovation) and continuous reforms to build harmonious development were defined in October 2005. The Communist Party's Central Committee and China's Government stipulated the Guiding Vision for the 11th National Economic and Social Development Program (2006-2010) (Gu and Lundvall, 2006), which introduced the guidelines of the Chinese government that explained the government's attitude towards innovation.

Chinese corporations have recently affirmed the key role of innovation in China. Governmental R&D funds are decreasing steadily, although the Chinese government, like other developing countries, is still providing substantial financial support to R&D policies⁵. On the contrary, Chinese corporations, which are the dominant driver of innovation, have realized the importance of R&D capability and are increasingly engaged in R&D activities (see figure-1).

Figure-1 R&D fund by sources in China (2001-2005)



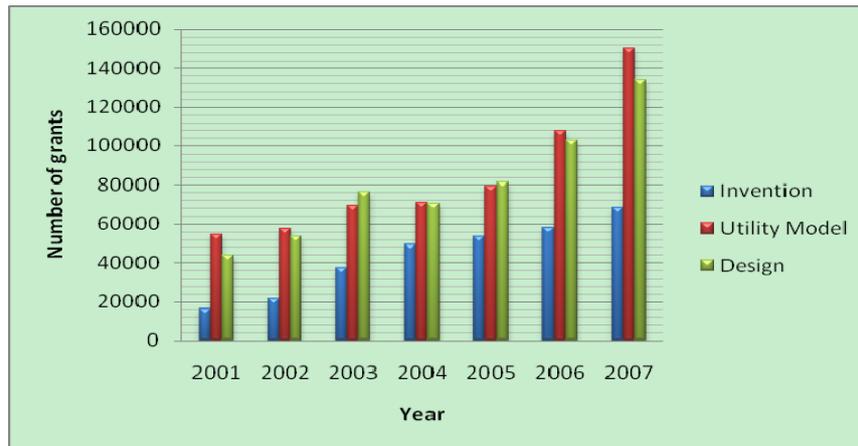
Source: Our elaboration of China Science and technology statistics (<http://www.sts.org.cn/>)

Patents can be used as a proxy to measure the endogenous innovation capability, but the existing Chinese patent system is still in its relative infancy and can therefore provide only partial evidence of this phenomenon. The indigenous Chinese workforce is catching up and the number of patents authored by Chinese inventors is increasing, although the growth of invention patents is still slower than that of utility models or design patents (see figure-2).

⁴ China Science and technology statistics (<http://www.sts.org.cn/>), summarized and calculated by author

⁵ China Science and technology statistics (<http://www.sts.org.cn/>)

**Figure-2 Grants for Three Kinds of Patents Received from Home and Abroad
2001-2007**



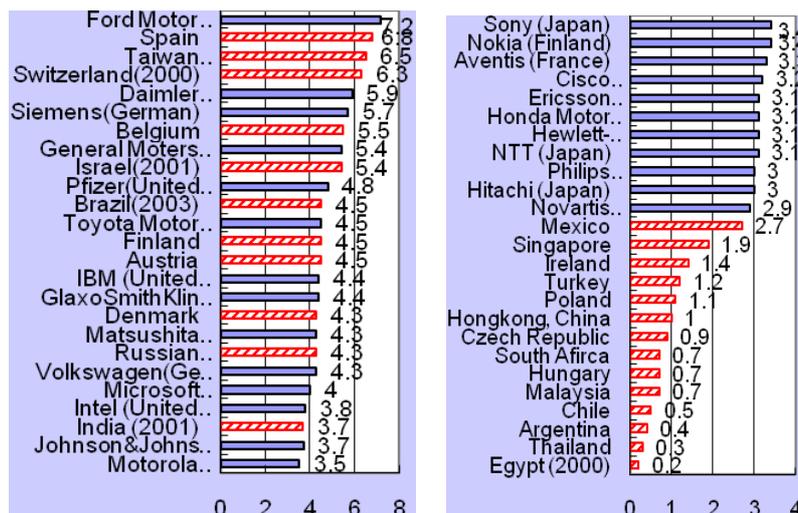
Source: Our elaboration of SIPO statistics (<http://www.sipo.gov.cn/>)

The Chinese academia also points out that China should change the status quo from ‘Made in China’ to ‘Created in China’. Some scholars have argued that “Chinese R&D engineers are not creative, because the Chinese education system and culture don’t encourage individualistic expression and creativity” (Von Zedtwitz, 2006). Accordingly, this school of thought suggests that it is critical for Chinese companies to embark on multinational R&D activities.

2.3 The relevance of R&D internationalization

Technological innovation and R&D are becoming the main driving forces of the international operations of MNCs. According to Gassmann and von Zedtwitz (1998) “International R&D has risen from a by-product of business internationalization to a quite important and far-reaching phenomenon”. From a national perspective MNCs play a key role in R&D internalization and account for a major share of international R&D, which therefore increases their presence and relevance in the national development strategy. Figure-3 shows us some evidence to prove that a growing number of international R&D activities are carried out by MNCs.

**Figure-3 R&D expenditure by selected MNCs and economies, 2002
(Billions of dollars)**



Source: WIR, 2005, Figure IV.1. ■ MNCs ▨ Economies

As we can see from the figure above, the R&D expenditure of some large MNCs has exceeded that of many countries. WIR (2005) revealed that MNCs account for almost half of total global R&D expenditure, and that at least 98% of the 700 largest R&D spending firms of the world are MNCs.

Compared to the MNCs from developed countries, Chinese companies have undertaken a comparatively small but steady step in R&D internationalization. Most Chinese companies are “relatively young (and therefore comparatively small) and focused on the domestic market” (von Zedtwitz, 2005) if we take the MNCs from developed countries as a reference. Chinese companies “often purchase core components and technologies from foreign MNCs, and then undertake system integration and develop features for the final product for the consumer market” (Wu and Callahan, 2005). This traditional cooperation pattern induces domestic Chinese companies to depend heavily on the technological support from foreign MNCs, which could be one of the main reasons why more and more MNCs from developing countries invest in R&D abroad. As Xie and White (2006) pointed out, Chinese companies are “accessing advanced technology abroad by establishing technology listening posts or R&D labs and by forming alliances with multinationals” since 1995 and this trend started to become significant in 1999, when outward FDI from China began to boost (Tung, 2005).

Nowadays, the challenge faced by many large MNCs is “how to effectively make use of their far-flung research and development operations” (Nobel and Birkinshaw, 1998), which means the role of the overseas R&D units is complex to manage but has an increasing potential and relevance for corporate strategy. Scholars and practitioners have become aware of the fact that overseas R&D subsidiaries go through a learning process, and in order to tap into the resources that are available on

a foreign market, and support the company's local and global competitiveness, they have to define their own identity. According to von Zedwitz (2004), they should "develop a clear technical competence that contributes both to the local community and to the parent's international R&D network". If this is the road ahead, Chinese companies are in their initial stage of R&D internationalization, and it is likely that they will face problems similar to those of the MNCs from developed nations. In the next section we will therefore review the main arguments found in the literature regarding the evolution of foreign R&D direct investment.

3. A theoretical framework of double-network R&D organization

3.1 The evolution of network organization theory

Today we see decentralized R&D units not only as knowledge transfer units, but also as knowledge creation centers, in a fully integrated network (Lehrer and Asakawa, 2002). In this section we will briefly review how the business literature achieved full awareness of the role of subsidiaries in the R&D corporate network.

