International R&D Strategies of Chinese Companies in Developed Countries: Evidence from Europe and the U.S.

by

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Abstract

Along with their mounting economic might, emerging economies are becoming the object of ever closer analytical attention. Yet, the phenomenon of international research and development (R&D) from multinationals headquartered there still remains neglected. This dissertation exploratorily analyzes Chinese companies' investment in R&D in Europe and the U.S., and claims that the phenomenon of R&D internationalization of Chinese firms is an emerging and varied phenomenon that deserves public attention. Our qualitative study is designed to identify and describe this phenomenon, showing its richness and complexity. In-depth multi-case studies are conducted, focusing on the international R&D strategies of Chinese companies in developed countries. How significant is the phenomenon? Why and how do Chinese companies invest in R&D in developed countries? Can we find significant differences or similarities in the comparison of Chinese R&D investment in Europe and the U.S.? Do Chinese companies behave differently from developed country MNCs in R&D? If so, how and why are they different? These questions are all addressed in the dissertation.

The evidence in Europe shows that the establishment of R&D centers, and most importantly the evolution of these centers do not follow what international business theories would have predicted. The Chinese companies that we have interviewed entered in Europe in a variety of forms, guided by various learning goals. Moreover, we found evidence of a growing tendency of these companies to insulate themselves from local partners, and to engage into a less explorative and more exploitative R&D activity, adapting technologies self-developed for the European market.

The comparison study of Chinese R&D investment in Europe and the U.S. allows us to further verify the findings from the European cases, drawing both the similarities and differences of R&D strategies between Chinese companies in these two destinations as well as the similarities and differences of R&D strategies between
Chinese companies and developed country MNCs. We found that Chinese companies are ambidextrous organizations but dominated by technology exploration. Also, they similarly construct participative-centralized and hierarchical R&D configuration for maximizing use of both internal and external knowledge resources. However, they follow different learning modes in Europe and the U.S. where the companies in our sample expect their European R&D investment to become relatively more insulated from local innovation system, getting access to good indigenous labor rather than to local partnerships, while the companies in the U.S. seek long-term local embeddedness.

The findings in this dissertation set the stage for further studies from developing and emerging countries/economies and have significant managerial & policy implications.
CHAPTER 1: Introduction and Research Questions

“Today’s thriving TW-MNEs (Third-world-MNEs) seem to target the much larger market of rich countries than the small markets of other developing countries, but this is only one example of the differences between the new crop of TW-MNEs and the old crop. IB scholars should systematically study these differences as well as those between TW-MNEs and rich-country MNEs. They should explore the circumstances under which the new crop of TW-MNEs are likely to remain independent actors rather than get gobbled up by their larger, Western counterparts, as has happened frequently in Latin America.” (Ramamurti, 2004)

1. Research Overview

Over the last few decades, outward foreign direct investment (FDI) from developing and emerging countries/economies has increased and has been undergoing transformations in different periods (Mathews, 2006; Ramamurti, 2004). Technological learning and internationalization of the latecomer firms in Asia were explored in depth at the end of the 20th century (Hobday, 1995; Kim, 1997; Sachwald, 2001).

Since the 21st century, the globalization of Chinese companies has obtained academic attention (Child and Rodrigues, 2005; Deng, 2007; Fan, 2006; Gao et al., 2007; Hong and Sun, 2006; Taylor, 2002; Wong, 1999). In the past decades, FDI into developing and transition countries has increased, and China has become the most attractive host country for FDI (UNCTAD, 2005). On the one hand, China has worked hard to attract foreign investment in R&D to enhance the technology capabilities of Chinese companies (Wu and Callahan, 2005). On the other hand, along with their increasing involvement in global competition, Chinese MNCs (Multinational Corporations) have also begun to expand overseas, especially since the mid-1990s (Tung, 2005). Chinese globalization owes much to the “going out” (Zouchuqu)
strategy enforced by the Chinese government since 1999, which encourages Chinese Science & Technology (S&T)-intensive companies, in particular, the successful ones to go global for both technology upgrading and brand building (OECD, 2008).

In recent years, both the Chinese government and Chinese academia are more concerned about how to cultivate the R&D capabilities of domestic Chinese companies and compete with global MNCs. In 2006, the Chinese government implemented the National Medium and Long-Term Science and Technology Plan (2006-2020) as its central S&T policy. The policy emphasizes building up an innovation-oriented country and an enterprise-centered national technology innovation system by keeping to the path of 'indigenous innovation' with Chinese characteristics (OECD, 2008). Meanwhile, Chinese scholars have also opened up an in-depth discussion on the technology strategies of Chinese domestic companies (Gao et al., 2007; Wu and Callahan, 2005; Xie and White, 2006).

Recent studies have begun to show intense interest in the global technological learning and innovation activities of Chinese companies. Scholars adopt an “asset-seeking” perspective to emphasize that Chinese outward FDI serves the purpose of building competitive competence (Deng, 2007). Some of the studies adopt the “latecomer catch-up process” perspective to determine how Chinese companies can cultivate their innovation capabilities (Child and Rodrigues, 2005; Fan, 2006; Gao et al., 2007). Furthermore, there are also some scholars who specifically focus on the contribution of overseas innovative activities to the Chinese competitive advantage (Chen and Tong, 2003; von Zedtwitz, 2005). However, most of the studies analyze international R&D activities as part of Chinese outward FDI and adopt a macro-perspective to investigate this emerging phenomenon. Up to now, we know little about how Chinese MNCs deal with their much stronger counterparts in industrialized countries. What is missing in academia, and what we think is relevant, is an explorative discussion on Chinese R&D internationalization with first-hand evidence from Chinese overseas R&D subsidiaries in developed countries.

This thesis therefore focuses on the R&D internationalization, the more advanced stage of FDI, and uses the evidence from Chinese MNCs in developed countries (both
Europe and the U.S.) to explore the specific R&D strategies used by MNCs from developing and emerging countries. This work boldly step into the academic "no man district" and uses the qualitative methodology of multi-case study, adopting the method of “theory building from case study research” developed by Eisenhardt (1989), in order to see through the appearance and perceive the essence of the new phenomenon. This research identifies the differences between the Chinese emerging MNCs and the MNCs from developed countries in terms of R&D strategies. Furthermore, a new model of R&D internationalization by Chinese MNCs is built up, and the potential evolutionary processes are also proposed. This research can be viewed as a useful attempt to bridge the gap between the conventional theories on globalization (especially R&D globalization) and the new phenomenon.

Based on the first-hand evidence collected in Europe and the U.S. along with various secondary source materials and detailed comparison with the existing literature on R&D internationalization, this dissertation addresses the following research questions:

1. Why and how have Chinese companies shown their presences in Europe and the U.S.?
2. Can we find significant differences or similarities in the comparison of Chinese R&D investment in Europe and the U.S.? If so, how and why are they different or similar?
3. Do Chinese companies have different R&D behaviors from those of developed country MNCs? If so, how and why are they different?

2. Research Findings and Theoretical Innovation

R&D internationalization from emerging and developing countries/economies is a new phenomenon, on which there is no systematic theory offering feasible explanations. This research directly links the latest phenomenon of emerging multinationals to the abundant studies on R&D internationalization from developed countries and narrows the theoretical gaps existing in the fields of both international
In order to answer the first research question, a brief introduction is first given on the background of global FDI and global R&D as well as the Chinese internationalization and innovation activities in chapter 2; Chapter 3 preliminarily uses five Chinese cases in Europe to explore the reasons why Chinese companies do R&D investments in developed countries. The discussion involves three main aspects which include the debate between technology exploration and technology exploitation, locational strategies and the dynamics of R&D motives. Chapter 4 reviews the main strand of international business literature on MNC network organization which evolves from centralization to decentralization and to integration/re-convergence. Furthermore, an innovative four-pattern learning model based on a theoretical framework of "double network" is put forward in order to examine Chinese R&D investments in Europe from two dimensions:

1. Why do Chinese companies invest in R&D in Europe? What is the motive of their presence?

2. How do Chinese companies conduct R&D activities in Europe? What is the mode of their presence?

On the basis of the learning model, different learning patterns are found existing in Chinese companies in Europe, though many of the cases are located in the pattern of “R&D outposts” begging for advanced technologies. The evidence shows that Chinese R&D motives and learning modes do not resemble and evolve as international business literature has predicted. On the one hand, we found that some Chinese cases in Europe expect their European R&D investment to become relatively more insulated from local innovation system and more close to Chinese HQ. On the other hand, some of them expect their European R&D activities to be less explorative and more exploitative of new technologies they’ve mastered.

In order to answer the second research question, a comparison of international R&D strategies of Chinese companies in Europe and the U.S. is made in chapter 5. Based on 16 R&D units of 12 Chinese companies, this chapter investigates the
R&D strategies of Chinese multinationals in Europe and the U.S., focusing on their strategic motives, R&D structure, and modes of learning, in order to understand the effect of global recession on Chinese international strategies.

**Motives:** According to the cases, we find similar dominant motive of Chinese R&D investments, which is technology exploration, and Chinese R&D units behave as ambidextrous organizations. On the one hand, Chinese companies pursue economic benefits for short-term survival. On the other hand, they have a clear technology-centered sense that obtaining core technologies is the key factor for long-term development and maturation.

**R&D Structure:** we discuss the R&D structure of Chinese companies from both horizontal and vertical perspectives. From a horizontal perspective, we find similar centralized R&D structure between subsidiaries and HQ. Important decisions must be shared / coordinated with HQ. However, we find that both the cases /subsidiaries in Europe / the U.S. take initiative in decision-making. In addition, we also find similar informal coordination mechanisms used by Chinese companies for facilitating knowledge learning and transfer. From a hierarchical perspective, we find a hierarchical division of R&D labor existing in Chinese companies. Overseas R&D units undertake high-value added R&D activities while the domestic R&D activities in China are low-value added.

**Modes of Learning:** In Europe, we found many cases of “vocational school model”/“technical school model”. Technological immaturity pushes Chinese companies to enter “vocational schools”/ “technical schools” which mean local technological counterparts, for skill training. We notice that, after initially very close collaboration, experiential learning is emerging, i.e., soon after graduation from vocational schools/technical schools, Chinese engineers pick up some fundamental skills and they can say “we can do the job by ourselves” in terms of some former “impossible tasks”. In the U.S., we found many case of “Ph.D. Student Models”, while we did not find much evidence of experiential learning. On the contrary, there are still many close collaborative learning activities in local knowledge networks after initially close collaboration. In order to abidingly keep
integration with cutting-edge technologies, Chinese companies act as “Ph.D. students” and get embedded in local innovation system. Moreover, US-based R&D units open a window to let Chinese engineers interact with “professors”, i.e., local technological counterparts, directly.

It is necessary for us to seek reasons. Firstly, we have to admit that most of our cases in the U.S. are younger than the cases in Europe. Secondly, Chinese companies in the U.S. are still catching up since the U.S. has a comparatively more innovative environment in cutting-edge technologies than Europe. Thirdly, we take notice of the significance of cross border movement of qualified human resource from emerging countries to the U.S.

In order to answer the third research question, I compare the evidence collected from Europe and the U.S. with the extant literature in chapter 3, 4 and 5. The evidence shows that Chinese companies perform in ways that traditional R&D FDI models would have not predicted.

Chapter 3 and chapter 4 suggest that the dynamics followed by Chinese companies appear to be different from that of MNCs from developed nations. Two converse evolutionary paths are indentified:

(1) Motive evolution: The traditional explanation of R&D internationalization motives of MNCs is from home-base exploiting (HBE) to home-base augmenting (HBA) (Almeida, 1996; Asakawa, 2001; Bas and Sierra, 2002; Florida, 1997; Lehrer and Asakawa, 2002; Ronstadt, 1978).

Chinese R&D units seem to often evolve from a strategy of technology exploration abroad, over fusion of foreign technologies with R&D activities back home, into one of technology exploitation in foreign locations. Developed-country multinationals on the other hand have traditionally proceeded in the opposite direction, from exploitation to exploration abroad.

(2) Learning mode evolution: Another traditional evolution of organizational learning of MNCs is from experiential learning, emphasizing inter-organizational knowledge sharing and utilizing, to cooperative learning, emphasizing intra-organizational knowledge transferring and digestion (Ambos et al., 2006;
Kogut and Zander, 2003; Tsai, 2001).

The overseas R&D units of Chinese firms in Europe reveal a different maturation process of learning mode from cooperative learning to experiential learning. The evidence shows that the cases in Europe become relatively more insulated after initial high dependence on local technological help.

In chapter 5, a semi-centralized and hierarchical R&D structure has been found that is different from what the mainstream studies describe. MNCs usually have a centralized R&D structure/coordination style with a home-market orientation and a decentralized R&D structure/coordination style with a local/global market-orientation (Cheng and Bolon, 1993; Chiesa, 1996; Fischer and Behrman, 1979). The most recently studies reveal the same evidence as Patel and Vega (1999) found 10 years ago that the core R&D activities of developed country MNCs are still centered at home which are the old centers of excellence(Cohen et al., 2009; Macher et al., 2007), and the low value-added/exploitative R&D activities are dispersed worldwide (Quan and Chesbrough, 2010).

The evidence in chapter 5 shows a participative-centralized structure where the authorities of funding, planning, project initiation, etc. are controlled by Chinese HQ. The R&D units, keeping a certain degree of autonomy, take the initiative in decision-making and give advices to the HQ in terms of new project launch, local human resource recruitment, etc.. Different from developed country MNCs, Chinese overseas R&D units engage in high-value added R&D activities, while the massive low-value added R&D activities are retained in China. Two main reasons are identified to explain this specialized R&D structure: proximity to external advanced R&D resources and using internal ‘proprietary advantage’ (Lall, 1983), including both firm-specific advantages and country-specific advantages (e.g. low-cost human resources). By contrast, technology or market orientation is not a key factor that influences the R&D structure of Chinese companies.

Chinese headquarters still hold the majority of the R&D resources of the companies, though the overseas R&D units master some high-value added R&D resources. In order to integrate worldwide R&D resources, centralized and
formalized coordination and control mechanisms are inevitable. Meanwhile, several informal coordination and communication mechanisms are commonly used in Chinese companies for inter-organizational learning and knowledge transfer.

3. Structure of the Dissertation

This dissertation is structured into five chapters. Following the introduction chapter, a literature review and a description on the methodology of multi-case study are given in chapter 2. First, I briefly review the relevance of MNC foreign investments and foreign R&D in the global economy, and focus in particular on China’s Zouchuqu (going out) policy, endogenous innovation strategy, and the relevance that FDI and R&D, both in China and from China, has gained on the political agenda. Secondly, an explanation on the choice of methodology and a detail description on the case study process and the data collection process are given following the literature review. Chapter 3 explores the motives of Chinese companies’ investment in R&D in Europe, focusing on three different aspects: technology exploration vs. technology exploitation as investment motive; locational strategies for R&D investments; and the dynamics of motives of overseas R&D units. By using five in-depth case studies, this chapter focuses on China’s R&D investments in Europe in order to clarify the technological activities undertaken by overseas R&D units and the internal R&D motives of Chinese MNCs.

Chapter 4 is focused on Chinese R&D presence in Europe. Following a review of the evolution of MNC network organization in academic studies, a four-pattern learning model is proposed based on a “double-network” MNC organization. 9 R&D units belonging to different Chinese companies are populated into different learning patterns. Two counterintuitive evolutionary paths are indentified from a dynamic perspective.

Chapter 5 gives a comparison between the Chinese R&D investments in Europe and the U.S. that not only verifies the previous findings in Europe, but also digs out the
differences. This chapter orderly compares the R&D strategies from three aspects of R&D motive, R&D structure, and learning mode. Finally, the content of the chapter is concluded together with policy and managerial implications.

This dissertation originates from a collection of three different articles, and part of the material has been published or is under review by the journals of Review of Policy Research and Industry and Innovation.
CHAPTER 2: Literature Review and Methodology

1. Global FDI and Global R&D

1.1 Global FDI Trends

Global foreign investment (FDI) flows are increasing in both developed countries and developing countries. According to figure 2-1 and figure 2-2, we can find that not only developed countries/economies, but also developing countries/economies have a high and steady growth rate in global inflow FDI until 2007.

FDI outflows from and inflows to developed countries/economies dramatically declined in 2008 largely because of the current recession. However, developing countries, as emerging sources of FDI, seem not affected by the economic crisis, but have further strengthened their global position, receiving $620,733 million of FDI inflow and investing $292,710 million of FDI outflow in 2008.

Figure 2-1 Outward FDI flows and inward FDI flows in developed economies

Source: Our elaboration of foreign direct investment database from UNCTAD (http://www.unctad.org/)
The role of MNCs in global FDI is very prominent. As stated by the WIR (2005), there had been 690,000 foreign affiliates belonging to around 70,000 MNCs by 2004. Most of the MNCs are based in developed countries and almost half of the foreign affiliates are located in developing countries. Along with the FDI, foreign investments by MNCs in particular expand to developing countries, with both positive and negative impacts on the latter. FDI from developed countries can increase employment opportunities, trade expansion, economic growth, and can have various spillover effects, such as the knowledge spillovers of technology, management and marketing skills in developing countries.

The benefits of technology diffusion through FDI in developing countries have been emphasized by many scholars (e.g. Cheung and Lin, 2004; Feinberg and Majumdar, 2001; Young and Lan, 1997; Borensztein et al., 1998). In particular, outward FDI by developed country 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 developing countries (e.g. Young and Lan, 1997, Haddad and 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.

1.2 The Relevance of R & D Internationalization

In a globalized economy, the companies’ knowledge creation processes have become increasingly global. International research and development (R&D) has risen from “a by-product of business internationalization to a quite important and far-reaching phenomenon” (Gassmann and von Zedtwitz, 1998:152). Technological innovation and R&D are becoming one of the main driving forces of the international operations of multinational corporations (MNCs). MNCs, as ‘producer of technical knowledge’, change their centralized R&D layout and shift to decentralized but integrated knowledge networks through technology-related foreign direct investment (FDI) (Caves, 2007; Zanfei, 2000). Such an R&D expansion of MNCs is no longer restricted to developed countries but has spread to emerging and developing countries/economies since the mid-1980s (Motohashi, 2006; Patibandla and Petersen, 2002; Quan and Chesbrough, 2010; Reddy, 1997; Wu and Callahan, 2005). Technology-intensive FDI is no longer located in developed countries, but also in developing and emerging counties. The emerging MNCs from the third world also

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\(^1\) Said by Haier CEO-Ruimin Zhang in The Economist, 2004 (von Zedtwitz, 2005: 6)
start to seek for their involvement in the globalization of technology (Archibugi and Pietrobelli, 2003).
Since 1990s, a third wave of emerging multinationals has germinated and come into our view (Andreff, 2003; Gammeltoft, 2006, 2008). Different from the first and second waves of outward FDI from emerging and developing countries, this wave of emerging multinationals are more prone to seek strategic assets, and resources (especially knowledge resources) when entering industrialized countries in order to obtain new sources of competitive advantage (Deng, 2007, 2008; Hong and Sun, 2006; Rui and Yip, 2008). As an important international strategy to maintain and build competitive advantages, technical innovation is adopted by more and more MNCs from emerging and developing countries although the phenomenon is newly emerged.

2. Internationalization and Innovation of Chinese Companies

2.1 Chinese FDI, the Open Door Policy and the “Going Out” Strategy

Today, more and more Chinese companies, especially in the high-tech industry, are investing overseas. Some of the bolder moves by these companies attained significant international attention, such as Lenovo’s acquisition of IBM’s personal computer (PC) business, and TCL’s acquisition of Schneider Electronics.
Chinese MNCs can be separated into two generations (see WIR, 2006). According to this report, the first generation of Chinese MNCs were dominated by large state-owned enterprises controlling monopolies such as financial services, shipping, and natural resources. Many of the Chinese MNCs took advantage of the open door policy implemented in China in the late 1970s and started to expand their operations abroad. The second generation of Chinese MNCs emerged in the early 1990s with different ownership structures\(^2\) compared to the first generation. This generation of

\(^2\) According to WIR (2006), the ownership structures include private ownership, local government
MNCs focused on sectors where international competition is higher, such as electronics, ICT\(^3\) and other high-tech manufacturing industries. As shown in figure 2-3, technology-related industries such as manufacturing and IT have occupied a certain amount of Chinese outward FDI stock though the traditional industries that the first generation of Chinese MNCs are involved in still take absolute dominance in Chinese outward FDI.

Figure 2-3 Distribution of Chinese outward FDI stock by industry (2008)

Outward FDI from China has taken off since the mid 1990s (Tung, 2005) and has continued to grow steadily into the early 21\(^{st}\) century (see figure 2-4).

\(^3\) ICT: Information and communication technologies.
To a large extent Chinese enterprises going abroad are encouraged to do so by the Chinese government. The Chinese government not only retains maintains great influence on the Chinese market (Wu and Callahan, 2005) but also has great policy influence on the international orientation of Chinese firms. The “going out” (zouchuqu) strategy was introduced by the Chinese government in 2000. The amendments made to China's Foreign Economic Development Strategy sought to shift priorities from merely attracting foreign direct investment to also developing ‘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 claimed that the government would encourage the development of Chinese MNCs.

2.2 Internationalization of Chinese Companies

Two waves of MNCs from the developing world have already been identified. Conventional theories which explain the reasons for the first wave of MNCs from developing countries focus on resource & market-seeking as well as assets exploitation in other developing countries (Lall, 1983; Wells, 1983). The theories on

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4 See the document ‘a number of decisions of CPC Central Committee on improving the socialist market economic system’, 2003, http://www.idpc.org.cn/.
the second wave of MNCs from developing countries state that developing country MNCs expand their investment not only for resource-seeking and market-seeking in other developing countries, but also for asset-seeking and market-seeking in industrialized countries (Dunning et al., 1996; Mathews, 2002, 2006; Sachwald, 2001).

As a latecomer in the global knowledge economy, China can obtain the critical resources and capabilities to move from the position of late-follower to the position of rapid-follower or even leader through different internationalization routes (Child and Rodrigues, 2005; Deng, 2008; Wong, 1999). Child and Rodrigues (2005) describe three internationalization routes taken by Chinese companies: (1) the OEM/JVs route: many mainland Chinese companies choose to cooperate with foreign MNCs through JVs, OEM or technology licensing. They gradually get the technologies or capabilities they need and move up the value chain; (2) the acquisition route: acquisitions can not only facilitate the process to secure raw material/natural resource supplies, but also accelerate the process to "gain access to technology", to "secure research and development skills", and to "acquire international brands"; (3) the greenfield investment: an international expansion which aims not only at technology exploitation to satisfy the needs of the local market and gain global brand recognition, but also at better managerial control and global integration.

The most traditional internationalization pattern of Chinese MNCs is the first route of "Reverse Value Chain" strategy, i.e. from original equipment manufacturing (OEM) to original design manufacturing (ODM) and to original idea manufacturing (OIM) or Own Brand Manufacturing (OBM) (Child and Rodrigues, 2005; Hobday, 1995; Wong, 1999). Following this pattern of internationalization, Chinese MNCs however depend a lot on the attitude of their foreign partners. Recently, increasingly more Chinese companies leapfrog over OEM and adopt the second (cross-border M&A) and the third (greenfield investment) international expansion patterns to directly and effectively tap into the resources and capabilities of advanced countries (Bonaglia et al., 2007; Deng, 2008; Globerman and Shapiro, 2009; Rui and Yip, 2008; Xie and White, 2006).
2.3 Chinese Policy on Investment in Innovation

Over the last decades, Chinese government has been committed to science and technology (S&T) reform and national innovation system development. However, how to transform China’s technological learning from ‘imitation’ paradigm to ‘innovation’ paradigm is still one of the principal unresolved issues, and is extremely urgent on Chinese government’s strategic agenda (Xie and White, 2006).

The first alteration to 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 innovation policy was unable to support coherent absorption of foreign technology with little assistance for domestic innovation. Compared to the MNCs from developed countries, most Chinese companies are “relatively young (and therefore small) and focused on the domestic market” (von Zedtwitz, 2005: 5). 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: 175). This traditional cooperation pattern causes domestic Chinese companies to depend heavily on the technological support of foreign MNCs. It’s a vicious circle where the lack of in-house R&D capability leads to over-dependence on the importation of foreign technologies, which further leads to a long-term technology lag.

The latest policy priorities indicate 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 national strategy of endogenous innovation/independent innovation and continuous reforms to build “harmonious” development, as well as the Guiding Vision for the 11th National Economic and Social Development Program (2006-2010) introduced the Chinese government’s guidelines and explained its attitude towards innovation. These national innovation policies demonstrate the Chinese government’s great determination to ‘step up investment in science and technology and build a full-fledged, high-performing national
innovation system' (OECD, 2008: 40) and change the status quo from 'Made in China' to 'Created in China'.

In 2006, the Chinese government included 'Strengthening Innovation Capacity and Building up Innovation-Typed State' as an essential step in the National Medium to Long-Term Science and Technology Plan which is the central priority of current S&T policy (OECD, 2008). This National Medium to Long-term Strategic Plan in particular stresses on the importance of 'building up an enterprise-centered technology innovation system and enhancing the innovation capabilities of Chinese firms' (OECD, 2008: 75). Figures 2-5 and 2-6 demonstrate that the percentage of governmental funds for R&D is steadily decreasing, while the Chinese government is still providing substantial financial support for R&D policies. The percentage of overseas funds in 2005-2007 are comparatively decreased with respect to 2000 and 2004 (see figure 2-5). By contrast, Chinese companies have recently played a major role in innovation in China.

Figure 2-5 National R&D expenditure by funding source in China (2000-2007)

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

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5 Chinese President Hu Jintao' speech at the national conference on science in 2006.
2.4 Chinese Innovative Activities: From Imitation to Innovation

Technological change in developing countries entails a technological learning process, which acquires and improves on technological capabilities from advanced industrial economies (Lall, 2000). Imitation is a natural learning strategy for latecomers to acquire technologies and develop capabilities although the knowledge related to a firm’s competitive advantage is hard to imitate (Hobday, 1995; Kim, 1997). Most of the technical activities in developing countries are still at the imitation or listening stage, focusing on assimilating and adapting the comparatively obsolete technologies of developed countries, which therefore are unable to help developing country firms build a sustainable competitive advantage (Kim and Nelson, 2000; Lee and Lim, 2001).

Chinese domestic companies have to purchase and utilize core technologies and components from foreign MNCs, and this induces a heavy dependence on technological support from foreign MNCs (Wu and Callahan, 2005). To achieve a sustainable competitive advantage, Chinese companies try to go beyond imitation and over-dependence on foreign MNCs and they try to promote independent innovation. As Mathews states, “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” (2002: 470). Hobday (1995) examines the strategies used by East Asian latecomer firms in the electronics industry to obtain...
foreign technologies. Setting up strategic partnerships with foreign MNCs is regarded as a more advanced way to acquire foreign technology so latecomer firms can successfully grow in size and competitive competence. Chinese latecomers firms expand into external resource networks and transfer knowledge inter-organizationally by establishing cross-border partnerships such as strategic alliances, technology-licensing agreements, joint ventures etc. with foreign multinationals in China to narrow resource gaps and raise R&D capabilities (Miesing et al., 2007; Wu and Callahan, 2005; Zhao et al., 2004). Moreover, along with the heavily intensive competition between domestic companies and foreign multinationals in China’s market, Chinese companies, especially in S&T-intensive sectors, have started to extend their technological learning strategies abroad in the form of outward FDI in developed industrial economies instead of the traditional learning channel of inward FDI (Xie and White, 2006). Chinese companies prevalently use greenfield investments in R&D, international technology alliances and mergers of foreign R&D organizations for technological upgrading. 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” (2006: 235). This trend began in 1995 but became significant in 1999 when outward FDI from China received a boost (Tung, 2005). Moreover, Chinese companies are “developing a clear technical competence that contributes both to the local community and to the parent’s international R&D network” (von Zedtwitz, 2004: 443). If this is the way ahead, Chinese companies are in their initial stage of R&D internationalization, and it is likely that they will face similar problems to those of MNCs from developed nations.

However, China’s emerging R&D/technology-related investments overseas are not drawing as much academic attention as China’s domestic technological activities. Indeed, there are very few explorative and empirical studies conducted to date. I

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These mechanisms include FDI, licensing, sub-contracting, original equipment (OEM), own-design and manufacture (ODM), joint-ventures (JVs), foreign and local buyers, informal means, overseas acquisitions and strategic partnerships.
have identified two pioneering studies in this unexplored field. Chen and Tong (2003) surveyed 28 Chinese MNCs, but a low response rate is insufficient for an explorative study (von Zedtwitz, 2005). Von Zedtwitz (2005) interviewed leading Chinese firms, six of which have overseas R&D units. These scholars gave a preliminary and general description of Chinese R&D internationalization both in developed countries and developing countries, but there have not been any further analysis since.

2.5 The Presence of Chinese Outward FDI in Europe and the U.S.

Both Europe and the U.S. are deemed hot destinations for China’s outward FDI although the total amount is relatively small compared to Hong Kong and some of the world’s tax havens, including the Cayman Island and the Br. Virgin Island (see table 2-1). Notwithstanding these destinations, Europe and the U.S. are also popular destinations that attract 2.8% and 1.3% of China’s outward FDI stock respectively.

Table 2-1 China’s outward foreign direct investment in major economies (100 Millions of US$)

<table>
<thead>
<tr>
<th>Economies</th>
<th>Stock at the end of 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sum</td>
</tr>
<tr>
<td>Europe:</td>
<td>51.34</td>
</tr>
<tr>
<td>E.U.</td>
<td>31.74</td>
</tr>
<tr>
<td>Russia</td>
<td>18.38</td>
</tr>
<tr>
<td>The U.S.</td>
<td>23.90</td>
</tr>
<tr>
<td>Australia</td>
<td>33.55</td>
</tr>
<tr>
<td>Singapore</td>
<td>33.35</td>
</tr>
<tr>
<td>Hong Kong (China)</td>
<td>1158.45</td>
</tr>
<tr>
<td>Cayman Is &amp; Br. Virgin Is</td>
<td>308.05</td>
</tr>
<tr>
<td>Total</td>
<td>1839.71</td>
</tr>
</tbody>
</table>

Source: Our elaboration of 2008 Statistical Bulletin of China’s Outward Foreign Direct Investment
Moreover, the total amount of China’s outward FDI stock in Europe and the U.S. are growing steadily even during the period of economic downturn in 2008 (see figure 2-7).

Figure 2-7 China’s outward FDI stock in Europe and the U.S. (2003-2008) (Millions of US$)

Source: Our elaboration of 2008 Statistical Bulletin of China’s Outward Foreign Direct Investment

3. Research Methodology and Data Collection

3.1 Research Methodology

The international R&D of Chinese MNCs is a new phenomenon and it has not undergone much academic research. While most studies have focused on the R&D investments of developed countries, this dissertation will concentrate on the new topic of Chinese R&D internationalization and analyze the R&D investments in developed countries.

Due to the small sample size and the low survey answer rate, questionnaire-based surveys have been proven to be unsuitable for quantitative empirical analysis of Chinese R&D internationalization (von Zedtwitz, 2005). This work tries to answer the question why and how Chinese companies invest in R&D in developed countries. Yin points out that “how” or “why” questions are more explanatory in case studies.