According to Chandler (1962) two are the key aspects to consider in an organization design. These are (1) "the lines of authority and communication between the different administrative offices and officers"; and "the information and data that flow through these lines of communication and authority". Similarly, also for multinationals, the authors have focused on the effective linkage of knowledge flow (transfer) (Kogut and Zander, 1992; Kurokawa et al., 2002) as well as the communication routines and control mechanism (Nobel and Birkinshaw, 1998; O'Donnell, 2000; Piscitello and Rabbiosi, 2006).

The inter-organizational network theory sees MNCs as "a group of geographically dispersed and goal-disparate organizations" (Ghoshal and Bartlett, 1990). Such a view is very useful to look at companies that are decentralizing their control mechanisms.

Hakanson and Zander (1988) observed a tendency among Swedish multinationals to move toward what they call an "integrated network model". This model leads to closer coordination between the headquarters and subsidiaries.

Many empirical studies suggest that MNCs have switched from a centralized hub organization to a more decentralized federation of units, and to integrated networks (Hakanson, 1990) for the purpose of facilitating not only traditional 'forward' knowledge transfer, but also reverse and lateral knowledge transfer. Indeed, ever since the resource-based and the knowledge-based views of the firm have emerged, it has been difficult to treat knowledge transfer only as "a one-way movement of methods from headquarters to foreign subsidiaries" (Bjorkman et al., 2004). Also, the presence of technological enablers and an ever-increasing pressure to adjust to the demands of

the market have facilitated such a transformation and are changing their roles of subsidiaries in the MNC organization (Zanfei, 2000).

O'Donnell (2000) emphasized that “the important resources and knowledge upon which the firm’s competitive advantage hinges exist at the subsidiary level”, and that effective resources are transferred from a subsidiary to other international locations. A lateral network of intra-subunit linkage with a high degree of interdependence is required. It is not, however, sufficient to focus on the intra-organization knowledge flows. In recent years, management theories have taken us beyond corporate borders to understand the role of subsidiaries in MNCs. The company’s external network has been greatly emphasized in the “metanational corporation” (Doz et al., 2001). According to these authors, companies, through their international network can sense, mobilize and operationalize resources and opportunities, located outside the boundaries of MNCs. Scholars and managers cannot therefore neglect the interaction between the internal and the external networks. Independence from the headquarters is only one of the features to consider for the new model. Zanfei (2000) suggests that the MNC can be seen as a “double network”, which includes both an “internal network” and an “external network”. The transfer of knowledge in a traditional network organization is vertical and unidirectional, and units can only absorb knowledge passively. On the contrary, in the double network organization, units not only absorb knowledge, but also generate and circulate new information and knowledge. Units increase the potential for use and generation of knowledge with local firms and institutions in the same area. The new organization structure is more cooperative and interdependent.

The double-network theory applied to MNCs coevolves with other new MNC theories, such as the asserts seeking theory (Dunning, 1993, 1995), the Resource-based view (RBV) (Barney, 1991; Barney, 1986; Wernerfelt, 1982), the Knowledge-based view (KBV) (Gupta and Govindarajan, 2000), the Dynamic capabilities perspective (DCP) (Luo, 2000, 2002), and the external network. When applying the double network theory to MNCs, the role of subsidiaries becomes crucial (Helble and Chong, 2004; Kuemmerle, 1999; Lehrer and Asakawa, 2002; Pagano, 2006; Piscitello and Rabbiosi, 2006) to interact with a variety of external actors such as universities, companies, research institutions etc., and “each of them might detain resources and capabilities which are critical for MNCs’ strategy” (Pagano, 2006). The interaction between the external network and the internal network has been regarded as an important competitive advantage (Andersson, 2002; Helble and Chong, 2004). Setting up external linkages becomes an important mission of the overseas subsidiaries. Through such cooperation, overseas R&D subsidiaries can tap into local scientific and

technological knowledge pools.

3.2 International R&D motivations and organizational learning in the double-network theory

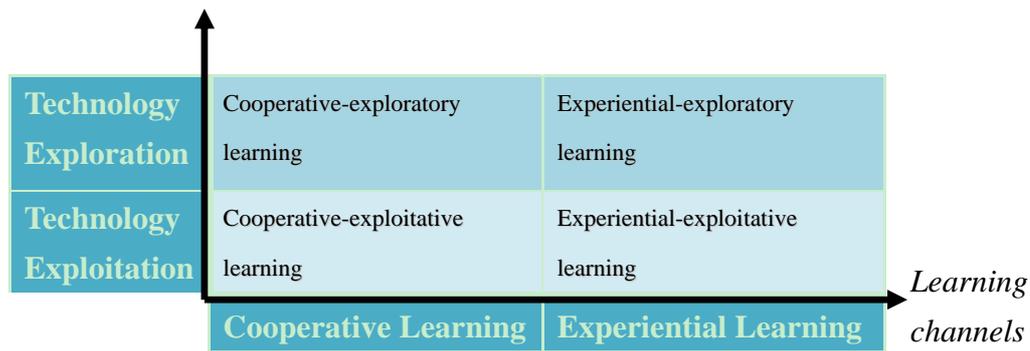
In a decentralized and more open MNC structure, the organization has plenty of opportunities to learn and change through interactions with a variety of networks. This is increasingly seen as one of the main motivations to decentralize R&D investment. Chiesa (1996) theorizes that the increasing importance of international R&D is due to the need to access **external sources of knowledge** relevant to a firm's innovation process and the related need to shorten the time spent to acquire, internalize, and utilize this knowledge to perform innovations. Two are the main motivations for R&D decentralization according to (Belderbos, 2003; Kuemmerle, 1999). These are (1) home-based exploitation (HBE): exploitation of a firm's technologies overseas by adapting the technologies to local circumstances in order to get access to foreign markets (Wu and Callahan, 2005); (2) home-based exploration (HBA): exploration of a firm's technologies through access to overseas technology and know-how.

If we look at how companies are changing and learning, exploration and exploitation can be seen as two different processes in organizational learning (Holmqvist, 2004)⁶. Such learning can take place through various channels, and in particular Hitt et al. (2005) isolate two dimensions: cooperative learning and experiential learning. Cooperative learning means creating new knowledge largely/wholly unrelated to the current knowledge stocks or enriching the current knowledge through knowledge transfer by cooperation with partners; on the contrary, experiential learning emphasizes 'learning by doing' (Hitt et al., 2005) and self-experience accumulation. If we combine the dimensions of motivations/learning processes (exploitation and exploration) and learning channels (cooperative and experimental), we obtain four different types of learning patterns (Hitt et al., 2005) (see figure-4).

Figure-4 four patterns of international organizational learning

⁶ As Holmqvist (2004) concluded: exploitation can be viewed as "the processes by which organizations create reliability in experience through refinement, production, and focused attention"; exploration can be viewed as "the processes by which organizations create variety in experience through experimentation, trialing, and free association".

Motivations/Learning processes



Source: Hitt et al., 2005

In the context of double-network organization, the dispersed R&D units play a learning role both with the external network and the internal network. In the external network, R&D units can learn through tapping into the local knowledge pool, through cooperation, and through self-experience; in the internal network, R&D units can fully utilize the knowledge stock within the firm to refine, implement or create knowledge. In the four different modes of international learning we can identify four different roles that R&D subsidiaries play.

R&D Subsidiaries as “observation outposts” (Cooperative-exploratory learning). The main role of the R&D subsidiary is to bring new sources of knowledge into the corporate network. This happens through the interaction with foreign external networks.

R&D Subsidiaries as “remote centers of excellence” (Experiential-exploratory learning). In this case, the generation of new knowledge is the main mission of the subsidiary, which however has internalized the most relevant local resources.

R&D Subsidiaries as “market gatekeepers” (Cooperative-exploitative learning). The foreign subsidiary has to adapt knowledge for a distant market. Close interaction and cooperative development with important customers is necessary.