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7 Von Zedtwitz (2005) identified a sample containing 37 Chinese R&D units abroad. There were only 11 units in Europe although Europe is tied for the hottest location for Chinese R&D FDI with the U.S. In Chen and Tong’s study (2003), only 28 questionnaires were completely answered out of 279 sample companies.
since ‘such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence’ (1994: 6). Moreover, Eisenhardt describes the process of building theory from case studies and points out that ‘this research approach is especially appropriate in new topic areas’ (1989a: 532). Therefore, this work specifically chose the multi-case study to explore this uncharted theoretical ground (Ghauri, 2004). Indeed, several scholars use a single case study to investigate the international strategies of Chinese companies (Liu and Li, 2002; Low, 2007). The multiple-case study allows us to perform case analysis replication and cross-case comparison to demonstrate that the findings from a simple case study are either unique or applicable to the other cases (Chiesa and Frattini, 2007; Eisenhardt, 1989; Eisenhardt and Graebner, 2007).

3.2 Case Study Process and Data Collection

I adopted the “theory building from case study research” approach (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). After an extensive review of the literature, I defined the research questions by focusing on the theoretical gap in Chinese R&D internationalization. I used the Chinese R&D units in Europe and the U.S. as our sample because Europe and the U.S. are the two most popular foreign R&D investment destinations for Chinese companies (OECD, 2008; von Zedtwitz, 2005). Multiple data collection methods are combined in order to collect data on Chinese R&D units in Europe and the U.S. In order to achieve a general picture of Chinese global R&D investment, I firstly start from the databases compiled by fDi markets (http://www.fdimarkets.com/) and von Zedtwitz (2005), and end up doing ‘snowballing’ by combining a variety of secondary sources, such as LexisNexis® Academic, Factiva, world investment reports, and official

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8 According to the report of Chinese FDI in R&D by fDi markets (http://www.fdimarkets.com/) and von Zedtwitz (2005), Europe and the U.S are the most popular destinations of Chinese R&D investments. Von Zedtwitz (2005) shows us a sample with 77 Chinese R&D units, in which 37 units are abroad and 26 units are located in advanced countries. 11 R&D units are established in Europe, along with 11 in the U.S. Moreover, according to the report of Chinese FDI in R&D by fdi markets, a total of 31 R&D investment projects from 18 Chinese companies are identified between Jan.2003 and May 2008. 10 out of the projects are invested in Europe, while only 4 projects are operated in the U.S.
websites of Chinese companies. In this phase, I finally identified 88 overseas R&D units established by Chinese companies.

Figure 2-8 A brief description of 88 global Chinese R&D units

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>The U.S.</td>
<td>31</td>
</tr>
<tr>
<td>Europe (exclude Russia)</td>
<td>32</td>
</tr>
<tr>
<td>Japan and Korea</td>
<td>16</td>
</tr>
<tr>
<td>The other</td>
<td>9</td>
</tr>
</tbody>
</table>

Source: Author’s database

Figure 2-9 Mapping of 88 global Chinese R&D units

Source: Author’s database

According to this database (see figure2-8 and figure2-9), Chinese companies have made a small but steadfast step in R&D internationalization. Europe (exclude Russia) and the U.S. are the hottest R&D investment destinations for Chinese companies. This finding conforms to the databases of fDi markets and von Zedtwitz (2005) though none of the database can exactly give the whole picture of Chinese global R&D investment. As shown on figure 2-10, most Chinese R&D units are quite young and were set up after 2005.
I followed the logic of case selecting in inductive case studies for theoretical reasons but not for statistical reasons (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Glaser and Strauss, 1967).

After contacting the Chinese R&D units in Europe by email or telephone, I finally selected 16 R&D units, 9 R&D units in Europe and 7 R&D units in the U.S., belonging to 12 Chinese companies which had accepted our request for research interview. These 16 units (14 cases) represent different companies and vary by industry, location of both home and host countries, set-up time, entry mode and R&D unit size in order to ensure that each case serves as a ‘distinct experiment’ and provides evidence of various perspectives (Creswell, 1998; Eisenhardt, 1989). The basic description of the 16 units (14 cases) is listed in table 2-3 and table 2-4. The majority of interviews were conducted between April 2008 and July 2009. In September 2009, follow-up interviews were conducted with cases A, B and C that were first interviewed in 2008.

Interview-based case studies allow researchers to develop stronger relationships with interviewees (Daniels and Cannice, 2004). After crafting interview protocols, I conducted face-to-face or telephone interviews with Chinese R&D managers and

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9 22 R&D units whose set-up time hasn’t been identified are excluded in this figure.
engineers together with a quantitative questionnaire and various secondary sources\(^{10}\) to collect the data while taking triangulation into consideration. Prior to the interview, I asked respondents to fill out a questionnaire of quantitative questions that was then used to pre-test the survey instruments (Helble and Chong, 2004) and to verify the validity of the interview findings.

After interviews, I followed the “constant comparison” grounded theory method developed by Glaser and Strauss (1967) that ‘data are collected and analyzed simultaneously’ (Suddaby, 2006). Every interview was taken field notes in Mandarin and then transcribed into English. Then, I cross-checked and integrated the data from the questionnaires and interviews. Whenever the answers provided in the questionnaire or in the interviews were unclear, the respondents were contacted again and asked for clarification. Table 2-2 lists the interview protocol of this research.

Both within-case narrative descriptions for familiarity with each case and cross-case comparison/analysis for pattern extraction were conducted subsequently. Both the conflicting and similar extant literature is enfolded for both internal validity building and theoretical sharpening.

Chapter 3 analyzes the motive of Chinese companies' investment in R&D in Europe with five cases, including ZTE Corporation (Case A), JAC Motors (Case B), Chang’an Motors (Case C), Hisense Group (Case D) and Hisun Group (Case H) in table 2-3.

Chapter 4 explores the international R&D strategies of Chinese companies in Europe with nine cases listed in table 2-3.

Chapter 5 compares the international R&D strategies of Chinese companies in Europe and the U.S. with the nine European cases listed in table 2-3 and the five American cases listed in table 2-4.

\(^{10}\) We traced the latest information on Chinese companies from secondary sources such as LexisNexis® Academic (http://www.lexisnexis.com/), Factiva (http://www.factiva.com/) and official websites.
Table 2-2 Interview protocol

<table>
<thead>
<tr>
<th>General</th>
<th>1</th>
<th>Some basic information on your R&amp;D unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motive</td>
<td>2</td>
<td>What are your company’s motives of your company to establish this R&amp;D unit?</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Which is your company’s main motive of your company to establish this R&amp;D unit?</td>
</tr>
<tr>
<td>External network</td>
<td>4</td>
<td>Does your R&amp;D unit cooperate with local partners?</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Who are the local cooperation partners of your R&amp;D unit?</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>How does your R&amp;D unit cooperate with and learn from local partners?</td>
</tr>
<tr>
<td>Internal network</td>
<td>7</td>
<td>Can you please briefly discuss how your R&amp;D unit interacts with the headquarters and your company’s other R&amp;D units of your company?</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Can you please briefly discuss the level of autonomy of your R&amp;D unit?</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Can you please briefly discuss the coordination and control mechanisms used between your R&amp;D unit and HQ?</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Do you learn from each other (your R&amp;D unit, the headquarters, and the other R&amp;D units)? How so?</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Can you discuss knowledge transfer within your company?</td>
</tr>
<tr>
<td>Follow ups</td>
<td>12</td>
<td>What are the consequences of the global recession to your business? Do you expect changes in your R&amp;D strategies?</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Do you consider that you are now working more/less closely with local partners than when the unit was first established?</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Do you consider that you are now working more/less closely with HQ than when the unit was first established?</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>If possible, could you discuss your company’s global R&amp;D strategy?</td>
</tr>
<tr>
<td>Case</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Company</td>
<td>ZTE Corporation</td>
<td>JAC Motors</td>
</tr>
<tr>
<td>R&amp;D unit</td>
<td>Unit 1</td>
<td>Unit 2</td>
</tr>
<tr>
<td>Entry mode</td>
<td>Greenfield</td>
<td>Greenfield</td>
</tr>
<tr>
<td>Main R&amp;D activities</td>
<td>TV sets</td>
<td>Automotive</td>
</tr>
<tr>
<td>Host location</td>
<td>Kista, Sweden</td>
<td>Turin, Italy</td>
</tr>
<tr>
<td>R&amp;D employment</td>
<td>&lt;20</td>
<td>30</td>
</tr>
<tr>
<td>Interviewee</td>
<td>Director of R&amp;D unit</td>
<td>General manager of R&amp;D unit</td>
</tr>
<tr>
<td>Parent company</td>
<td>MNC A</td>
<td>MNC B</td>
</tr>
<tr>
<td>Industry</td>
<td>Telecommunications</td>
<td>Automotive</td>
</tr>
<tr>
<td>Employees</td>
<td>50,000</td>
<td>9,000</td>
</tr>
<tr>
<td>HQ location (Province)</td>
<td>Guangdong</td>
<td>Anhui</td>
</tr>
<tr>
<td>R&amp;D unit</td>
<td>Entry mode</td>
<td>Main R&amp;D activities</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Unit 10</td>
<td>Greenfield</td>
<td>TV sets</td>
</tr>
<tr>
<td>Unit 11</td>
<td>Acquisition</td>
<td>Automotive spare parts &amp; components</td>
</tr>
<tr>
<td>Unit 12</td>
<td>Greenfield</td>
<td>Soft switch</td>
</tr>
<tr>
<td>Unit 13</td>
<td>Greenfield</td>
<td>CDMA</td>
</tr>
<tr>
<td>Unit 14</td>
<td>Greenfield</td>
<td>Optical communication</td>
</tr>
</tbody>
</table>
CHAPTER 3: Chinese Foreign Direct Investments in R&D in Europe: A New Model of R&D Internationalization?\textsuperscript{11}

Summary

This chapter analyzes Chinese companies’ investment in R&D in Europe, focusing on three different aspects: technology exploration vs. technology exploitation as investment motive; locational strategies for R&D investments; and the dynamics of motives of overseas R&D units. The analysis proceeds to draw out differences between the R&D internationalization process of multinationals from developed economies and those from emerging economies. Evidence of Chinese R&D internationalization is provided through analyses of five cases of international R&D units set up by Chinese companies in Europe: ZTE Corporation, JAC Motors, Chang’an Motors, Hisense Group, and Hisun Group. Based on the analyses we find that the Chinese R&D units represent important differences from the conventional R&D internationalization process of developed-country multinationals.

Keywords:
R&D internationalization, outward foreign direct investment, investment motives, emerging multinationals, China, Europe

\textsuperscript{11} The chapter is co-authored with Alberto Di Minin and Peter Gammeltoft. The first draft of the chapter was presented in the 2008 conference on ‘Emerging Multinationals’ at Copenhagen Business School.
1. Overview

This chapter attempts to understand the motives that impel Chinese MNCs to conduct international R&D activities in a highly competitive environment such as Europe. We want to explore the evolution of motives, and if there is any difference between Chinese MNCs and developed country MNCs in terms of R&D maturation determinants.

We will therefore focus on the following research questions: (1) To what extent have Chinese companies set up R&D units in Europe? (2) Why do Chinese MNCs establish Chinese R&D units in Europe and how do their motives dynamically evolve? (3) Are the R&D motives of Chinese companies different from those of MNCs from developed countries?

This chapter is organized into five sections. The next section looks at the received literature on R&D internationalization; the third section discusses processes of internationalization and innovation of Chinese companies; the fourth section analyzes our case studies; and the fifth and final section concludes our study.

2. R&D Investment Motives, Locational Strategies and Dynamics

In this section we will draw out lessons from the received literature on the three aspects of R&D internationalization under study: technology exploration vs. technology exploitation motives; locational strategies; and the dynamics of motives and mandates of R&D units abroad. This will allow us to compare these lessons later with the observed behavior of Chinese R&D units in Europe.

2.1 Technology Exploration vs. Technology Exploitation Motives

The motive for firms investing in R&D overseas is not a new topic. Based on the evidence from developed-country MNCs, different explanations of overseas R&D activities have been given. Cheng and Bolon state that "motivations reflect the organizational benefits that a firm could expect to obtain from investing in foreign
A large body of studies classify R&D internationalization motives into dichotomous sets, such as push/pull factors, demand side/supply side factors, input-oriented/output-oriented factors, access to internal/external capabilities and so on (Blanc and Sierra, 1999; Gassmann and von Zedtwitz, 1998; Pearce and Papanastassiou, 1999; Shan and Song, 1997; Gammeltoft, 2006). The main debate around global investments in R&D can be narrowed down to a debate between the technology-driven motive (access to technology) and the market-driven motive (access to market) (von Zedtwitz and Gassmann, 2002). The market-driven motive for R&D decentralization can be explained as technological exploitation, i.e., exploitation of a firm’s technologies overseas by adapting those technologies to local circumstances in order to gain access to foreign markets. The technology-driven motive for R&D decentralization is defined as technological exploration, i.e., exploration of a firm’s technologies through access to overseas technology and know-how (Belderbos, 2003; Kuemmerle, 1997, 1999; Motohashi, 2006; Wu and Callahan, 2005).

2.2 Locational Strategies

The asymmetry of technological capability between headquarters and host countries has been considered by some scholars as a determinant of R&D internationalization (Almeida, 1996; Bas and Sierra, 2002; Kuemmerle, 1999). Early studies use the internalization theory to explain that a firm-specific advantage can best be exploited internally by overseas subsidiaries (Hennart, 1989; Rugman, 1981). With a globalized production process, overseas R&D facilities are needed to provide technical services to local manufacturing subsidiaries. Existing technological knowledge is transferred from the parent company and then exploited in a foreign market (Bartlett and Ghoshal, 1990; Håkanson and Zander, 1988). Product adaptation and satisfying local customers’ demand have been proved by several empirical studies to be the primary functions of overseas R&D units (Håkanson and Nobel, 1993; Håkanson and Zander, 1988; Patel and Vega, 1999; Ronstadt, 1978). However, scholars soon perceived the difficulty of internalizing all the relevant technological resources (Blanc and Sierra, 1999; Pisano, 1990), and have argued that firms are able to obtain external technological resources and generate new technological capabilities by tapping into
foreign advantageous knowledge bases in various locations (Florida, 1997; Kuemmerle, 1997, 1999).

2.3 Dynamics of Motives and Mandates of R&D Units Abroad

Concerning the dynamics of R&D internationalization overseas, Ronstadt points out that R&D units “change purpose and continue operations at the same location” (1978:15). Subsequent studies further confirm the evolutionary tendency of the goals of overseas R&D units (Ambos, 2005; Asakawa, 2001; Cantwell et al., 2004; Florida, 1997; Lehrer and Asakawa, 2002). During the transition of motive from market-driven to technology-driven, overseas R&D units have a more active knowledge-learning (technological learners/absorbers) and knowledge-creation (technological creators/contributors) role (Almeida, 1996; Bas and Sierra, 2002; Kuemmerle, 1999). Technological learners/absorbers seek technologies in which they are weak in their home countries but strong in host countries, to offset their technological weakness (Bas and Sierra, 2002). Conversely, technological creators/contributors accumulate strong technological capabilities and participate in new knowledge-generation activities in host countries, thus complementing their multinationals’ existing knowledge stock (Almeida, 1996; Bas and Sierra, 2002; Kuemmerle, 1999). Most of these studies define taxonomies and collect empirical evidence of R&D internationalization motives from the perspective of R&D investments between developed countries, or from developed countries to developing countries. However, R&D investments from developing countries to developed countries have been neglected.

3. Discussion of the Five Cases

We present five cases as a pilot study of Chinese R&D internationalization in Europe: ZTE Corporation, JAC Motors, Chang’an Motors, Hisense Group and Hisun Group (See table 2-3).

MNC A (ZTE Corporation) is one of the first and largest Chinese telecommunications equipment providers. As early as 1996, MNC A began its march on the road to globalization (Xinhua Daily Telegraph, 2007). In recent years, MNC A has attempted
to enhance its presence in Europe. 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 France Telecom Group in 2005 and British Telecommunications in 2006. MNC A has 16 global, wholly-owned R&D centers across North America, Europe and
Asia (Malik, 2009). The European R&D center in Kista, Sweden (hereafter, Unit A) was
established in 2002 and it focuses on applied research and product development in
3G mobile communication technology and long-term evolution (LTE). MNC A’s
decision to set up Unit A is proof of a strong technology-driven motive to receive
foreign technological support and to compete in 3G technology R&D. “It is not
enough to rely solely on the R&D forces in China to catch up with our competitors in
a short time, unless we have good technological support” (interview, Case A).
Sweden is a leader in telecommunication technology, from which MNC A can obtain
the advanced R&D human resources it needs. After several years of development,
Unit A has become a relatively mature R&D center, and it can handle the R&D
activities of core 3G technologies. The European market is also a driver for MNC A to
set up its R&D center in Europe. Close coordination with the marketing and sales
functions of MNC A is one of the obligations of the R&D center in Sweden. Managers
have to make detailed plans for product development and to communicate with
global operators to gain an in-depth understanding of the different demands of its
European operators. Alongside Unit A, there is an MNC A sales office covering the
marketing operations of eight to ten European countries. No matter how competitive
the bidding, or the technical solution of the products, the R&D center will offer its
support.
Unit A also undertakes another important mission. It carries out a global
telecommunication monitoring job, i.e. it monitors both the technology and the
technological standards of the telecommunication operators. Unit A monitors global
market trends and guides the MNC’s R&D strategies. “Although this R&D center is
located in Europe, we keep the whole world in view” (interview, Case A).
Both MNC B (JAC Motors) and MNC C (Chang’an Motors) are among the most

12 http://www.factiva.com/
renowned Chinese automotive companies. They maintain their traditional advantages in the commercial automobile market and have just started their R&D activities for passenger vehicles (including MPVs, SUVs and basic models). Their current export operations are mainly limited to developing regions such as Southeast Asia, South America, the Middle East, etc. Their main market is China, although they are already planning to expand their activities to other foreign markets such as Europe.

MNC B’s Italian Design Center (hereafter, Unit B) and MNC C’s European Design Center (hereafter, Unit C), both established in 2005 in Turin, Italy for automobile design, are the first international R&D centers of their companies. There are strong similarities in these two companies’ international R&D motives, because of their similar backgrounds. Approaching centers of excellence for automotive design and development and engaging in automotive R&D activities are the primary motives for both companies. They simultaneously chose Turin as the location of their R&D units and they both cited the presence of industry leaders in car design (such as Fiat, Bertone, Pininfarina etc.) as motives for their decision. Both companies seek to promote close cooperation with their local technological partners. Unit B is viewed as an ‘advance troop’, not only for design and style, but also for outsourcing knowledge, integrating resources and monitoring trends in the automobile industry. “We came here to have good front-line control and localization management. Accordingly, we can also develop close cooperation with our local partners” (interview, Case B).

During the interviews, both companies emphasized their desire for high-quality local R&D human resources. On the one hand, Unit B and Unit C are keen on utilizing abundant highly skilled local R&D specialists (automotive designers and engineers) for sophisticated R&D projects. On the other hand, they also emphasize their own R&D talent cultivation and reserve strategies. Take Case C for example. Unit C currently has approximately 20 Chinese employees (including designers and engineers) sent from headquarters, as well as 20 local designers and technicians working in its R&D center on a full-time basis. As the interviewee for Case C said: “In any case, the Italian designers are more skilled. We cooperate with the local companies and we invite their engineers and designers to work with us for our R&D projects” (interview, Case C).
MNC D (Hisense Group) is an emerging market leader in China's electronics industry and it is now one of the leading producers of LCD televisions, with a high market share in China. In 2005, MNC D successfully developed the digital visual media processing chip independently, which represents the first occasion when the core technology of a TV set made in China was not monopolized by foreign companies (Hisense, 2005, 2008). On September 19th, 2007, MNC D established the first LCD module production line on the Chinese mainland. It was the first time a Chinese company did not have to purchase an LCD module from foreign companies. MNC D obviously devoted time and effort to enhancing its independent innovation capabilities. As a domestic LCD-TV giant, MNC D is also setting up a globalization strategy. At present, MNC D owns TV production bases in Hungary, France and South Africa, and sales offices in the USA, Europe, Australia and Japan. In the past few years, MNC D has focused on the European and North American markets, which are viewed as the biggest LCD-TV markets. MNC D has set up R&D centers in both the USA and Europe. The R&D center we interviewed is MNC D's fifth global R&D center as well as its first European R&D center (Unit D, hereafter).  

Established in 2007 with 10-15 R&D employees in Eindhoven, Holland, Unit D mainly engages in the R&D of LCD televisions (styling, development and testing), set-top boxes and the technologies related to digital TV. The primary motive expressed by the interviewee is to utilize the local “mature” technology chain to produce localized TV products and to satisfy the demands of European customers. As the interviewee of Case D said, the development of new products that can satisfy European customers is based on a profound understanding of the local culture, the technological development level, and the consumption behavior. Setting up Unit D in one of the European hubs for electronics products gives Chinese engineers an excellent opportunity to interact closely with local customers. The general manager of the international marketing division of MNC D made a before-and-after comparison during an interview: “Previously, we had to send our prototypes to each of our European customers for confirmation. If any of the customers raised some specific issues regarding local user habits, we had to continuously communicate with

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13 MNC D has six R&D centers located in the Chinese cities of Qingdao (headquarters), Shenzhen, Shunde, the USA, and the city of Eindhoven (Netherlands).
them by e-mail. Now we can contact our customers face to face, which tremendously improves our work efficiency, and further enhances the quality of product configuration and product adaptation to the local market” (Qingdao Finance Daily, 2007).

Meanwhile, the interviewee also explained MNC D’s technological needs in Europe. Setting up a European R&D unit also significantly extends MNC D’s technology strategy towards Europe’s technological frontier, and allows for external help concerning core technologies. After evaluating the technical personnel sources, suppliers, investment costs, traffic conditions, geographical location, and language environment, MNC D finally chose Eindhoven as the location for its first European R&D center. Obviously, the setting up of Unit D was determined by the European market to a large extent. Meanwhile, Unit D is also eager to explore and appropriate new technologies, and it has established cooperation relationships with local companies that can supply specific core technologies. However, up to now technological learning has mainly been limited to peripheral R&D activities, given the existing technological gap and strong intellectual property (IP) protection (interview, Case D).

As early as 1996, MNC H (Hisun Group) started to use an electronic jacquard loom bought from a German textile machinery company manufacturing one of the world’s top three brands of electronic jacquard looms. However, the high prices of these looms are not sustainable for a Chinese company purchasing for the domestic market. A jacquard loom with 2,688 needles costs 40,000 euro and one with more than 100,000 needles costs 100,000 euro (Zhuang, 2008). In order to reduce the cost, MNC H dedicated its R&D activities to developing its own electronic jacquard loom by copying the sample machine bought from the German company. In 2004, MNC H successfully developed its own CCJB electronic jacquard loom, and by then it had filed for 5 state patents for the key technologies and parts created during product development (Zhuang, 2008). At the same time, the German company with the world’s top technology for jacquard machines was facing a financial crisis. With the deliberate intention of mastering the advanced technology of electronic jacquard looms, MNC H ultimately purchased the German company for $4.98 billion in 2005. The interviewee for Case H explained that although MNC H acquired the
assets of the German company, such as its product lines, the motive to buy weighed heavily on technology-related factors: (1) the second generation of electronic jacquard machines, and (2) world-leading R&D capabilities in jacquard machinery. Subsequently, MNC H increased the capital for its German subsidiary in 2006 and 2008, so that total investment has been over $11 billion (Zhoushan China, 2008). With the aim of utilizing the strong R&D capabilities on the German side and the cost advantage on the Chinese side, MNC H established a joint-R&D center with the acquired German company in 2006, focusing solely on the development of electronic jacquard machines.

Along with enhancing its capability in the technology, the Chinese parent company can strengthen its ability to produce components and parts for electronic jacquard machines domestically. Indeed, MNC H has closed its European product line and shifted its production base to a domestic economic development zone in Zhejiang Province, while its German company has been transformed into a technology center (Wang, 2009). The dual advantage of both technology and cost facilitates the marketing strategy of MNC H in the global arena.

4. Analysis of the Cases

In the following section we analyze the five cases of Chinese R&D investments in Europe according to the three aspects of R&D internationalization under study: technology exploration vs. technology exploitation motives; locational strategies; and the dynamics of motives and mandates of R&D units abroad.

4.1 Market-driven (Technology Exploitation) vs. Technology-driven (Technology Exploration)

As mentioned previously in our literature review, not only China but also the other emerging countries lack two main resources to compete with developed countries: lead user markets and technological innovation (von Zedtwitz and Gassmann, 2002; Wong, 1999). It is commonly said of MNCs from advanced Western countries that it is better to practice marketing in the host countries and technical innovation at home. This means international R&D activities from developed countries are mainly market-
or technology exploitation-oriented, which has been proved by many empirical studies (Håkanson and Nobel, 1993; Håkanson and Zander, 1988; Patel and Vega, 1999).

As for Chinese companies, external sources of knowledge are a major consideration (Deng, 2007; Hong and Sun, 2006; Zhao et al., 2004). Seeking resources, in particular natural resources, has been one of the main strategic considerations for China’s outward FDI since the very beginning. Parallel to resource-seeking investments, Chinese companies have been spurred to obtain access to advanced foreign technologies and managerial know-how with a view to establishing themselves in international markets. In this case, the main motive of Chinese R&D internationalization is technology-driven.

In the cases we studied there is a straightforward technology-driven motive in the decision to establish R&D centers in technology-intensive areas, though the R&D units are relatively small and the technology base camps mostly still remain at headquarters. Chinese companies are no longer satisfied with the functional orientation of overseas R&D units which are confined to technology monitoring or technology listening, but view them as active knowledge learners/absorbers. Case A was originally positioned to catch up with the competition in 3G mobile communication technology, while Cases B and C specialize in the domain of automotive design. Definite requirements for specific technologies force Chinese companies to set up R&D units in advanced countries where they can have close interactions with the leading local technology providers. Meanwhile, these R&D centers try to enhance their local embeddedness and to plug into local innovation systems. Case A is characterized by highly localized and qualified human resources, and it recruits worldwide R&D human resources, which even include the Chinese national director of Unit A. MNC A has already participated in local innovation activities and contributed new knowledge in Europe: between 2004 and 2009 it filed a total of 192 patent applications in Europe. Moreover, the acquisition of Case H was specifically aimed at the core technology of electronic jacquard looms. MNC H does not just have access to the pre-manufactured advanced jacquard machine, but also to the follow-up product research and development capability.
Finding 1: We find evidence of Chinese R&D investments in Europe driven by technology exploration.

The interviewees of Cases A, D and H all expressed a dual motive involving both technology and market expectations, though their cases come from different contexts. Case A is changing from a technology-latecomer to a technology-emulator in the global competition for 3G telecommunication technology. Enhancing technological capability increases the chances of serving European telecom operators and enables MNC A to provide high-end localized products that meet customer demand. As for Case D, the initial intentions were to support European production bases and develop localized products, although seeking technological backing from the upstream product-chain partners is regarded as an important motive as well. MNC H was in a similar situation as MNCs A, B and C in terms of technological backwardness before acquiring the German company. After the M&A, MNC H also obtained relevant market resources such as brand and distribution channels, while acquiring technical knowledge about electronic jacquard machines. Acquisition accelerates the process of local embeddedness. At present, Case H is mainly involved in integrating the R&D resources it obtained and exploiting the market share of the enterprise it bought.

Our cases suggest that Chinese companies have not only internationalized their operations to seek technological knowledge, but that many Chinese overseas R&D units are created for both market and technology determinants.

Finding 2: Chinese overseas R&D units in Europe may undertake tasks of technology-exploration and technology-exploitation simultaneously with a dual motive driven by market and technology.

4.2 Locational Strategy

Several studies have shown that MNCs from developed countries conduct overseas R&D activities in those technological fields where they have a strong technological home base (i.e. adopting a home-base-exploiting strategy and a home-base-augmenting strategy) (Almeida, 1996; Bas and Sierra, 2002; Kuemmerle,
In addition, MNCs with a relatively weak technological home base may also adopt a technology-seeking strategy in host countries with stronger technological capabilities, or adopt a market-seeking strategy in host countries where technological capabilities are also relatively weak (Bas and Sierra, 2002).

In other words, in host locations where technological capabilities lag behind those of the investing companies, MNCs will tend to undertake technology-exploitation and market-seeking-related activities rather than technology-augmentation.

In our study, Cases A, B, C, and H are all established in locations where there is absolute superiority in R&D capabilities in some specific technological field. These cases all fit into the technological-seeking motive in the initial stages of development. However, we have found that Case D adopts a strategy that cannot be positioned in any of the categories summarized by Bas and Sierra (2002).

MNC D possesses a competitive advantage in the domestic market. MNC D ranked No.1 in terms of market share in the domestic market for flat-panel TV sets in China for six successive years: 2004-2009 (Hisense, 2004, 2010). Although MNC D owns its LCD module and factory, it still has not mastered the core LCD technology owned by large MNCs such as Philips. MNC D set up its European technology center and integrated it with MNC D’s local production and distribution facilities to better serve the European market. In the process of localized product development, the European R&D unit receives strong support from its HQ, and at the same time turns to those local upstream suppliers with strong technical competence, such as NXP semiconductor and STMicroelectronics. Unit D cooperates with these famous companies to co-develop new TV products targeted at the European market, and buys core technologies/patents from them. At the same time, these companies provide technical support and professional engineers to help Unit D perform its R&D for the development of new products.

Kuemmerle argues that R&D units “generally originate from a base location in which product strategies are developed and core technologies are developed and updated” (1999: 3). He conceptualized the motives of FDI in R&D as home-base exploiting and home-base augmenting.

An MNC makes technology-seeking investments abroad with the purpose of “offsetting home country weaknesses in a given technological field by selecting a host country with proven strength” (Bas and Sierra, 2002: 592); while market-seeking investments are made in activities in which “it is relatively weak in its home country and the host country is also relatively weak” (Bas and Sierra, 2002: 594).
Finding 3: The Chinese companies possessing domestic competitive advantages in terms of technology capability may also be involved in technology-exploitation activities in Europe where the technology is relatively stronger, but they still need technological assistance from local partners.

4.3 Evolution of Motives for Chinese R&D Internationalization

A number of empirical studies have identified an evolutionary transition from technology exploitation to technology exploration (Ambos, 2005; Bas and Sierra, 2002; Cantwell et al., 2004; Florida, 1997; Ronstadt, 1978). The overseas R&D units of Chinese companies in Europe also reveal a different R&D internationalization pattern from that which the international business literature predicts. Our cases suggest that these units are moving from technology exploration to technology exploitation. Technology exploration is still the most important goal of the Chinese R&D subsidiaries in Europe, according to our evidence. However, along with the maturation of technology, these previously technology exploration-dominated Chinese R&D subsidiaries also tend to be involved in more R&D activities that combine technology-exploration with technology-exploitation.