R&D Subsidiaries as “market colonizers” (Experiential-exploitative learning). The adaptation of production for remote markets remains the main mission of the subsidiary. Rather than interaction with key customers, the headquarters are requesting the subsidiary to experience directly and learn from the new market, codifying and transferring new knowledge, which is necessary for market access.

4. The latecomer international R&D strategies of Chinese MNCs

There are two waves of MNCs from the developing world. The first wave is due to the difficulties and restrictions faced by the local firms in their home countries, and the other one is mainly the result of the rising pressures of the global economy (Mathews, 2006b).

The theories developed during the second wave of MNCs from developing countries since 1990s commonly referred to the catch-up strategies of the latecomer MNCs to compete with the MNCs from developed countries in the global economy (Child and Rodrigues, 2005; Christensen and Rosenbloom, 1995; Kim, 1997; Lee and Lim, 2001; Mathews, 2006a; Mathews, 2006b; Wong, 1999). The conventional theories, which explained the reasons of the first wave of MNCs from developing countries, focus on the exploitation of domestic assets aboard with multinationals' existing advantages (Mathews, 2006b). The new theories for the second wave of MNCs investment are based on the assumption that the latecomer MNCs are seeking strategic assets, resources, especially knowledge resources, through internationalization, to obtain competitive advantages (Deng, 2007, 2008; Hong and Sun, 2006; Mathews, 2002, 2006b). As a latecomer in the global knowledge economy, China has the chance to move from the position of late-follower to the position of rapid-follower or even leadership through different routes (Wong, 1999), which we will describe below.

The most traditional catch-up route for Chinese companies to seek key assets or resources follows the “Reverse Value Chain” strategy” (i.e. from OEM to ODM to OIM or OBM)⁷ (Child and Rodrigues, 2005; Hobday, 1995; Wong, 1999). Child and Rodrigues (2005) described three internationalization routes taken by Chinese companies. (1) OEM/JVs route: many Mainland Chinese companies choose to start JVs, cooperating with foreign MNCs through OEM or technologies licensing. Gradually, they get the technologies or capabilities they need and move up the value chain. Following this pattern of internationalization, Chinese companies depend a lot on their relationship with foreign partners. Indeed, to compete with developed countries, not only China, but also the other emerging countries, lack two main resources: lead user markets and technological innovation (von Zedtwitz and Gassmann, 2002; Wong, 1999). These two gaps induce Chinese companies to expand their international R&D activities globally to obtain access to either technologies or market resources through the “acquisition route” or the “organic international expansion route” (Child and Rodrigues, 2005). (2) Acquisition route: acquisition can

⁷ Wong, (1999): OEM is the shortened form of original equipment manufacturing; ODM is the shortened form of Original Design Manufacturing; OIM is the shortened form of Original Idea Manufacturing; OBM is the shortened form of Own Brand Manufacturing

accelerate the process to “accrue market strength”, to “gain access to technology”, to “secure research and development skills”, and to “acquire international brands”. (3) Greenfield investment. A pure international expansion which aims not only at technology exploitation to satisfy the needs of the local market and global brand recognition, but also intends to enhance managerial control and global integration.

According to the different routes, a question can be raised: how can Chinese companies get the technology or market resources through effective international strategies? Imitation and cooperation are natural strategies for latecomers to accumulate knowledge and enhance the learning process. But then, Chinese companies should go beyond imitation and promote independent innovation to achieve sustainable competitive advantage. There is some discussion on international learning strategies of latecomers (e.g. Hobday, 1995; Mathews, 2006a; Wong, 1999). However, empirical studies offering insights into managing practices and the development of emerging MNCs are still limited.

As Mathews (2006) mentions, “latecomer firms, like latecomer nations, are able to exploit their late arrival to tap into advanced technologies, rather than to replicate the entire previous technological trajectory”. Some scholars emphasized Chinese latecomers should expand into external resource networks to narrow the resource gaps (e.g. Gao et al., 2007; von Zedtwitz, 2005). Gao et al. (2007) indicate that from a technical resource-based perspective, using advanced countries as R&D bases is useful in order to partly acquire local technology and science, and to partly support local product development (von Zedtwitz, 2005). These studies only showed the strategy that Chinese companies should follow to internationalize their operations and learn from the local knowledge environment to cultivate their competitive advantages. But these scholars didn’t show us how these Chinese companies tap their linkages into advanced knowledge resources through their dispersed organizational configurations.

Some scholars study the R&D internationalization of Chinese companies from the perspective of organizational configuration (Chen and Tong, 2003; von Zedtwitz, 2005). Besides the traditional consideration of the HQ-subsidiary relationship, these studies show us a stronger attention to the role of the R&D units in both internal and external networks. Chen and Tong (2003) recognized the issue that constructing a suitable international organization mode is really an important part of international R&D strategies implementation, and pointed out that international R&D is ‘an effective way to leverage technological level and corporate competences’. Then, the authors used the case of Huawei to define a three-stage R&D internationalization pattern. This study is a one-case longitudinal analysis, but lacks a horizontal

comparison of different cases. On the contrary, von Zedtwitz (2005) did a mapping of the R&D units of Chinese companies, and suggested that Chinese companies internationalize their R&D operations not only in developed countries, but also in developing countries with the purposes of both developing ‘alternate channels of technology sourcing from advanced countries’ and “supporting product localization and process innovation”. Obviously, we can get some macro impressions about the R&D internationalization of Chinese companies from this pilot literature, whereas the international organizational learning of Chinese companies and the significance of the progressively dispersed R&D units involved in a double network are still blind spots in academia, which need more explorative studies.

Considering the gaps in the existing literature, several research questions will be pursued in this paper:

- To what extent have Chinese companies set up R&D units in Europe?
- What are the international R&D learning strategies of Chinese companies in Europe?

Three sub-questions follow this research question:

- a. *Which are the main motivations of the establishment of international R&D units by Chinese companies in Europe?*
- b. *What are the organizational learning channels of international R&D units established by Chinese companies in Europe? And in particular to what extent is such learning influenced by interaction with external/local actors in their learning modes?*
- c. *Is the R&D international strategy/pattern of Chinese companies different from that of developed countries?*

5. Research methodology and data collection

This research investigates the overseas R&D units of Chinese companies and the international R&D strategies of Chinese companies. With regard to the cases selection, this research focuses on the overseas R&D units of Chinese multinationals in Europe. There are two reasons to choose the R&D subsidiaries in Europe as the research samples. Firstly, Europe is deemed as one of the most popular ODI destinations by emerging countries, including China, and a lot of R&D subsidiaries of Chinese MNCs have assembled in Europe; secondly, there are many developed countries with diversified technological advantages and consumer markets concentrated in Europe to attract R&D investment of different industries.

Considering the limited samples of R&D subsidiaries of Chinese MNCs in Europe⁸,

⁸ According to a research by von Zedtwitz in 2005, there are 77 R&D units operated by Chinese companies. 40 of

the multi-case study-based qualitative method combined with the empirical analysis based-quantitative method should be used in this research. Case study is a useful method when the area of research is relatively unexplored, and the researcher is engaged in theory-building (Ghauri, 2004). Hence, an important reason to use the multi-case study method in this research is to try to explore a new theoretical ground. The theories used in MNCs from developed countries cannot fully explain the phenomenon of MNCs from emerging countries. Without doubt, the international R&D activity of Chinese MNCs is quite a new phenomenon for academic research.

In an exploratory study, in-depth interviews with R&D managers and a supplementary questionnaire would be the main method used to collect the necessary data. Daniels and Cannice (2004) explained the reason for the application of interview-based research methods in case studies, stating that interview-based research studies are suited for exploratory and theory building studies, when there is a small population of possible respondents; what's more, interviews allow researchers to develop a deeper relationship with informants.