As we observed, exploring technology-related knowledge and developing new products in Turin to serve the domestic market in China is the main task for Cases B and C in their first internationalization phase. At this moment, these two Chinese automotive companies are still struggling to compete with global automotive MNCs for a larger Chinese market share and neither company has begun to sell its products to the European market. However, entering the markets in developed countries is part of their future plans, even given the global economic downturn. Take Case C as an example. MNC C established a new factory in Mexico in 2009, which is its sixth overseas factory. The vice-president of MNC C recently depicted its future R&D plan during a media interview as follows: “According to our overall plan, our global R&D employees will increase to 5000 in 2014. We insist on utilizing global resource and exploiting the global market. In the future, our global R&D units will satisfy local customers rather than just develop and upgrade existing domestic products like we
are doing now. The mission of our global R&D units will gradually change.” (Netease, 2009)

The R&D internationalization process of MNC A also shows explicit evidence of the evolution from technology-seeking to home-base exploitation. MNC A uses an international market strategy that first enters developing-country markets and then expands to developed countries. MNC A entered the markets of South Asia and Africa from 1998-2001; it marched into India, Russia, and Brazil between 2002-2004 (ZTE, 1998, 2006). By contrast, its international R&D strategy shows a different trend. MNC A set up its R&D centers in the countries with the most advanced telecommunication technologies. It opened its first R&D institute in the USA in 1998 (ZTE, 1998), and another in Sweden at the beginning of the 21st century. Unit A has been dedicated to the exploration of the most advanced wireless technologies in Sweden ever since it was established seven years ago. At that time, Unit A was a pure technology-seeker due to its technological inability in China, which forced the company to seek opportunities for technological progress. Gradually, MNC A has caught up with the competition in 3G technology and built up a relatively strong home base, allowing Unit A to be a technology contributor, rather than simply a technology seeker, in Europe.

Along with its technological development and the growth of its market share at home and in other developing countries, MNC A is also gradually shifting its attention to the European market. Since 2005, MNC A has emerged as a 3G competitor in Europe by signing many cooperation agreements with important European telecommunication operators and companies such as France Telecom, Cabletel, and Telenor. In the meantime, Unit A is also adjusting its position, and it is now becoming not merely a technology explorer but an R&D center with a dual role (both technology explorer and technology exploiter) within the global R&D system of MNC A. Unit A helps MNC A grasp the opportunities to catch up and become competitive in the wireless technologies market and to take the lead in 3G technology R&D.

Differently from the newly-established R&D units, MNC H soon internalized the core technologies it needed through M&A. Even though the renowned brand and the worldwide sales network of the German company were part of the acquisition, the
primary intention of MNC H was to have its technology-related resources. That goal is still being pursued, along with the process of integrating the acquired German company’s technological knowledge into MNC H's knowledge network. As the interviewee of Case H said: “The German company had previously expanded into several markets such as Europe and South America. Particularly, 70% of the market share in Turkey was occupied by the German company. After the acquisition, our company stepped into the global market and followed up on the occupied market share. We mainly consolidate and exploit our existing markets including Germany and other European countries by producing machinery components and parts in China, and by cost reduction” (interview, Case H).

In the light of Cases A, B, C and H, we find Chinese companies seem to prefer to catch up on technological aspects and consolidate and enlarge their market share in China first, and then expand into the international market. The process appears to involve companies first seeking and exploring technologies abroad. Next, they transfer these back and fuse them with domestic R&D activities to enhance their R&D capabilities in China. Finally, the new capabilities and technologies are exploited in development of products for global markets, and may also be transferred out to foreign locations.

Finding 4: The motives of Chinese R&D internationalization commonly evolve from pure technology-seeking to (a) home-base augmenting and then (b) home-base exploiting.

Another evolutionary strategy identified is that related to human-resources. Motive moves from seeking external technological assistance to cultivating high-quality, Chinese domestic R&D human resources. As for the technology exploration-dominated R&D units, recruiting qualified local R&D personnel according to a firm's need is important for new knowledge (Kuemmerle, 1999). Moreover, the cost of the R&D human resource is also an important location determinant for overseas R&D activities (Kumar, 2001). In many studies, Chinese low-cost and technologically well-trained human resources are the main reason why MNCs from developed countries relocate their R&D activities to China (von Zedtwitz, 2004; Wu and Callahan, 2005).

However, some scholars point out that while China has a large stock of human
resources for science and technology, the efficiency of the R&D-related workforce lags far behind that of advanced countries (OECD, 2008). Chinese designers and engineers are criticized for their lack of originality or creativity because “the Chinese education system and culture don't encourage individualistic expression and creativity” (Von Zedtwitz, 2006). This deficiency forces Chinese companies to turn to external high-quality, but expensive, knowledge-based human resources in the host country (Von Zedtwitz, 2006). This argument is supported to some extent by Chen and Tong (2003), who provide evidence that “recruiting highly skilled personnel and absorbing new knowledge” are two of the major motives that provoke Chinese MNCs to engage in overseas R&D activities.

In the cases we studied, the recruitment of highly-skilled researchers and engineers from the local environment was emphasized by the interviewees. In their opinion, using local human resources with advanced technological knowledge is the most effective way for the R&D units to access the local knowledge environment. As for MNCs B and C, the key factors of success are highly skilled and creative designers and engineers. Both companies clearly recognize their disadvantages and tap into European automotive R&D human resource networks through their overseas R&D units. As an ex-designer who worked for a long time in foreign design companies, the interviewee for Case C has his own human resource network. “We can even organize a project team with hundreds of employees by outsourcing automotive designers and engineers from various local small and medium-sized enterprises (SMEs) and other channels, which is very flexible” (interview, Case C). The local R&D human resource thus plays a pivotal role for Chinese overseas units so that they can accomplish increasingly sophisticated R&D projects.

Chinese engineers and designers are offered an excellent opportunity to learn through cooperation with foreign technology leaders since R&D internationalization is also regarded as “a tool to improve the technical learning capability of the firm” (De Meyer, 1993:119). Chinese companies can have the opportunity to “learn from cooperation” or “teach through cooperation” with local specialists in order to cultivate their own high-end but low-cost R&D talents. Due to the technological inadequacy of passenger vehicle R&D, Unit B makes use of the cooperation form of contracting-out. “In order to teach our R&D employees, we send them to the
cooperative companies to learn automotive development processes” (interview, Case B). The interviewee for Case C also indicated that “We employ the local designers to work together with our Chinese designers as a team, and level up the skills of our own designers during the cooperative R&D projects. Our biggest achievement with a project is cultivating our own R&D talents” (interview, Case C).

Finding 5: Specialized human resources in Europe drive Chinese companies to set up overseas R&D units not only to get external technological assistance but also to cultivate the development of high-quality Chinese human resources.

5. Conclusion

International R&D from emerging countries is a new phenomenon and it has not yet attracted much attention from scholars. As the modes of a growing domestic market change, and as home-base technology competences evolve, we bring forward new evidence of the important, unique, and dynamic role of R&D units abroad. The international business literature can only partially explain this evidence. Our findings suggest a new model of R&D internationalization, which deviates from the typical trajectory followed by MNCs from developed countries (see Table 3-1).
### Table 3-1 A comparison of international R&D strategies between Chinese MNCs and developed country MNCs

<table>
<thead>
<tr>
<th>Debates</th>
<th>The international R&amp;D strategies used by MNCs from developed countries</th>
<th>The international R&amp;D strategies used by Chinese MNCs in Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. The debate between technology exploration and technology exploitation</strong></td>
<td>Technology-exploitation-dominated strategy: MNCs mainly exploit existing firm-specific technical capacity in foreign environments in order to adapt products, processes and materials to foreign market and provide technical support to off-shore manufacturing plants (Håkanson and Zander, 1988; Håkanson and Nobel, 1993; Patel and Vega, 1999)</td>
<td>(1) Technology exploration-dominated strategy: Evidence from case A, case B, case C, and case H</td>
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<tr>
<td></td>
<td>(2) A strategy driven by both technology-exploration and technology-exploitation motives: Evidence from case A, case D, and case H</td>
<td>(2) A strategy driven by both technology-exploration and technology-exploitation motives: Evidence from case A, case D, and case H</td>
</tr>
<tr>
<td><strong>2. The locational strategies</strong></td>
<td>Four types of strategy (learning): Almeida, 1996; Bas and Sierra, 2002; Kuemmerle, 1997, 1999; Patel and Vega, 1999:</td>
<td>(3) A technology-exploitation strategy (market-orientation) in host countries where technological capabilities are stronger than those in home country: Evidence from case D</td>
</tr>
<tr>
<td>Technology orientation</td>
<td>(1) Technological-seeking FDI in R&amp;D: MNCs with a relatively weak technological capability invest in host countries where technological capability is relatively strong</td>
<td></td>
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<td></td>
<td>(2) Home-based-augmenting (HBA) FDI in R&amp;D: MNCs with a relatively strong technological capability invest in host countries where technological capability is also relatively strong</td>
<td></td>
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<tr>
<td>Market orientation</td>
<td>(3) Home-based-exploiting (HBE) FDI in R&amp;D: MNCs with a relatively strong technological capability invest in host countries where technological capability is relatively weak.</td>
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<td></td>
<td>(4) Market-seeking FDI in R&amp;D: MNCs with a relatively weak technological capability invest in host countries where technological capability is also relatively weak.</td>
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<td><strong>3. The evolutionary strategies</strong></td>
<td>An evolutionary strategy: the R&amp;D motive transits from technology exploitation to technology exploration: A shift from technology-exploitation motives to technology-exploration motives (Almeida, 1996; Bas and Sierra, 2002; Florida, 1997; Ronstadt, 1978; Cantwell et al., 2004, Ambos, 2005).</td>
<td>(4) An evolutionary strategy: the R&amp;D motive transits from technology-seeking to (a) home-based-augmenting and to (b) home-based-exploitation: Evidence from case A, case B, case C and case H</td>
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<tr>
<td>A low-cost strategy of R&amp;D human resource:</td>
<td>Low cost manpower is one of the major determinants of location of overseas R&amp;D activities (Kumar, 2001). Obtaining technological well-trained but low-cost human resource is one of the major reasons for foreign MNCs to set up R&amp;D facilities in China (von Zedtwitz, 2004; Wu and Callahan, 2005).</td>
<td>(5) An evolutionary strategy of R&amp;D human resource: the motive transits from seeking external technological assistance (high-quality and high-cost) to cultivating Chinese domestic high quality R&amp;D human resource (high-quality but low-cost): Evidence from case B and case C</td>
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</table>
Where the theoretical implications of our study are concerned, there is a body of literature investigating FDI in R&D from developed countries. From a different perspective, we observe the phenomenon of R&D internationalization from emerging countries to developed countries, and in particular we focus on the motives of Chinese FDI in R&D in Europe. Our multi-case study shows that technology exploration is still the most important motive driving Chinese companies to expand their R&D activities into developed countries. Chinese companies take the initiative to go overseas and learn from their stronger counterparts in developed countries. Overseas Chinese R&D units emphasize their role as knowledge-seekers and learners/absorbers for new and relevant technology. Along with technological competence upgrading, Chinese R&D units gradually fit into the local innovation system and act as knowledge contributors/creators. For Chinese companies with a relatively strong technological home-base and for the ones catching up through technological learning, entering the markets of developed countries may be a secondary yet important motive for overseas R&D expansion to advanced countries. Indeed, our cases support this finding because Chinese R&D units in Europe also engage in technology-exploitation activities and participate in local market competition. From all this, we propose a maturation process for Chinese R&D internationalization, whose motive evolves from pure technology-seeking to home-base exploration and finally to home-base exploitation. This evolution is the opposite to the common path described in studies on FDI in R&D from developed countries.

With respect to the implications of our study for practice, Chinese companies are regarded as potential global R&D players through their R&D internationalization. This study opens a window for both scholars and managers to observe this overlooked phenomenon and explores the reasons that spur Chinese companies to engage in R&D-related activities in advanced regions such as Europe. Our evidence shows that technology-seeking is no longer the only reason why Chinese companies expand their R&D to Europe, although utilizing local technology resources is still the most important motive. Chinese overseas R&D units no longer remain outside the
European innovation system as mere technology monitoring centers. They now have the potential to be active participants in R&D projects that create new knowledge and exploit local markets. Chinese companies have made their first move in Europe for advanced knowledge sourcing. It is important for European technological participants to get ready to respond to Chinese technological newcomers, and seek more cooperation opportunities based on reciprocity and mutual benefit.

Finally, concerning policy implications, responding to recommendations by both national and regional governments has been recognized as a driving factor for R&D localization. Some of the Chinese interviewees indicated that support from the Chinese government and preferential policies for international R&D is an external impetus, but maintained that political factors play a secondary role in their decisions on R&D expansion. At present, Chinese outward FDI mostly flows to developing countries such as those in Asia and Latin America (OECD, 2008). Chinese policy makers give strategic suggestions to Chinese companies on the advantages of different countries or regions, and encourage Chinese companies to invest in these destinations with intensive technological resources for independent intellectual property rights.

Moreover, we also noted that the Chinese interviewees seldom mentioned the support and incentives they receive from local European governments. Such indifference may signal a parallel lack of interest and awareness on behalf of European policy makers. We believe that the lack of a strategy for dealing with and responding to Chinese R&D investment in Europe and its evolution is undesirable, and potentially harmful for the EU’s own innovation system.
CHAPTER 4: An Exploratory Study on International R&D Strategies of Chinese Companies in Europe

Summary

We here present a study that arms the reader with various discussion points on the R&D FDI strategies of Chinese Multinationals in Europe. The relevance of the topic is self-explanatory, if we consider that for the first time, an emerging economy has been heavily investing in R&D beyond its borders. Through archival research and interviews we adopted a multi-case study approach to investigate how significant are these investments and how relevant do they become for the local innovation systems.

Our analysis shows that the establishment of R&D centers, and more importantly the evolution of these centers, does not coincide with what international business theories would have predicted. The Chinese MNCs considered entered Europe in a variety of forms, guided by various learning goals. However, we found evidence of the growing tendency of these companies to insulate themselves from local partners and to engage in less explorative and more exploitative R&D activity, adapting technologies developed elsewhere for the European market, gaining access to good indigenous labor and technologies rather than to local partnerships.

This finding is rich of policy implication and leaves our readers thinking what are the opportunities that this presence is creating in Europe.

Keywords: China, R&D internationalization, double network, Europe

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16 This chapter is co-authored with Alberto Di Minin, forthcoming in the Review of Policy Research (RPR) journal.
1. Overview

Little is known about R&D FDI strategies of Chinese Multinationals in Europe. How significant are these investments? How have these companies entered Europe? How relevant do they become for the local innovation system? This topic undeniably has significant policy implication.

In this chapter, we argue that Chinese R&D presence in Europe is variegated and is growing that most of all is changing its strategic modes of learning and engagement with local business, in ways that traditional R&D FDI maturation models would have not predicted. The case of Chinese R&D investment in Europe allows us to look at a phenomenon relatively unexplored by mainstream international business literature, but with significant policy implications, such as the expansion of innovation activities by multinationals headquartered in emerging Asian countries.

As the technological capabilities and the rise of the domestic markets for these companies increase dramatically, these companies will necessarily change their strategies abroad. Do Chinese MNCs respond to different incentives? Do they follow different customs and routines than what western "business as usual" would predict? This chapter aims to answer these questions in an explorative way. It should come to no surprise for the counterintuitive findings of this chapter.

The rest of this chapter is organized as follows. Section 2 introduces the most relevant threads of the literature on international business and knowledge management, which contribute to define our theoretical framework. Section 3 briefly comments on Chinese presence in Europe. Section 4 positions and describes our cases in the theoretical framework previously discussed. We then interpret the "dynamic" elements of our findings in Section 5, where we identify emerging strategies of Chinese R&D presence in Europe. Section 6 concludes with policy implications and directions for future research.
2. Literature Review and Theoretical Framework

2.1 R&D Internationalization: The Orchestration of Global Networks of Knowledge

Today we see decentralized R&D units not only as knowledge transfer units, but also as knowledge creation centers in a fully integrated network. Many empirical studies suggest that MNCs have switched from centralized hub organization to a more decentralized federation of units and integrated networks (Håkanson, 1990) for the purpose of facilitating not only traditional ‘forward’ knowledge transfer, but also reverse and lateral knowledge transfer. Indeed, ever since resource-based and knowledge-based views of the firm have emerged, it has been difficult to treat knowledge transfer as solely “a one-way movement of methods from headquarters to foreign subsidiaries” (Li, 2004: 8). Furthermore, the presence of technological enablers and the ever-increasing pressure to adjust to the demands of the market have triggered this transformation and are changing the roles of subsidiaries in MNC organizations (Zanfei, 2000).

O’Donnell emphasized that “important resources and knowledge upon which the firm’s competitive advantage hinges exist at the subsidiary level” (2000: 530), and that effective resources are transferred from a subsidiary to other international locations. A lateral network of intra-subunit links with a high degree of interdependence is required. It is not, however, sufficient to focus on 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 use their international network to sense, mobilize and operationalize resources and opportunities located outside the boundaries of MNCs. Scholars and managers cannot therefore neglect interaction between internal and external networks. Independence from headquarters is only one of the features to consider for the new
R&D model of MNCs. This idea has been further discussed and theoretically developed into a more systematic “open innovation” paradigm (Chesbrough, 2003). In this paradigm, companies rely more and more on R&D, which originates from the integration of inventive activities taking place in other companies and other distant geographies. MNCs are no longer closed organizations but can utilize internal and external talent and innovative ideas, as well as intelligence properties.

However, the process of decentralization is only a one-sided debate on R&D globalization. Ghemawat’s (2003) business model of semi-globalization thoroughly explained the complexity of this research field on international convergence/integration. In particular, referring both to Patel and Pavitt (1991) and to more recent work by Macher et al., (2007), Dunning and Lundan, (2009) and Cohen et al., (2009), these studies lead this debate into the field of R&D internationalization, which is the object of this chapter. In sections 5 and 6 we place our findings in the context of the business and policy literature that has looked and is still investigating this phenomenon. To achieve this, we next present a theoretical framework.

2.2 Theoretical Framework

In order to understand the phenomenon of Chinese outward FDI in R&D, we present a framework with which to view Chinese R&D investments in Europe. We consider it particularly useful to use the “double network” framework. Zanfei (2000) defines double network organization as a multinational organization, including both an “internal network” (i.e. headquarter and subsidiaries) and an “external network” (i.e. local partners, suppliers, customers etc.). Within the double-network organization framework, we intend to investigate the new phenomenon of Chinese R&D internationalization from two perspectives: (1) the motive for their presence (exploration vs. exploitation) (2) the mode of their presence (experiential learning vs. cooperative learning).
2.3 Motive of R&D Internationalization: Exploration vs. Exploitation

In a decentralized and more open MNC structure, the organization has plenty of opportunities to learn and change through interaction with a variety of networks (Håkanson, 1990; Kuemmerle, 1999; Zanfei, 2000). This is increasingly seen as one of the main motives 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 implement innovations. There are two main motives for R&D decentralization according to Kuemmerle (1999, 1997) and Belderbos (2003). They are: (1) technology exploitation: exploitation of a firm's technologies overseas by adapting technologies to local circumstances in order to access foreign markets and (2) technology exploration: exploration of a firm's technologies through access to overseas technology and know-how. Exploration and exploitation can be seen as two different processes in organizational learning (March, 1991). 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" (Holmqvist, 2004).

2.4 Modes of R&D Internationalization: Experiential Learning and Cooperative Learning

The dynamics of exploitation and exploration have also been investigated both intra-organizationally and inter-organizationally (Crossan, 1999; Hitt et al., 2005; Holmqvist, 2004; Larsson, 1998). When applying the double network theory to MNCs, technological learning can take place through various channels. MNCs can not only leverage the existing knowledge stock in the internal knowledge network, but also interact with a variety of external knowledge actors through cooperation. R&D units no longer absorb knowledge passively, but take the initiative to tap into external...
knowledge networks and ‘increase the potential for use and generation of knowledge’ (Zanfei, 2000) of local firms and institutions in the same area. Holmqvist (2004) and Hitt et al. (2005) therefore summarized two dichotomous dimensions of technological learning processes, cooperative learning and experiential learning in organizational networks. Cooperative learning means creating new knowledge largely or wholly unrelated to the current knowledge stock or enriching current knowledge through knowledge transfer by cooperating with partners. MNCs can tap into external knowledge bases through cooperation with a variety of external partners. By contrast, experiential learning emphasizes self-knowledge stock leveraging in the internal knowledge network as well as self-experience accumulation during the ‘learning by doing’ process (Hitt et al., 2005).

2.5 The Learning Model 2x2 Matrix

If we combine the motive/learning process (exploitation and exploration) and learning channel (cooperative and experimental) dimensions, we obtain four different types of learning patterns (Hitt et al., 2005) (see figure 4-1).

**Figure 4-1 Four patterns of international organizational learning**

<table>
<thead>
<tr>
<th>Motive/ Learning process</th>
<th>Technology Exploration</th>
<th>Cooperative-exploratory learning</th>
<th>Experiential-exploratory learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Exploitation</td>
<td></td>
<td>Cooperative-exploitative learning</td>
<td>Experiential-exploitative learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooperative Learning</td>
<td>Experiential Learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Learning channel</td>
</tr>
</tbody>
</table>

In the double-network organization context (Zanfei, 2000), dispersed R&D units play a learning role both in the external and internal network. In the external network, R&D units can learn through tapping into the local knowledge pool through cooperation and 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 international learning modes we identify four different roles that R&D
subsidiaries play in the double-network framework.

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

R&D Subsidiaries as “remote centers of excellence” (experiential-exploratory learning): in this case, subsidiaries have already learned or acquired the most relevant local resources of technology and the new mission is to generate new technology-related knowledge.

R&D Subsidiaries as “market gatekeepers” (cooperative-exploitative learning): the foreign subsidiary has to adapt knowledge for a distant market. However, owing to the insufficiency of technological capability, close interaction and cooperative development with technological partners and key customers is necessary.

R&D Subsidiaries as “market colonizers” (experiential-exploitative learning): The adaptation of production for remote markets remains the subsidiary’s main mission. The most relevant knowledge resources have been internalized and integrated in the MNC. Rather than interaction with core technological suppliers or key customers, headquarters require the subsidiary to directly experience and learn from the new market, codifying and transferring new knowledge necessary for market access.

Before we use this theoretical framework in the context of Europe, we first briefly observe the phenomenon of Chinese FDI and R&D in Europe, as stated in the next section (Section 2).

3. Chinese R&D Presence in Europe

Europe is one of the most popular destinations for China’s overseas R&D investments as evidenced by the large number of Chinese MNCs here present\(^\text{17}\). The reasons are

\(^{17}\) According to the report on Chinese FDI in R&D by fDi markets (http://www.fdimarkets.com/) and von Zedtwitz (2005), Europe is the most popular destination for Chinese R&D investments. Von Zedtwitz (2005) shows us a sample with 37 Chinese R&D units abroad, where 26 units are located in advanced countries. Moreover, 11 R&D units are located in Europe, along with 11 in the U.S. According to the report on Chinese FDI in R&D by fdi markets, a total of 31 R&D investment projects
twofold. On one side, Chinese outward FDI is now undergoing a shift from nature-resource seeking to strategic asset & market seeking to build competitive advantages (Burghart and Rossi, 2009; Deng, 2007; Wang, 2002). In order to access new capabilities and resources, Chinese companies recently disclosed a preference to invest in industrialized countries/economies and tap into industry hot hubs. This phenomenon is considered a new characteristic of China’s outward FDI. On the other side, Europe is not only a global innovation center with a superior investment environment, high technology and advanced management methods, but also an attractive consumer market. Chinese companies set up subsidiaries in European logistics & service centers such as the U.K. and Italy and use them as springboards to western markets (Burghart and Rossi, 2009; Rabellotti and Sanfilippo, 2008).

We identified an original database of 32 R&D units established by Chinese companies in Europe. According to this database, Germany and Northern Europe (Sweden and Denmark) are the favorite destinations where respectively 9 and 6 R&D units have been set up. Moreover, our database indicates Chinese companies’ preferences for specific locations with a variety of regional advantages (e.g., the machine tool industry in Germany, the telecommunications industry in Sweden and the automotive industry in Italy).

However, we feel that this "macro" description of Chinese R&D internationalization in Europe is rather incomplete since there is no existing data that precisely demonstrates the scale of R&D related investments by Chinese companies. Chinese FDI in R&D is a new and growing phenomenon. We believe monitoring and updating the growing list is still important, but we need to go beyond the numbers and explore what these companies are actually doing by way of inductive case studies.

### 4. A Representation of Chinese R&D in Europe

We finally populate the 9 cases in table 2.4 into the 2x2 matrix according to the
evidence gathered from interviews, questionnaires and various secondary sources (see figure 4-2).

**Figure 4-2 Case classification of international organizational learning**

<table>
<thead>
<tr>
<th>Motive</th>
<th>Observation outposts</th>
<th>Remote centers of excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Exploration</td>
<td>Case A, Case B</td>
<td>Case G, Case H</td>
</tr>
<tr>
<td></td>
<td>Case C, Case E</td>
<td></td>
</tr>
<tr>
<td>Technology Exploitation</td>
<td>Case D, Case I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Market gatekeepers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case F, Case I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Market colonizers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooperative Learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Experiential Learning</td>
<td></td>
</tr>
<tr>
<td>Learning channel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Our elaboration of interviews and questionnaires

4.1 Quadrant 1: “Observation Outposts” (Cooperative-Exploratory Learning)

Cases A, B, C, and E belong to this quadrant, which is the most popular learning mode for Chinese R&D units in Europe.

Concerning learning motives/processes, cases A, B, C and E all disclose strong motive for technology seeking. With the purpose of catching up and competing in 3G R&D, and since its establishment 6 years ago, case A is dedicated to the exploration of the most advanced wireless technology in Sweden, an important telecommunications power in the world with numerous leading telecom equipment companies such as Nokia and Ericsson.

Similarly, we observed that cases B and C are neither serving the local European market countries nor exploiting technologies transferred from HQ. These two Chinese automotive companies established their first overseas automotive design centers abroad because Turin is one of the most famous design centers in this industry with numerous qualified engineers and designers. Similarly, Case B expresses strong motive to approach the centers of technological excellence and
develop new technologies. The case C interviewee explained, “Turin is a world class design center, where the surroundings, infrastructure and supporting facilities are satisfactory. For example, there are a lot of local modeling companies that can be utilized to build car models (interview, case C)”. The same motive is also expressed by case B. Both cases referred to highly 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 their projects as well as to train their own designers and engineers. As the case B interviewee said, “The biggest achievement for us is the training of our own R&D talent (interview, case B).”

Case E’s sole motive for internationalizing was exploring diesel engine technology. “Before the foundation of this R&D center, our company had established a long and close cooperative relationship with European companies, especially parts & components manufacturers. We always have 3-4 projects running at the same time. Meanwhile, many of our R&D employees are working in Europe with local companies. We established this European R&D center in order to run all the projects smoothly (interview, case E)”.

Concerning learning channels, cases A, B, C and E all closely interact and cooperate with their local partners since cooperation with local partners owning resources (knowledge & human resources) is the best way to overcome their deficiencies. Cooperative learning with external technology networks makes up a large proportion of technological learning compared to knowledge acquisition from HQs and self-experiencing.

Due to strong technology-driven motives, case A mainly seeks technological help from local private R&D institutions/companies that are usually recommended by consulting firms. After several years of development, case A has become a relatively mature R&D center involved in R&D of core 3G technologies. The explanation given in the interview was the following “we master core technologies through cooperation with local technological expert and sequentially complete R&D projects through cooperation with the HQ R&D team (interview, case A)”. Thus, case A pays much attention to localized human resource recruitment and has achieved a high degree of
foreign embeddedness.
Cases B and C particularly illustrate cooperative learning. Car design is a very creative job and high-skilled designers and engineers are a key success factor. They have established multiple cooperative links with local partners such as Pininfarina and IDEA. In order to obtain independent intellectual property rights, case C from the start participates in joint-R&D projects with partners already at an advanced stage of technology development. For example, case C cooperates with the local company IDEA and employs several engineers and designers to work together on a project. “In the cooperative project, for example, we take designers from IDEA as the main labor force and our designers participate in the project. Because we control the project’s expenses and the wages of foreign designers, we have the right to ask foreign designers to train our designers in the project process. The best way is to pair up foreign designers with our designers and every month the foreign designer grades our designer”.18

Furthermore, case E is a project-concentrated R&D center for external technological cooperation. Originally, the case E parent company established a strategic alliance with AVL, famous for the development of power train systems with internal combustion engines and a world-class company. With the increase of cooperative partners and the improvement of technical capabilities, case E gradually became an independent R&D center with a flexible team structure. The average 30-40 R&D employees are all dispatched from HQ and keep transferring according to project requirements. Although too-frequent personnel transfer leads to unstable personnel management problems, this project-based cooperative mode achieves the goal of training and cultivating high quality Chinese R&D employees19. “At present, this R&D center takes R&D projects as the central task and employees vary with the changing projects. This arrangement has achieved our purpose of R&D professional cultivation”.

19 Case E’s next step is to implement the practice of managerial personnel immobilization.
These cases demonstrate strong technology-driven motive to obtain overseas technological support. Chinese 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 links and the extent of their involvement in cooperation has increased. Moreover, integrating with local knowledge networks provides these Chinese companies with unique learning opportunities and allows them to cultivate their own high-quality R&D professionals.

4.2 Quadrant 2: “Remote Centers of Excellence” (Experiential-Exploratory Learning)

Cases G and H belong to this quadrant and can be viewed as remote centers of excellence. Both were established through merger and acquisition (M&A) and focus on specific product R&D (case G focuses on large gantry machining centers and case H on electronic jacquard machines). They both retained their preexisting R&D branches, regular and patented technologies after their acquisitions of local firms. Due to the prior knowledge stock, cases G and H have relatively high technology levels compared to their new Chinese headquarters. Large technological gaps exist between these acquired R&D units and their parent companies. Internalizing these remote centers of excellence means Chinese companies have a greater chance of absorbing and learning core technologies that they cannot obtain externally. The case G interviewee emphasized, “This German company we bought is among the best in the world in terms of its technology of large gantry machining centers. Our primary consideration in taking over this company was to acquire core technologies/know-how (interview, case G)”. The Case H interviewee also expressed similar technology-driven motives: “Two reasons weighed heavily in our acquisition. The first reason is the new generation of the jacquard machine developed by this company and the second is its world-leading R&D capabilities (interview, case H).” By comparison, the desire for a European market is not as strong as the technological
ambitions of these Chinese companies. The parent companies of cases G and H still concentrate on domestic market expansion, though their acquisitions in Europe also include product lines, brands and distribution channels. During the current economic crisis, case H’s previous product lines have been closed down and the production base has shifted to China\textsuperscript{20}.