In order to collect the data we first defined the research samples and identified the location and established time by combining a variety of sources⁹. In this step, 19 R&D units established by Chinese companies in Europe were identified, 4 of which accepted to participate in this research.

Table-2 Mapping the R&D subsidiaries of Chinese MNCs in Europe

	Establishment Date	Company name	Destination Country	Industry
1	N.A	Huawei Technologies	Germany	Telecommunication
2	2001	Huawei Technologies	Sweden	Telecommunication
3	2003-August	ZTE	Sweden	Telecommunication
4	2005-September	Haier Group	Netherlands	Domestic appliance
5	N.A.	Haier Group	Italy	Domestic appliance
6	N.A.	Haier Group	Demark	Domestic appliance
7	N.A.	Haier Group	Germany	Domestic appliance
8	2007-January	Hisense	Netherlands	Consumer electronics (TV set)
9	2005-September	Leader	Sweden	Automotive
10	2005-June	Anhui Jinghuai Automobile Group	Italy	Automotive

these centers are located in China and 37 in developed countries (11 in US and 11 in Europe).

⁹ Secondary information available in newspapers, and the internet, personal interviews and the database compiled by fDi Markets: Crossborder Investment Monitor, <http://www.fdiintelligence.com/>

11	2005-June	Shanghai Baosteel Group	Sweden	Steel
12	2003-October	Changan Automobile Group	Italy	Automotive
13	2005-May	SAIC	UK	Automotive
14	2006-July	Shenyang Machine Tool	Germany	Machine tool
15	N.A.	Weichai	Austria	Diesel engine
16	N.A.	FOTON	Germany	Automotive
17	N.A.	TCL	France	Consumer electronics
18	N.A.	TCL	France	Consumer electronics
19	2003	JIALI Technology	Germany	Storage & transport equipment

We then conducted face-to-face or telephone interviews. Most of the interviewees were senior R&D managers of the R&D unit¹⁰. Before the interview, we let the respondents fill up a questionnaire for the quantified questions, which were used for “pre-testing the survey instruments” (Helble and Chong, 2004) and enhancing the validity of the interviews’ findings.

The third step was the integration of the data and information from both questionnaire and interviews. Whenever the answers provided in the questionnaire or in the interviews were unclear, the respondents were contacted again and asked to clarify their response. The information and data that could not be obtained directly from some of the companies were obtained from secondary sources, such as LexisNexis®Academic (<http://www.lexisnexis.com/>), Factiva (<http://www.factiva.com/>) and official websites.

6. Case studies

In this paper, we present four cases as a pilot study of the R&D internationalization of Chinese companies in Europe. The analysis is based on face-to-face/telephone interviews and questionnaires in Europe supplemented with data obtained from secondary sources.

6.1 R&D center A: ZTE is a multinational headquartered in Shenzhen, China. It is one of the first and largest Chinese telecoms equipment providers, which was established in 1985. ZTE has about 50000 employees, and more than 33 percent of the workforces are involved in R&D and around 10 percent of the annual revenue is injected into R&D¹¹. ZTE operations cover the telecommunication technologies in the wireline, wireless and terminal markets¹².

¹⁰ I also did interviews with some engineers

¹¹ <http://www.zte.com.cn/>

¹² <http://www.zte.com.cn/>

In the early 1990s, 2G (Second Generation) technology was growing fast in China. Ericsson and Nokia, these large telecommunication equipment companies, possessed advanced technologies and occupied a large share of the market. Compared to the global MNCs, Chinese telecommunication equipment companies lagged behind in the development of telecommunication technology. 3G (Third Generation) mobile communication technologies developed in the 21st century and 3G standards are spreading rapidly. Chinese telecommunication companies have the opportunity to become competitive in the 3G mobile communication technology.

As early as 1996, ZTE began its march on the road of globalization¹³. Nowadays ZTE is providing its products and services to over 100 countries and regions with about 100 representative offices and over 4000 employees around the world¹⁴. In the last few years, ZTE has also attempted to enhance its presence in the European market. It owns regional offices (8 in Western Europe and 11 in Eastern Europe) and branch offices in most European countries, and it has signed a number of agreements with many important European telecom operators, such as the France Telecom Group (in 2005), British Telecommunications (in 2006)¹⁵.

ZTE has 16 global, wholly owned R&D centers across North America, Europe and Asia¹⁶. We have interviewed the director of the European R&D center of ZTE (ERCZ, hereafter), which was established in Aug. 2002 in Kista, Sweden's science city. This European R&D center is one of the 16 global R&D centers of ZTE. Their main focus is applied research and product development on 3G mobile communication technology and long-term evolution (LTE), which is one of the most difficult R&D missions in ZTE.

ZTE's decision to set up a European R&D center is evidence of a strong technology-driven motivation to receive overseas technological support and to compete in 3G technology R&D. *"It is not enough that we only rely on the R&D forces in China to catch up these competitors in a short time, unless we have a good technological support (interview, ERCZ)."* Sweden is a leader in the telecommunication technology from which ZTE can easily obtain the advanced R&D human resources they need. Due to its strong technology-driven motivation, ERCZ chooses its local partners according to their various technological requirements, especially for those projects that are difficult to accomplish for ZTE. ERCZ mainly cooperates with the local research institutions and firms by human resources outsourcing. It signs contracts with the suitable R&D specialists from the local

¹³ <http://www.zte.com.cn/>

¹⁴ <http://www.zte.com.cn/>

¹⁵ <http://www.factiva.com/>

¹⁶ <http://www.zte.com.cn/>

companies to work for the corresponding projects with the R&D experts in the center. Some important projects are also contracted out to some local companies. ERCZ is also characterized by highly localized and qualified human resources, and it recruits R&D human resources from all over the world, and not only from the HQ. Even the Chinese national director is locally recruited. After several years of development, ERCZ has become a relatively mature R&D center, and handles the R&D activities of core 3G technologies. The explanation in the interview is the following, “*we master the core technologies through the cooperation with the local technological experts, and sequentially we finish the R&D projects through the cooperation with the R&D team in the HQ*”.

The European market is also a driver for ZTE to set its R&D in Europe. Cooperation with the market departments of ZTE is one of the obligations for the R&D center in Sweden. It has to make detailed plans for product development, and to communicate with global operators to gain a deep understanding of the different demands of the operators. There is a sales office of ZTE alongside its R&D center, which covers the marketing operations in 8-10 European countries. No matter how competitive the bidding or the technical solution of the products, the R&D center will offer its support.

This R&D center also undertakes another important mission. It carries out a global telecommunication monitoring job, i.e. monitoring both the technology and the technological standards of the different telecommunication operators. The R&D center monitors the global market trend, and guides ZTE’s R&D strategies. “*Although this R&D center is located in Europe, we keep the whole world in view (interview, ERCZ).*”

ERCZ is changing from a pure technology exploration unit into a multirole (both technology exploration and technology exploitation) R&D center within the global R&D system of ZTE. It establishes close relationship with local partners and cultivates its independent R&D capability. ERCZ helps ZTE grasp the opportunities to catch up and become competitive in the wireless technologies market and to take the lead in 3G technology R&D.