Following the acquisitions, cases G and H became an inseparable part of the knowledge stock of their Chinese companies. Their parent companies do not have to learn through cooperation with external knowledge networks but utilize the available knowledge resources in their European centers of excellence. Both cases G and H retained most of their previous staff members in order to maintain a high degree of local embeddedness. Continuous short-term professional transfers from headquarters to remote R&D units enable better technological learning through the internal knowledge network. As the Case H interviewee said, “Learning is the main purpose of implementing periodical engineer transfers from our HQ. Chinese engineers learn product concept development from the German side, but do not really participate in R&D activities owing to the weak technological foundation of our HQ (interview, case H)”. With regard to cases G and H, technological upgrading of their Chinese parent companies is largely due to ‘learning by doing’ in the form of joint R&D projects in which both Chinese engineers from HQ and European specialists from the European R&D units get involved. The European R&D units mostly dispatch their selected R&D teams back to HQ according to specific technological requirements. These project-based R&D teams take charge of delivery of technical specialists from R&D units to HQ and skill training of Chinese engineers, as well as assisting in project planning and decision-making. Contrary to the ‘observation outposts’, cases G and H already embody a set of capabilities that their parent companies do not possess. They are mainly involved in R&D of new technologies/products, while the headquarters in China take responsibility for applying new technologies and commercializing new products. Advanced

technologies are transferred back from the centers of excellence to headquarters and further disseminated through internal knowledge networks.

In sum, in the acquisition of European companies, cases G and H seized key strategic assets including technologies, patents, human resources and managerial skills. This was a highly strategic and successful move, since the parent companies of cases G and H needed these assets to build up competitive advantages. Both companies retained and further enhanced the R&D departments of their acquired companies. Cases G and H have become centers of excellence whose R&D capabilities are leveraged by their parent companies and disseminated to other parts of the internal knowledge networks (Frost et al., 2002).

4.3 Quadrant 3: “Market Gatekeepers” (Cooperative-Exploitative Learning)

Cases D, F and I belong to this quadrant and can be viewed as market gatekeepers. Their parent companies possess a certain degree of R&D capacity and have seized a share of the European market.

Case D's parent company has emerged as market leader in air-conditioners, computers, mobile phones, LCD televisions, etc. in China's electronics industry. At present, this Chinese company owns TV production bases in Hungary, France and South Africa, and has sales offices in the U.S., Europe, Australia and Japan. In the last few years, the company has begun monitoring the European and North American markets, viewed as the biggest LCD TV market. The establishment of case D entailed strong market-driven motives. “If you hope to develop products that can satisfy European customers, you have to establish the situation of the local market, technological development and consumer consumption and habits (interview, case D)”. After evaluating technical personnel sources, suppliers, investment costs, traffic conditions, geographical location and language environment, Eindhoven was chosen as case D’s location.

Case F’s parent company is a major supplier to several international firms, such as
Siemens and GNNetcom\textsuperscript{21}. 60\% of their handset receiver products are exported to Asia, Europe and America. Close interaction and cooperation with key European customers is important in order to indentify the newest market demands and to seek potential product development projects. The parent company has consequently decided to set up a subsidiary in Denmark, and the reasons are clarified in the board meeting notes as “integrating with the global market, opening more markets abroad and striving to become the world’s primary supplier.” Moreover, a variety of MNCs belonging to the same industry set up R&D bases in Denmark, which facilitates communications with them as well as expanding the customer base.

However, due to the technological advantages existing in Europe learning from local technological partners is still necessary for Cases D and F. It thus requires them to set up cooperation relationships with local technological partners who can provide specific core technologies. As the case F interviewee said, “Denmark is an electro-acoustic kingdom. We come here for better R&D projects since it is a large market with strong technological capability. Our engineers are able to learn from local R&D professionals through cooperation (interview, case F)”.

Case I was established through an M&A. Following the acquisition of case I\textsuperscript{22}, the Chinese parent company has not only reached a higher technological level, but has also been able to offer high-end brands to the European motorcycle market\textsuperscript{23}. This is exactly what they hoped to achieve in planning the acquisition. Meanwhile, their domestic R&D counterparts are mainly focused on China’s market. The case I interview provides some evidence: “Our European center is responsible for high-end motorcycle research and development, and mainly cooperates and communicates with local suppliers; Conversely, R&D of low-end scooters primarily depends on cooperation with the domestic R&D department (interview, case I).”


\textsuperscript{22} The acquired company, Benelli, was previously a famous Italian motorcycle maker.

\textsuperscript{23} Before the acquisition of case I, the Chinese motorcycle company created two motor brands aimed at European low-end and mid-range markets in 2002 and 2004 respectively. After the acquisition, the Chinese company successfully implemented an international brand strategy from low-end brands to mid-range and high-end brands in the mainstream European motorcycle market.
Cases D, F and I choose their local partners according to their various technological requirements, especially for those projects that are difficult for their parent companies to accomplish. The current knowledge stock, in particular the mastery of core technology that resides in the internal network has not sufficed for complete independent development of new products for high-end market such as Europe. Especially for these small-scale dispersed Chinese R&D units established through the greenfield investment mode, accomplishing an R&D project relies heavily on external technological bases, in particular the support from core component suppliers and private research institutes/companies providing R&D services. Case D is a representative case engaged in R&D subsidiary-supplier teamwork of joint R&D projects: “At the moment we don’t own the independent capabilities to develop chips for the European market. We have to rely on professional companies like NXP ST to provide us with mature chip solutions. The foreign specialists sent by suppliers are fully involved in the whole project. They provide us with technical support and assist us with relevant software development and debugging (interview, case D)”.

In sum, the parent companies of cases D, F, and I have successfully applied their technological know-how to the needs of the Chinese domestic market since they have already attained a certain degree of independent R&D capabilities. Expansion into the European market has become an integral part of their internationalization strategy. However, lacking both international market experience and high-end/core technologies becomes a stumbling block for Chinese companies to compete with global rivals in the European market. Their competitive disadvantages force them to establish R&D branches in Europe, and in some cases to acquire existing companies. Besides close interaction with local customers, these “market gatekeepers” also have to seek help from technological suppliers.

4.4 Quadrant 4: “Market Colonizers” (Experiential-Exploitative Learning)

We haven’t identified any market colonizers from our European cases. There are two
basic requirements for R&D units to fit into this quadrant: (1) internalization of the most relevant technological knowledge; (2) internalization of the most relevant market knowledge. Chinese MNCs in Europe are still pursuing both knowledge resources and international experience as part of their overseas learning. In the next section, we argue that moving to this quadrant is currently an explicit strategy of some of the companies we interviewed.

5. Strategic Maturation of Chinese R&D Units in Europe

5.1 Motive: from Technology Exploration to Technology Exploitation

A body of literature suggests that the most common direction for maturing R&D internationalization is from home-base exploiting (HBE) to home-base augmenting (HBA) (Almeida, 1996; Asakawa, 2001; Bas and Sierra, 2002; Florida, 1997; Lehrer and Asakawa, 2002; Ronstadt, 1978). As Asakawa (2001), Lehrer and Asakawa, (2002) concluded, there is a ‘classic evolution path’ for R&D internationalization. First, the overseas R&D units learn to adapt the firm-specific knowledge they’ve gained in their home country to the host country. These R&D units undertake more and more research tasks in the evolution process.

Early literature on international business explained that firm-specific monopolistic advantages are transferred across borders through subsidiaries and exploited in the local markets of host countries (Caves, 1971; Hymer, 1976; Rugman, 1981). More recent studies show that knowledge augmenting by establishing a new presence in advantageous locations is becoming the dominating motive of global FDI (Bas and Sierra, 2002; Kuemmerle, 1997). However, Almeida (1996) found differences in the motives of MNCs from different countries and argued that foreign firms should be viewed as technological knowledge contributors rather than technological knowledge absorbers. European and Korean firms are motivated by ‘offsetting home country technological weaknesses’ and operate as U.S. technology absorbers, while Japanese firms operate more as U.S. technology participants contributing to
inter-firm knowledge flows with domestic firms. Furthermore, Patel and Vega (1999) evidenced that product adaptation and technical support to local markets remain key factors in promoting R&D internationalization. The empirical analysis conducted to support these theories mainly focuses on R&D investments within the most advanced countries. However, when looking at investments from emerging countries, we need to consider how foreign R&D unit mandates are adapted as the domestic national innovation and economic system changes.

The overseas R&D units of Chinese companies in Europe show a different R&D internationalization pattern than the traditional HBE to HBA (See figure 4-3, Arrow 1). When entering the European market, most Chinese companies possess comparatively weak innovation capabilities in their headquarters and the internal sources of competitive advantages are too weak to compete on quality in the European market. Tapping into external knowledge networks to explore new technological advantages and augment previous home-based knowledge proves to be the initial motive for Chinese companies to expand R&D activities internationally. As technological capabilities are continuously being upgraded, technology exploitation and participation of host market competition will gradually emerge and coexist with technology exploration.
5.1.1 Observation outposts are evolving into market gatekeepers

At present, case B and case C still struggle to compete for a larger automotive market share in China with international assemblers. The two Chinese automotive companies are in their first stage of internationalization; neither company has begun to sell its products on the European market. The European market is, however, an inevitable part of future plans of both companies. During the interview, the general manager of case B expressed their hunger for a local market.

The R&D internationalization process of case A could be explicit evidence of the evolution from technology exploration to technology exploitation. Case A’s parent company operates an international market strategy that first occupies the developing country’s market and then expands to developed countries\(^ {24}\). By contrast, its international R&D strategy is a reverse process. This Chinese company set up its R&D center in countries with the most advanced telecommunication technologies. As early as 1998, it opened its first R&D institute in the U.S.

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\(^ {24}\) 1998-2001, entered the South Asia and Africa market; 2002-2004, marched into India, Russia, and Brazil’s emerging markets. Source: case A’s official website and http://www.fmprc.gov.cn/
The decision to set up a European R&D center in Sweden demonstrates a strong technology-driven motive to obtain overseas technological support and compete in 3G technology R&D. "It is not enough that we only rely on the R&D forces in China to catch up with these competitors in a short time, unless we have good technological support (interview, case A)". Along with technology development and market share enlargement, this Chinese telecommunications company is also gradually shifting its attention to the European market. Especially since 2005, it has emerged as a 3G competitor in Europe, signing numerous cooperation agreements with key European telecom operators and companies such as France Telecom. In the meantime, case A is also adjusting its position and is becoming not only a simple technology explorer but also a technology exploiter serving the European market. In addition to technological considerations, case A tracks the global telecom standards of major operators, analyzes telecom market trends and assists in strategic formulations. “Since we assist our company in formulating product planning, we are obligated to have intense communication. We have to understand the operators’ demands and support market operations (interview, case A)".

Obviously, technology exploration is still the most important mission for Chinese R&D subsidiaries in Europe according to our preliminary evidence. At the same time, however, these originally technology-exploration dominated Chinese R&D subsidiaries also plan to be involved in more technology exploitation R&D activities.

5.1.2 Remote centers of excellence are evolving into market colonizers

We discussed cases G and H as remote centers of excellence that seize key technologies and products that haven’t been mastered by their Chinese parent companies. The immediate concern of the HQ is to digest and disseminate the knowledge transferred from the centers of excellence within the MNC. As the case H interviewee said, “Only a small portion of Chinese staff here participate in R&D projects. The R&D employees dispatched by HQ are always learning oriented but not R&D project oriented (interview, case H)”. In the process of integrating the acquired R&D resources, market-driven motive is also demonstrated in case G and case H. In
addition to advanced and sophisticated technologies, M&A also assures the acquisition of brands, markets and distribution channels. The case G interviewee indicated that “FORD, GE, Volkswagen, etc. are all customers of the company we acquired. We consolidate and further expand the existing global markets after M&A (interview, case G)”.

A thorough assimilation of specialized technological capabilities in the internal R&D network is a basic premise for remote centers of excellence to change their technology exploration role and evolve into market colonizers. The case H interviewee explained when he mentioned their current market-related intention: “After the acquisition, we started to exploit the global market including Europe. Our Chinese HQ is now learning design ideas from German professionals and is mainly dedicated to the development of domestic-made parts & components with the purpose of providing auxiliary products to our German side, as well as reducing costs (interview, case H)”.

5.2 From Cooperative Learning to Experiential Learning

Another traditional evolution of MNC organizational learning is from experiential learning to cooperative learning (Ambos et al., 2006; Kogut and Zander, 2003; Tsai, 2001). Lehrer and Asakawa (2002) viewed the R&D subsidiary evolution from an organizational configuration perspective and concluded that the 'classic evolution' path of foreign R&D subsidiaries is from knowledge transferor to fully integrated knowledge hubs, able to interpret and aggregate external sources. More explicitly, organizational MNC learning channels initially emphasize internal knowledge learning, transfer, sharing, integration and systemization (Gupta and Govindarajan, 1991; Gupta and Govindarajan, 2000; Hymer, 1976; Kogut and Zander, 2003; Tsai, 2001). Gradually, external knowledge networks are regarded as an important competitive advantage and 'serve as sources of learning' (Andersson, 2002: p: 981). The ultimate state of integrated network configurations is that of facilitating the bi-directional flow of both internal and external knowledge (Kurokawa et al., 2007). The overseas R&D units of Chinese companies in Europe show a different R&D
maturation pattern from cooperative learning to experiential learning (See figure 4-3, Arrow 2). Although Chinese R&D units bear a resemblance to the evolutionary path from knowledge incubator to knowledge integrator (Lehrer and Asakawa, 2002), some significant differences cannot be ignored. The key mission of knowledge incubators is to create new knowledge\(^25\), while Chinese R&D units mainly operate as knowledge learners, but not as knowledge contributors, absorbing and transferring knowledge from external networks back to HQ. In this case, Chinese companies will first pursue external knowledge sources through cooperative learning, where knowledge flows reverse from the external knowledge network to the internal knowledge network. Along with internal knowledge accumulation, Chinese companies will disseminate and integrate their knowledge within multinational organization. Meanwhile, the internal reinforcement of R&D subsidiary technological strengths also stimulates self-learning and self-experiencing in the host knowledge environment. Finally, both cooperative learning and experiential learning are utilized simultaneously by Chinese companies in a double-knowledge network. However, we here have to inter-relate the decreased importance of cooperation with local partners and the emergence of more autonomous learning modes. This trend is somehow opposite to what most international business literature would have predicted.

5.2.1 Observation outposts are evolving into remote centers of excellence

Our cases provide insight into the expected/projected transformation of cooperation modes. Cases B, C, and E still depend on local partners to a large extent and in the beginning had to contract out their R&D projects. During the cooperative learning process, these R&D subsidiaries upgraded their R&D capabilities and improved the quality of R&D human resources. Over time, these R&D units increased their involvement in R&D projects by renegotiating their joint R&D project and enhancing their self-experience and self-discovery skills in new technological environments, starting up their own independent R&D projects.

\(^25\) The cases used in this study are research-based incubators.
Both case B and case C are experiencing the transition of R&D capability from weak to strong through cooperation with famous local automotive design companies. Case C’s Director mentioned their cooperation with IDEA during a media interview in 2006: “In the project CM8 design & development process, R&D employees from our Chinese parent company could only do some assistance work, maybe 20%. But in project CV6, Chinese R&D employees could undertake 50% of the workload. Moreover, Chinese R&D employees could even take on 70%-80% in subsequent projects”.

Another representative example is case E. Since its establishment, case E has never changed its technology exploration motive or disclosed its ambition for the European market. Consistently upgrading its own technological level through continuous project cooperation with local technological partners, case E has achieved a qualitative leap from cooperative R&D of Landking (Euro III) series Diesel Engines to independent R&D of Landking (Euro IV) series Diesel Engines. “Originally, it was absolutely impossible for us to complete the R&D task of Euro III, and we had to turn to the ‘outside brain’, i.e., AVL, for help. During the cooperation project, our own R&D employees had the opportunity to participate in the whole R&D process. After the Euro III cooperation project, we not only developed several Euro III series diesel engines but also independently designed and developed Euro IV and V series diesel engines except for some key component support from our suppliers, such as Bosch (interview, case E)”. Although case E still relies on advanced component suppliers, it has internalized the most relevant aspects of R&D capabilities and is shifting towards a remote center of excellence.