6.2 R&D center B and R&D center C: Anhui Jianghuai Automobile Co., Ltd. (JAC, hereafter) and Chana Auto Co. Ltd, (ChangAn, hereafter) are two of the most renowned Chinese automotive companies. JAC was founded in 1999 and headquartered in Anhui, Hefei Province¹⁷. By the end of 2007, JAC owned total assets of 6.1 billion yuan and more than 9000 employees. JAC maintains its traditional

¹⁷ The predecessor of JAC is Hefei Jianghuai Automobile Factory which was established in 1964, <http://www.jac.com.cn>

advantages in the commercial car market with its main products which include 6 to 12- meter bus chassis, 0.5 to 50-ton trucks etc. In recent years, JAC has also stepped into the passenger car market. In 2007, JAC sales revenue totaled 14.3 billion yuan. Changan was officially established in 1996. Changan's headquarters –Chana- are located in the Chongqing Municipality, whose history can be traced back to 1862¹⁸. Chana has eleven car manufacturing plants and 28,000 employees, 1000 of which with a scientific and technical background. It operates a complete model line including low-, middle- and high-class passenger and commercial vehicles.¹⁹

China is one of the fastest developing automotive markets. The automotive industry has been developing for more than 50 years. In comparison with global automotive MNCs, most of the Chinese automotive manufacturers are small-sized firms with low R&D capability. They are latecomers compared to the large foreign MNCs, and they don't have enough internal resources or knowledge to carry out the R&D activities independently. Many Chinese automotive companies choose the strategy of "Exchange Market for Technology", and they cooperate with international automotive leaders and set up joint ventures. For example, Chana has established several JVs such as Chongqing Chana Suzuki Automobile Corp. (in 1993), ChangAn Ford Auto Corp. (in 2001), and ChangAn Ford Nanjing Corp. (in 2004) in China. However, the core automotive technologies, especially the technologies of passenger car vehicle development, are still mastered by foreign automotive leaders and JVs.

Both JAC and Changan have just started their R&D activity for passenger vehicles (such as MPV, SUV, basic cars etc.). JAC, in particular, was a traditional commercial vehicle company. Their small quantity of vehicle exports are mainly restricted to developing regions such as Southeast Asia, South America, Middle East, Eastern Europe, Africa, etc. Although they are already planning to expand their activities in other overseas markets such as Europe, their main market remains China. The demand for advanced technological resources and independent intellectual property rights drive them to internationalize their R&D activities in more advanced countries.

We have interviewed the general manager of the JAC Italy Design Center and the vice director of Changan European Design center. The JAC Italy Design Center (JIDC, hereafter) was established on May 15, 2005, and it is regarded as the first overseas R&D operation of Chinese carmakers²⁰. At present, JIDC has around 30 employees, and only 25%-30% are Chinese. The Chongqing Changan European Design center (CEDC, hereafter) was established in June 2005. This R&D center currently has about

¹⁸ The predecessor of Chana is the Shanghai Foreign Gun Bureau which was founded in Shanghai, <http://www.changan.com.cn>

¹⁹ <http://www.changan.com.cn>

²⁰ www.itp-agency.org

20 Chinese employees and 20 foreign employees. In fact, Changan has set up its subsidiary in Turin in 1999. The purpose is to increase the communication with the overseas cooperators, fund allocation, trace design process, and assess the local R&D human resources. In Aug. 2003, the Changan Automobile Co., Ltd. representative office was set up in Italy, which now also serves CEDC²¹.

Both JIDC and CEDC are the first international R&D centers of their companies. The similarity in their international R&D motivations depends on their similar background. The primary motivation for both of the companies is to approach the centers of technological excellence and engage in R&D activities to develop new technologies. *‘Turin is a world class design center, where the surroundings, infrastructure, supporting facilities are satisfactory. For example, there are a lot of local modeling companies in Turin that can be utilized to build car models (interview, CEDC).’* The same motivation is also expressed by JIDC, i.e. that technological R&D and the development of new technologies is the main drive for JAC to internationalization. While constantly maintaining and developing its commercial car market position, JAC has also consistently sought to develop the passenger car market²².

The second primary motivation is to improve cooperation with the local partners. JIDC is viewed as an ‘advance troop’, not only for design & style, but also to take on the responsibility of outsourcing knowledge, integrating resources and monitoring the developing trend of automobile industry. *“We come here to have a good front-line control and localization management. Accordingly, we also can develop a close cooperation with the local partners (interview, JIDC).”*

Last but not least, the motivation is R&D human resources. Both companies referred to the high-skilled R&D human resources (designers and engineers). They all employ designers and engineers from the plentiful and high-quality local human resources to accomplish the projects as well as to train their own designers and engineers. As the interviewee said, “the biggest achievement for us is the training of our own R&D talents.”

Stimulated by these motivations, cooperating with the local partners who own the resources (knowledge & human resources) is the best way to overcome their deficiencies. The most useful and common cooperation strategies are contracting-out, cooperative R&D projects and human resources outsourcing.

● **Contract out- the case of JIDC**

At the very beginning, JIDC could not build the necessary platform for projects operation. They therefore contracted out 75%-80% of their design projects to the

²¹ A report from www.people.com.cn (Zhang, 2006) (in Chinese)

²² <http://jacen.jac.com.cn/>

famous local automobile design companies. For example, Pininfarina²³ has a high cost but good automotive design strength. For JIDC, however, the cost of carrying out the project by themselves is still higher than that of contracting out to this company. Through their cooperation with Pininfarina, JIDC gradually developed their independent design/R&D skills, and succeeded in cooperating with some local SMEs. “We tell the local SMEs what we want to do and we can control them (90% are done by ourselves, and 10% contract-out) (interview, JIDC)”. At the same time, the cost is dramatically decreasing by 40%.

- **Cooperative R&D projects with local firms- the case of CEDC**

When they started their international R&D activities to get their own independent intellectual property rights CEDC chose an independent R&D strategy. Even at the beginning, they aimed at participating in joint-R&D projects with the firms with more advanced technologies. As an example, let’s take the cooperation between CEDC and IDEA-a famous automotive design company. ‘*In the process of CM8 design & development, the R&D employees of Changan can only do some assistant work, maybe 20%. But in project CV6, the R&D employees of Changan can assume 50%. In the following projects, the R&D employees of Changan can assume 70%-80%. (Yu Chenglong, Director of CEDC, 2006)*²⁴,

- **Local R&D human resources outsourcing**

The manager of JIDC was an engineer, and he used his human resources network to set up an R&D platform in a very short time. Besides improving JIDC’s human resources, he sent his employees to the cooperative companies to learn the design & development process of an automobile.

CEDC cooperates with local companies, and employs some engineers and designers to work together for a project. ‘*In the cooperative project, for example: we take the designers from IDEA as the main force, and our Changan designers participate in the project. Because we control the project expenses and the wage of the foreign designers, we had the right to ask the foreign designers to train our designers in the process of the project. The best way is to pair up the foreign designers and our designers, the foreign designer grading our designer every month (Yu Chenglong, Director of CEDC, 2006).*’ CEDC leveled up the skills of their designers only in the projects. ‘*Anyway, the Italian designers are more advanced. We also employ the local designers to work in our R&D center on a long-term and full-time basis (Yu Chenglong, Director of CEDC, 2006).*’²⁵

²³ Pininfarina is one of the major suppliers of automotive design, product & process engineering and manufacturing

²⁴ Report from ‘21st Century Business Herald’, 2006 (Chinese)

²⁵ Report from ‘21st Century Business Herald’, 2006 (Chinese)

These two Chinese automotive companies are very representative. The aspiration for independent intellectual property rights and the increasing competitive pressure in the domestic market are very demanding. Car design is a very creative job, and the key factor of success is high-skilled designers and engineers. The two companies clearly recognize their disadvantages and set up their “observation outposts” in the most intensive knowledge pools to utilize abundant local human resources. They have established multiple cooperative linkages and the extent of their involvement in the cooperation has increased, which provides them with good learning opportunities and allows them to cultivate their own high-quality designers and engineers.

R&D center D: Hisense is a Chinese company which was founded in 1969 and headquartered in Qingdao, Shandong Province. Hisense has emerged as the market leader of China’s electronics industry for the production of TVs, air-conditioners, computers, mobile phones and so on. In particular it is now one of the leading producers of LCD televisions. There are over 1500 employees engaged in R&D activities in Hisense. Each year, Hisense sets aside 5% of its sales revenue for the development of technologies²⁶. As the leader of Chinese TV brands, Hisense keeps a high TV market share in China. In July 2004, the sales revenue of Hisense TV ranked 4th in China’s color TV industry²⁷. Hisense ranked No.1 in terms of market shares in the domestic market of flat panel TV sets in China for 4 successive years (2004-2007)²⁸.

On June 24th, 2005, Hisense successfully created the first digital visual media processing chip independently developed by a Chinese television enterprise, called “Hiview”. The creation of “Hiview” represents the first time the core technology inside a TV set produced in China is not monopolized by foreign entities²⁹. On September 19th, 2007, Hisense established the first LCD module production line on the Chinese mainland. It was the first time that a Chinese company did not have to purchase an LCD module from foreign companies. Hisense obviously devoted great effort to enhance its independent innovation capability.

As a domestic LCD TV giant, Hisense is also beginning a globalization strategy. At present, Hisense owns TV production bases in Hungary, France, South Africa, etc. and sales offices in U.S., Europe, Australia, Japan, etc. In the past few years, Hisense has focused on the European and North American market, which are viewed as the biggest LCD TV markets. Hisense has established R&D centers in both U.S. and Europe.

We have interviewed both the vice manager and a senior engineer of the European

²⁶ <http://www.hisense.com/>

²⁷ <http://www.hisense.com/>

²⁸ <http://www.ce.cn/>

²⁹ <http://www.hisense.com/>

R&D center. At the beginning of 2007, Hisense established its first overseas R&D center in Eindhoven, the Netherlands, which is the fifth R&D center of Hisense³⁰. This European R&D center of Hisense (ERCH) focuses on the development of LCD televisions (styling, development and testing), set-top box and the technologies related with digital TV. Since the R&D center has been set up only recently, most of the employees come from the HQ and the center employs 10-15 persons.

The establishment of the R&D center has a strong market-driven motivation. *“If you hope to develop the products that can make the European customers satisfied, you have to find out the situation of the local market, the technological development, and the consumer consumption and habit (interview, ERCH)”*. After evaluating the technical personnel sources, suppliers, costs of investment, traffic conditions, geographical location, and language environment, Hisense finally chose Eindhoven as the location of their first European R&D center.

Although Hisense owns its LCD module and factory, it still has not mastered the core LCD technology owned by large MNCs, for example, Philips. In the process of product development with strong support from the HQ, ERCH still needs to turn to the local suppliers with strong technical competence, such as NXP semiconductor, STMicroelectronics. ERCH cooperates with these famous companies to co-develop new TV products targeted at the European market. ERCH buys core technologies/patents from these companies. At the same time, these companies provide technical support and professional engineers to help ERCH finish the projects for the development of new products.

Obviously, the establishment of ERCH is driven by the European market. Meanwhile, ERCH also has a strong technological demand. Hence, ERCH still set up cooperation relationships with the local companies who can supply the specific core technologies. However, technological learning is sometimes ineffective because of the existing technological gaps.

7. Interpretation of case studies

The four cases involving the three different telecommunications, automotive, and TV set industries are a good example of the R&D internationalization of Chinese companies, although it is only a small proportion of worldwide Chinese R&D subsidiaries. In this section, we will interpret these cases and clearly clarify our 7 main findings.

7.1 Motivation

³⁰ Hisense has six R&D centers located in Qingdao, Shenzhen, Shunde, USA, and Eindhoven. The R&D center in Qingdao is the HQ of the R&D system.

As mentioned in the previous literature review, there are two main motivations for international R&D: a technology-driven motivation (technology exploitation), and a market-driven motivation (technology exploration). Hong and Sun (2006) supposed that external sources of knowledge are increasingly considered by Chinese companies today. Seeking resources, in particular natural resources, has been one of the key strategic considerations for China's outward FDI since the very beginning. Parallel to resource-seeking investments, Chinese companies have been urged to obtain access to advanced foreign technologies and managerial know-how in view of establishing themselves in the international markets. In this case, the main motivation of Chinese companies was technology-driven.

The common saying about MNCs from advanced Western countries is that it is better to practice marketing in the host countries, while practicing technical innovation in the home countries. This means international R&D activities from developed countries are mainly market- or technology exploitation-oriented. For developing countries, Lall (1983) deemed that technical innovation could be a competitive advantage for the firms from developing countries, which suggested a technology exploration-oriented view of international R&D activities from developing countries. Lee and Lim (2001) concluded that most of the technology-oriented views on newly industrialized economies still rest on the imitation or listening stage, and these economies always try to catch up with developed countries by assimilating and adapting the comparatively obsolete technologies of developed countries.

In most of our cases³¹ there is a straightforward technology-driven motivation³² and the choice to establish R&D centers in technology-intensive areas (the two automotive design centers in Turin, the telecommunications R&D center in Stockholm, and the TV set R&D center in Eindhoven³³). Therefore, Chinese companies can have close interactions with the leading local technology providers. These R&D centers try to enhance local embeddedness and some even perform as offshore knowledge incubators (Lehrer and Asakawa, 2002) with a high autonomy degree. Chinese companies apparently prefer to catch up with the technological aspects and consolidate and enlarge the market share in China first, and then to expand into the international market.

Finding1: the Chinese R&D investments in Europe that we have interviewed are mainly driven by technology.

³¹ ZTE, JAC, and Changan have a strong motivation for technology exploration; Hisense has a strong market-driven motivation and some motivation for technology exploration.

³² The basic research of Chinese companies is mostly still retained in the HQ.

³³ Turin is the world famous vehicle design center; Sweden is the birthplace of Ericsson; Eindhoven is the birthplace of Philips.

A technology-related motivation emphasized in the cases is the human resources-driven motivation. In a lot of studies, the Chinese low-cost and technologically well trained human resources are the main reason why MNCs from developed countries delocalize R&D activities in China (Motohashi, 2006; Wu and Callahan, 2005). Similarly, the MNCs from China would also like to use high-quality, but not low-cost knowledge-based human resources in the host country (Von Zedtwitz, 2006).

In the cases we study, the recruitment of high-skilled researchers and engineers from the local environment has been emphasized by each interviewee. In their opinion, using the local human resources with advanced technological knowledge is the most effective way for the R&D units to tap into the local knowledge environment.

Finding2: High quality specialized human resources are the most important technology-driven motivation of Chinese companies for setting up overseas R&D units in Europe.

7.2 Organizational learning

Organizational learning has been regarded as the core activity of international R&D subsidiaries rather than transferring the knowledge from the parent company to the host country (De Meyer, 1993; Lam, 2003). For the multinationals in the early stage of R&D internationalization, both cooperative learning and experiential learning are necessary organizational learning channels.

On the one hand, self-accumulated experience is an important path of organizational learning. And in particular, international experiences have been regarded as the prime source of organizational learning for MNCs (Belderbos, 2003). The overseas R&D units can enhance their learning capability by obtaining the knowledge stock from the knowledge center (i.e. HQ) (Zhao et al., 2005). Furthermore, they can both explore new codified & tacit knowledge and exploit their existing knowledge stock by accumulating self-experience in different geographic locations.

On the other hand, cooperative learning is another very effective organizational learning path for MNCs. By developing modern international market activities and increasing decentralized R&D operations, the dispersed R&D subsidiaries have more opportunities to interact with global knowledge pools. Self-accumulated experience is no longer the only learning mode for firms. Latecomer MNCs with a relatively low knowledge stock can tap into more advanced technologies and accelerate the learning process through cooperation, rather than “replicate the entire previous technological trajectory” (Mathews, 2002).

As latecomers, most Chinese companies have only existed for a few decades. Compared with the MNCs from developed countries, Chinese companies are still in

their initial development stage. The shortage of both international experiences and core technologies encourages Chinese companies to learn by doing as well as to learn by cooperating. In our cases, all the R&D units have established some degree of cooperation with the external technological network. Through the process of cooperation, the overseas R&D units get access to local knowledge pools and take advantage of the advanced technologies that they haven't mastered. At the same time, the interviewees also emphasized the importance of experiential learning. As part of the global R&D system of their companies, these R&D units are supported by the HQ in terms of capital, human resources, etc. As a geographically detached R&D subsidiary, these R&D units can self-experience different knowledge contexts and generate innovative sparkles.

Finding3: the overseas R&D units of Chinese companies we have interviewed engage in both cooperative learning and experiential learning to enhance their R&D capabilities.

The knowledge stock-lag of Chinese companies led them to seek resources and knowledge from the external network. This process enhances their competitive capabilities in the Chinese market first and in the international market later. The linkage with the external network is cooperation.

The R&D centers of Chinese companies turn to the local technological environment, especially the large local firms with advanced knowledge resources that haven't been mastered by Chinese companies. They take the local companies as knowledge sources and cooperate with the local companies to fully and effectively utilize the technological resources. They learn and accumulate knowledge and experiences, but they also train their own R&D human resources.

Finding4: The overseas R&D units of Chinese companies we have interviewed can tap into the external knowledge network through cooperative learning with local actors in Europe.

Hiring advanced technical human resources from local specialized partners is considered an effective approach of cooperative learning by the interviewees. Human resources cooperation does not only involve the local specialists and the employees in the R&D centers. It also involves the R&D human resources in the HQs. The cases of this study show that a tripartite teamwork of joint R&D projects and HQ-subsubsidiary professional transfers facilitate the communication between Chinese R&D employees and local specialists, upgrade the skill level of Chinese R&D human resources, and accelerate the learning process within Chinese companies.

As previously emphasized, human resources are among the most important motivation for international R&D activities. The high-skilled researchers, engineers

and designers in the local environment are not only a key factor to finish R&D projects (result), but also an effective way to train their own R&D human resources (process). Hence, cooperation with local, high-level human resources has been viewed as one of the main reasons for the enhancement of R&D capabilities through the establishment of overseas R&D centers.

Finding5: Joint work with highly skilled partners leads to significant HR upgrading, which is an important method of cooperative learning for the R&D units of Chinese companies we have interviewed in Europe.

Although cooperative learning is commonly used by the R&D units of Chinese companies, experiential learning is still strongly emphasized by Chinese companies not only for the ‘refinement and implementation techniques and processes’ (Hitt et al., 2005) but also for the development of core technological competence development.

In our cases, the case of R&D center D has a strong market-driven motivation. The development of localized products and the exploitation of the relatively mature technologies stored in the HQ are the main tasks for this R&D unit. Through self-experiencing the local market environment, this R&D center has developed several localized products targeting the European market. However, its technological competence has suffered the incapability of finishing product development independently. They have to cooperate with the local firms carrying out the core competence. The interviewee argued that, this kind of cooperation is sufficient to finish the product’s development, but not to master the core technology. Because of the existing technological gap, many technology catch-up opportunities were missed until the late 1990s (Gao et al., 2007)³⁴. Hence, this company focuses on self-research and self-experiencing in both the HQ and the R&D centers to develop its own core technology and to enhance its independent R&D capability to catch up and compete with the MNCs from developed countries.

Finding6: for emerging multinationals (especially those with more opportunities for technology improvement), experiential learning is necessary to build up core technological competence

7.3 The evolution of R&D internationalization

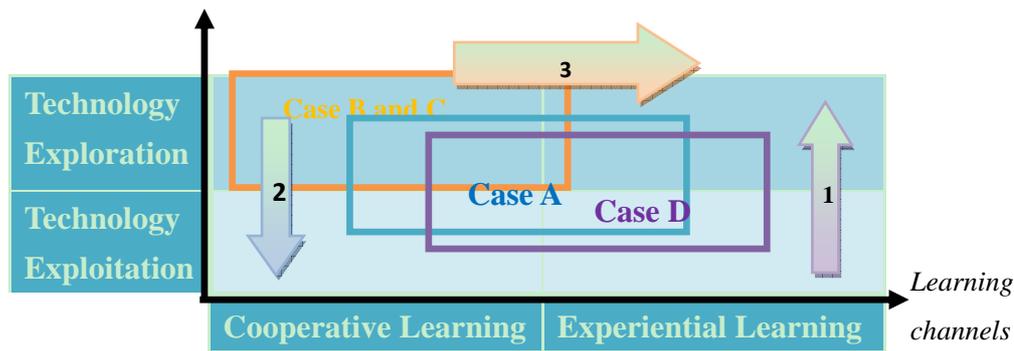
According to the two-dimension analysis of both motivation and organizational learning³⁵, the four cases can match the patterns as depicted in figure-5:

Figure-5 the classification of the cases of international organizational learning patterns

³⁴ Hisense started to develop core technologies in the late 1990s. But before that time, Hisense focused on a technology strategy based on developing strong manufacturing capabilities with some ineffectiveness. This caused the loss of many technological catch up opportunities (Gao, et al., 2007)

³⁵ The cases have been classified according to the questionnaire and interviews.

Motivations/Learning processes



In the cases analyzed, we find three possible evolution paths for the overseas Chinese R&D subsidiaries.

- **Evolution path 1: from HBE to HBA**

As Asakawa (2001), Lehrer and Asakawa, (2002) concluded, there is a ‘classic evolution path’ for R&D internationalization. R&D labs always transfer from home-base exploiting (HBE) to home-base augmenting (HBA) (Kuemmerle, 1997). Firstly, the overseas R&D units adapt, in host countries, their firm-specific knowledge which has been explored in home countries. Then, these R&D units undertake more and more research tasks in the evolution process.

Being the youngest R&D subsidiary in our study, Case D is different from the other three cases. Before the existence of case D in Europe, Hisense performed more like a traditional MNC, in that R&D activities were geographically centralized and the product manufacturing facilities were built in Europe. Better service to the ever-enlarging European market and the production of localized TV products became the main reason for establishing ERCH. Meanwhile, the accelerated upgrading of products also reveals Hisense’s shortage of advanced technology accumulation, which accordingly induces ERCH to have more technology exploration demands from external technology centers of excellence.

Hence, we find the first possible evolution path of Chinese overseas R&D subsidiaries from home-base-exploiting (HBE) to home-based augmenting (HBA) according to the R&D units of Chinese companies we have interviewed in Europe. (See figure-5, Arrow1).

- **Evolution path 2: from HBA to HBE**

Asakawa (2001) also pointed out a different evolution pattern from HBA to HBE (more specifically, CTUs to GTUs or ITUs³⁶), which was identified with Japanese MNC samples, especially those with overseas basic research R&D units (Asakawa,

³⁶ Ronstadt, 1978 P8-P9: CTUs, Corporate Technology Units; GTUs, Global Technology Units; ITUs, Indigenous Technology Units. (See Asakawa, 2001, Note 1-4)

2001). The overseas R&D units of Chinese companies in Europe also reveal a different R&D internationalization pattern from HBA to HBE (See figure-5, Arrow2). As we observed, case B and case C are neither serving the local European markets countries nor exploiting the technologies transferred from the HQs. The most important reason that induced these two Chinese automotive companies to establish their first overseas automotive design centers is because Turin is one of the most famous design centers, with a number of qualified engineers and designers. Similarly, case A is also dedicated to the exploration of the most advanced wireless technologies in Sweden ever since it was established 6 years ago.

Obviously, technology exploration is the most important mission for the Chinese R&D subsidiaries in Europe according to our preliminary evidence. At the same time, these original HBA-dominated Chinese R&D subsidiaries also tend to involve in more HBE R&D activities combined with HBA R&D activities.

At present, the two Chinese automotive companies are still struggling to compete with the global automotive MNCs for a larger Chinese automotive market share. Case B and case C are in their first step of internationalization, although neither of the companies has begun to sell their products in the European market. However, the European market is an inevitable part of the future plans of both companies. The chief engineer of the Changan automotive engineering institute leaked the information that Changan anticipated entering the European car market in 2010³⁷, and during the interview the general manager of JIDC also expressed their longing for the local market.

The R&D internationalization process of ZTE can be explicit evidence of the evolution from HBA to HBE. ZTE takes an international market strategy that first occupies the developing countries market, and then expands to developed countries³⁸. By contrast, its international R&D strategy is a reverse process. ZTE set up its R&D center in the countries with the most advanced telecommunication technologies to obtain. As early as 1998, ZTE opened its first R&D institute in the U.S.³⁹. At the beginning of the 21st century, ZTE set up its R&D center in Sweden.

Along with the technological development and the enlargement of its market share, ZTE is also gradually shifting its attention to the European market. Especially since 2005, ZTE is emerging as a 3G competitor in Europe, signing many cooperation agreements with important European telecommunication operators and companies

³⁷ <http://cdtb.mofcom.gov.cn/>

³⁸ From 1998-2001, ZTE entered the market of South Asia and Africa; from 2002-2004, ZTE marched into India, Russia, and Brazil these emerging markets. (According to the history profile of ZTE, <http://www.zte.com.cn/> and the report from the website of ministry of foreign affairs of the people's republic of China, <http://www.fmprc.gov.cn/>)

³⁹ <http://www.zte.com.cn/>

such as France Telecom. In the meanwhile, case A is also adjusting its position, and it is becoming not only a simple technology explorer but also a technology exploiter serving the European market.

Hence, we find the second evolutionary path of Chinese overseas R&D subsidiaries from home-based augmenting (technology exploration) to home-base-exploiting (technology exploitation) according to the R&D units of Chinese companies we have interviewed in Europe.

● **Evolution path 3: from cooperative learning to experiential learning**

Chinese R&D units were most probably established in the countries with an extensive knowledge pool and with high-quality human resources. However, the R&D units cannot get enough technological support from the HQ, because most Chinese companies have neither the strong technical competences nor the international experience to compete with large MNCs. Consequently, all the cases mentioned the incapability of independent R&D especially in the start-up stage, which means the impossibility of totally independent experiential learning by the R&D subsidiaries themselves. To some degree, cooperation is the only solution to help Chinese R&D units to tap into the knowledge pool easily.

The significant evidence is the transformation of the cooperation modes. Case B and case C, as well as Case A, depend on the local partners to a large extent, and they had to contract out their R&D projects at the beginning. During the process of cooperative learning, these R&D subsidiaries upgraded their R&D capabilities and improved the quality of R&D human resources. Furthermore, these R&D subsidiaries increased their involvement in the R&D projects by switching to the cooperation mode of the joint R&D project and enhanced their self-experience and self-discovery skills in the new technological environment.

Accordingly, we find the third evolutionary path of Chinese overseas R&D subsidiaries from cooperative learning to experiential learning according to the R&D units of Chinese companies we have interviewed in Europe (see figure-5, Arrow 3)⁴⁰.

8. Conclusion

International R&D from emerging countries is quite a new phenomenon and it has not yet attracted the attention of the academia. This is a tentative study with all the limitations of qualitative research. The cases are all centralized in Europe without considering the other developed and developing destinations mostly because of the geographical difficulties and time required to get access to Chinese companies. While

⁴⁰ The only exception-Case D, which was established only one and a half years ago, has a low cooperation extent compared to the other three cases. If this case follows the evolution path or not can not be observed yet.

this study is delivered, we are still contacting other Chinese companies that are setting up their R&D units not only in Europe but also in the U.S. and trying to perform more interviews to obtain more evidence to support our study.

This study is based on the double-network organization theory and observes the international R&D strategies of Chinese companies in Europe. It attempts to define, the effective international R&D evolution paths for the companies from emerging countries to catch up with developed countries. This study can be viewed as a small window to observe this new phenomenon and as a new open path to enhance the theoretical base about emerging multinationals.

According to two main dimensions: motivation/learning processes and learning channels, we identify four types of learning patterns: (1) Cooperative-exploratory learning; (2) Experiential-exploratory learning; (3) Cooperative-exploitative learning; (4) Experiential-exploitative learning, which correspond to four different roles of the R&D subsidiaries: (1) “Observation outposts”; (2) “remote centers of excellence”; (3) “market gatekeepers”, and (4) “market colonizer”. In our cases, most of the R&D subsidiaries are closer to the role of “Observation outposts”⁴¹. Exceptionally, case D shows some unstable characteristics of the “market colonizer”⁴².

Apparently, technology exploration is the most important motivation that drives Chinese companies to internationalize their R&D activities into developed countries. The role of Chinese overseas R&D units is to place more weight as a knowledge contributor/creator in the double-network organization. Along with technological competence upgrading, entering into the market of developed countries gradually becomes another motivation of some Chinese companies, and the Chinese R&D units in Europe also engage in technology exploitation activities. Responding to recommendation by both national policy makers and priorities of regional government has been recognized as a driving factor of R&D localization, even if we could not find consensus on this during our interviews.

Regarding the organizational learning channels, most of the dispersed R&D units of the Chinese companies in our study deeply tap into the local knowledge pool by cooperating with external partners, especially the specialized companies owning highly-skilled human resources. Through cooperation, these R&D subsidiaries cultivate their own talents, and consequently strengthen the independent R&D capabilities.

In the meantime, however, Chinese companies and their overseas R&D units still insist on learning by doing through self-research, self-discovery and self-experiencing

⁴¹ Case A, case B and case C

⁴² As the interviewee explained, the low cooperation extent is mainly due to their new establishment.

both in the external network and the internal network. Along with the development of independent R&D capability, the percentage of experiential learning of Chinese R&D subsidiaries in Europe is also increasing.

Based on the study of the four cases, we find 3 possible R&D internationalization evolution paths of Chinese companies: (1) The traditional evolution path from HBE to HBA; (2) The evolution path from HBA to HBE; (3) The evolution path from cooperative learning to experiential learning. According to the development process of our cases, the last two evolution paths seem to be the most feasible for the emerging MNCs.

The second wave of multinationals from developing countries faces more aggressive global technology competition. To compete with the MNCs from developed countries, Chinese companies aim at bridging their technological gap. According to our preliminary cases, these Chinese companies with a neither strong technology base nor much international experience set up their overseas “Observation outposts” in developed countries, and formulate their specific international R&D strategy of technology exploration through cooperative learning. After a process of both technology and international experience accumulation, these “Observation outposts” will develop an additional role of technology exploitation through not only cooperative leaning but also experiential learning.

The above findings provide emerging multinationals with some new ideas to develop their international catch up strategies.

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