5.2.2 Market gatekeepers are evolving into market colonizers

Case I could be seen as a potential example of the evolutionary trajectory from remote centers of excellence to market colonizers. Case I is not a simple R&D center with independent design capabilities for motorcycles and scooters, but owns its own

renowned brand, factory, distribution and after-service facilities. Case I not only serves the European high-end motorcycle market, but also pours technological resources into the parent company. Its HQ is undertaking more and more challenging technical tasks and continuously improving the level of manufacturing capabilities while digesting technological knowledge from the European R&D unit. The production of some motorcycle parts has shifted from Europe to China. “Let’s take the scooter as an example, our scooters are designed in Europe and manufactured in China. We also have a sales service center here and our scooter products will be delivered to Europe, the U.S. and worldwide (interview, case I)”. At the moment, except for cooperation with suppliers concerning high-end motorcycle parts, case I has internalized the most relevant knowledge resources and is positioned as a springboard to launch into the European motorcycle market.

6. Conclusions and Policy Implications

Chinese R&D presence outside China is causing many headaches but is also creating many opportunities and is indeed something that policy makers as well as managers cannot ignore. In this chapter, we have gathered preliminary evidence of a growing phenomenon whose dynamics could only be in part predicted by what literature on international business has so far discussed. We discuss predominant R&D strategies used by Chinese companies in Europe since we find Chinese companies are ambidextrous organizations (Luo and Rui, 2009; O'Reilly and Tushman, 2004) implementing a variety of strategies, i.e., technological exploration/exploitation and cooperative/experiential learning at the same time.

The relevance of the phenomenon discussed in this chapter is self-explanatory: for the first time, an emerging economy is seen heavily investing in R&D beyond its borders. Similar trends have been observed in other rising Asian countries, but the scale of Chinese investments together with the continuous expansion of the Chinese economy, should make this topic a top priority in our research agenda. In this chapter, we argue that motives and learning modes do not resemble what has thus far been
studied in business literature and our findings are somewhat counterintuitive. As the technological capabilities and domestic markets of these companies rise dramatically, they will necessarily change their strategies abroad. Chinese MNCs respond to different incentives. They follow different customs and routines than those predicted by the western “business as usual” approach.

Growing cross-investment between Europe and China is not something that can be prevented and indeed can be interpreted as a growing co-dependence between these two important global economies. However, R&D FDI needs to be monitored in order to detect anomalies and we were surprised to find such scarce and contradicting sources of information on Chinese presence in Europe.

Our preliminary analysis demonstrates the Chinese FDI presence in areas of European technological excellence. A census of their R&D footprint would be beneficial not only to researchers and scholars but also to policymakers, both in China and in Europe.

Moreover, it is interesting to focus here on the counterintuitive evolution of Chinese R&D investments in Europe. From a policy perspective, growing evidence of the tendency of these companies to insulate themselves from their original partners should cause some concern. Why are some Chinese companies engaging less in explorative R&D activities in Europe? Why are some Chinese companies becoming less demanding with respect to their local partners? The maturing FDI strategies of competitive companies into advanced regions should be accompanied by increasing integration of these multinationals into the local innovation system. When this does not happen, as we show in some of our cases, real concerns ought to emerge on the evolution of these investments.

Is Europe becoming a less attractive technological hub and only a market to be present in? The discussions we had with some Chinese managers that plan on increasing their R&D presence in Europe show strong disagreement with this view. In their opinion, Europe remains central for the development of their industries. In the cases studied, we noticed a growing effort to become engaged in the local innovation system, a two-way learning mechanism is becoming common and a clear division of
labor is taking place within their groups.

Perhaps the involution of some of the most critical cases we observed needs to be explored further to bring to light individual problems and difficult interactions. However, going behind the scenes of changing strategic scenarios and divergent goals between headquarters and subsidiaries is always difficult, and even more so with Chinese managers. Growing concern about Chinese competition in the European market is at the top of the agenda of EU industrial policy. However, this should not foreshadow the benefits that both economies could derive from a more effective division of labor between Europe and China when it comes to R&D activities. In this area, maybe European policy makers could learn something from their Chinese colleagues. We found extremely scarce evidence in our interviews of active engagement and outreaching by European policy makers, who have so far ignored the phenomenon of Chinese R&D FDI in Europe. This indeed is quite the reverse in China, where foreign multinationals are actively involved from the very beginning in conversations with local and national authorities. Is this something that regional and European authorities could work on? Should European policy makers identify and plan potential developments of the evolution of the Chinese R&D footprint in Europe together with Chinese partners?

We leave our readers with these open questions but a comparative analysis between what is happening in Europe and in the United States could potentially address these issues.
CHAPTER 5: A Comparison of International R&D Strategies of Chinese Companies in Europe and the U.S.²⁷

Summary

Europe and the U.S. are the two main overseas R&D destinations for Chinese companies. Our previous study of Chinese R&D presence in Europe shows counterintuitive evidence that Chinese companies behave in ways that traditional R&D FDI maturation models would have not predicted. Are our findings exclusive in Europe or applicable in other developed countries such as the U.S.? Also, do Chinese MNCs have different R&D behaviors from the R&D activities of developed country MNCs?

We adopt the method of “theory building from case study research” developed by Eisenhardt (1989). Based on 16 R&D units of 12 Chinese companies in Europe and the U.S., our analysis investigates and compares the R&D strategies of Chinese multinationals in Europe and the U.S., focusing on their strategic motives, R&D structure, and modes of learning.

We found similar motives and R&D structure but different learning modes of Chinese companies investing in Europe and the U.S. Potential possibilities inducing different choices of R&D strategies were also discussed. This chapter raises many managerial and policy issues that both managers and policy makers may concern. How to deal with the dilemma between short-term goal and long-term goal? How to reach equilibrium state of R&D structure with both internal integration and external embeddedness? How to enable R&D cost minimization and R&D efficiency maximization? How to effectively learn from external knowledge networks? Why do

²⁷ This chapter is co-authored with Alberto Di Minin and Xiaohong (Iris) Quan
some Chinese companies adopt different learning modes? Is there something that regional authorities can mutually emulate? Our findings present some Chinese experience to managers and aim to call attention to policy makers.

Key words: Europe, the U.S., comparison, R&D motive, R&D structure, learning mode
1. Overview

Chinese research and development (R&D) in developed countries is a variegated and growing phenomenon which the academic world has somewhat neglected. In a dynamic global competitive environment, some bold emerging Chinese multinational corporations (MNCs) have expanded their technological investments abroad (Chen and Tong, 2003; Deng, 2007; von Zedtwitz, 2005; Xie and White, 2006), to Europe and the U.S. which are the two main overseas R&D destinations for Chinese companies.28

As an important force of the third wave of outward foreign direct investment (OFDI) from emerging and developing countries, Chinese companies that have emerged since 1990s reveal different characteristics from developed country MNCs as well as the first and the second waves of MNCs from emerging and developing countries (Andreff, 2003; Gammeltoft, 2008).29 It is interesting, as well as necessary, to investigate why and how Chinese MNCs find innovation opportunities and implement international R&D strategies in developed countries such as Europe and the U.S..

Our main research question in this chapter is: can we find significant differences or similarities in the comparison of international R&D strategies of Chinese MNCs in Europe and the U.S.? Do Chinese MNCs behave differently R&D from the developed country MNCs in R&D? If so, how and why are they different?

More specifically, this chapter aims to compare Chinese R&D investments in Europe and the U.S. from three main aspects:

(1) Motive - Why do Chinese companies expand their R&D activities into developed

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28 See the description of author’s database in chapter 2
29 Two waves of outward FDI from Third World have been considerably discussed and distinguished by different characteristics including periods, destinations, motives, types of outward FDI, and ownership advantages (Dunning, 1996; Lall, 1983). Recently, a third wave of outward FDI flow from emerging and developing economies/countries is conceptualized by Andreff (2003), Gammeltoft (2008), etc.. This wave of third-world multinationals emerging in the period of 1990s-2000s is described as more going into developed countries for asset augmenting and market power enhancing.
countries (Europe and the U.S.)?

(2) R&D structure - How do Chinese companies organize their global R&D structure in Europe and the U.S.?

(3) Modes of learning - How do Chinese companies in Europe and the U.S. deploy their learning strategies?

This chapter is structured into 6 sections. Following the introduction section, we review the literature on R&D internationalization from three aspects, R&D motive, R&D structure and learning modes. In section 3, we briefly describe the presence of Chinese outward FDI in Europe and the U.S. In the subsequent section (section 4), we make a comparison between the cases in Europe and in the U.S.. Meanwhile, several propositions are generated. In the next section (section 5), we further discuss and conclude our findings. Finally, both managerial and policy implications are provided to managers and policy makers in section 6.

2. Literature Review

2.1 R & D Motive

In order to keep competitive advantages, companies have to build global R&D networks for both new knowledge accessing and product commercialization (Kuemmerle, 1997, 1999). The early role of MNC R&D subsidiaries is conceptualized as a pure market strategy for product adaptation and supporting manufacturing in host countries by exploiting firm-specific capabilities at home (Almeida and Phene, 2004; Håkanson, 1990; Kuemmerle, 1999), i.e., technology exploitation. Soon after, accessing to technology, i.e., technology exploration, was identified as another important motive leading to R&D decentralization (Florida, 1997; Kuemmerle, 1999). Developed country MNCs will cultivate their R&D capabilities and build a strong home base before they locate their R&D activities abroad (Patel and Vega, 1999). With this prerequisite, Kuemmerle (1999) divides the R&D motives into home-base-exploiting (HBE) and home-base-augmenting (HBA). Moreover, a lot of
literature shows R&D subsidiaries undergo a shift from HBE to HBA (Almeida, 1996; Bas and Sierra, 2002; Cantwell and Mudambi, 2005; Florida, 1997; Ronstadt, 1978). However, ‘there is little evidence to suggest that even these most internationalized firms routinely go abroad to compensate for their weakness at home’ (Patel and Vega, 1999). On the other hand, whether the evidence obtained from developed country MNCs can be applied to the MNCs from emerging countries such as China is still doubtful. As latecomers, Chinese companies ‘lag behind technology frontiers (Xie and White, 2006)’ as well as lack international market experience. Chinese companies have technological disadvantages when they step into global competition, even though they’ve already cultivated a certain degree of competitive advantage in the domestic market. In such a disadvantaged situation, Chinese MNCs are supposed to take different R&D strategies with different motives.

2.2 R&D Structure: A Two-dimension Review

2.2.1 The horizontal perspective: centralization vs. decentralization

R&D centralization/decentralization is not really a new topic since it has been discussed over the last few decades. Many empirical studies suggest that MNCs have switched from a HQ-centered organization to a more decentralized network, where dispersed MNC units are granted more autonomy than before (Asakawa, 1996; Birkinshaw, 1996). The presence of technological enablers and an ever-increasing pressure to adjust to the demands of the market have triggered the transformation from centralization to decentralization and are changing the roles of subsidiaries in the MNC organization (Zanfei, 2000). Such an organizational arrangement facilitates a better utilization of global resources and also encourages independent creativity of MNC units (Asakawa, 2001).

However, a decentralized R&D structure usually induces managerial challenges because of the tension between the local embeddedness and organizational integration of global R&D units (Asakawa, 2001; Bartlett and Ghoshal, 1990; Häkanson, 1990; Lehrer and Asakawa, 2002). As for Chinese companies, or other
emerging multinationals, how to coordinate and control the decentralized R&D organization has become one of the key factors of R&D efficiency.

2.2.2 The vertical perspective: hierarchical division of R&D labor

A traditional explanation of the hierarchical division of R&D labor is that MNC R&D laboratories typically locate in developed countries for the latest technologies (Florida, 1997; Håkanson and Nobel, 1993; Kuemmerle, 1999; Nobel and Birkinshaw, 1998; Pearce, 1999), and MNCs establish R&D laboratories in developing countries primarily for image building, local adaptation, product development, local manufacturing supporting (Dunning, 1994, 1998), as well as low-cost but high quality human resource (von Zedtwitz, 2004; Wu and Callahan, 2005). Although R&D globalization is a growing phenomenon and some explorative studies have shown preliminary evidence that “the R&D operations in developing countries, such as India and China, become central parts of MNCs' global strategies, and are assigned higher value-added R&D activities” (Dossani and Kenney, 2009; Quan, 2005), old centers of excellence are still attractive and retain the dominance in cutting-edge technologies and industries (Cohen et al., 2009; Di Minin and Palmberg, 2007; Dunning and Lundan, 2009; Macher et al., 2007). Moreover, MNCs also have a consideration for intellectual property (IP) protection in developing countries for such a hierarchical labor division (Cohen et al., 2009; Quan and Chesbrough, 2010).

2.3 Modes of Learning

Organizational learning can be conceptualized as “the ways firms build, supplement and organize knowledge and routines around their activities and within their cultures, and adapt and develop organizational efficiency by improving the use of the broad skills of their workforce”(Dodgson, 1993: 377). Organizational learning, rather than knowledge transfer from the parent company to the host country, has been regarded as the core activity of international R&D subsidiaries (De Meyer, 1993; Lam, 2003). Organizational learning can be divided into dichotomous learning processes: cooperative learning and experiential learning (Hitt et al., 2005; Holmqvist, 2004).
For the multinationals in the early stage of R&D internationalization, both cooperative learning and experiential learning are necessary organizational learning channels.

Experiential learning is an important channel of organizational learning. 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.

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.

Most Chinese companies are young and have only been around for a few decades. Learning in organizational networks has become a natural catching-up strategy for Chinese latecomers (Hitt et al., 2005; Zhao et al., 2004). It is necessary to observe the learning behaviors of Chinese companies in R&D, the most technology-intensive sector, from both inter-organizational and intra-organizational perspectives.

3. Case Analysis and Comparison

Before case analysis and comparison, we have gathered evidence from Europe and the U.S. (see table 2-3 and table 2-4 in chapter 2). The construction of the comparative sample in the U.S is started by doing a "one to one" matching from the original European sample. In particular, for each R&D site in Europe, we first looked for another R&D site controlled by the same Chinese in the U.S. If we could not find
a site (or if the site was engaged in R&D for other industries), we then looked for an R&D subsidiary controlled by another company operating in the same industry as the European one. Finally, the U.S. sample is chosen involving the industries of consumer electronics, automotive and internet & telecoms.

In this section we compare the evidence of two samples of companies in Europe and the U.S. from three aspects which include motives, R&D structure and learning modes.

3.1 R&D Motives

We found similarities in the establishing motives. When mapping the cases in our database according to their location selection and industry distribution in the U.S. and Europe, we discovered a clear strategy: Chinese R&D units settled down close to centers of excellence with specific technological advantages. In the U.S., Chinese companies prefer to invest in telecommunications, pharmaceutical, etc., and Chinese companies in Europe are more willing to invest in machinery, equipments and automotive industry (see figure 5-1 and figure 5-2).

Figure 5-1 Industry distributions of Chinese R&D investments in the U.S.

![Industry distributions of Chinese R&D investments in the U.S.](source: Author’s database)
According to our interviews, technology-exploration-motivated companies also account for the majority of our cases (see table 5-1). This evidence further confirms our finding in Europe. Most Chinese companies are still in infancy in terms of both technology and market knowledge in global market. In order to catch up and compete with their stronger counterparts from developed countries, they are not merely content to accumulate their technological capabilities at home, but take the initiative in seeking global technological resources. Foreign-market-related motive, by contrast, is placed at the second place.

As the interviewees stated, proximity to the centers of technological excellence enables Chinese companies to connect with the world’s latest technologies, strengthen the R&D capabilities and seize more innovation opportunities by conducting R&D in the areas with advanced technologies. This motive covers all of the cases in Europe and the U.S., who usually had either clear product development plans or specific technological requirements before deciding to expand their R&D operations into certain locations in developed countries. The dominant technology-driven motive of proximity to centers of excellence can be further broken down into the following five sub-motives.

First: local R&D infrastructure. Chinese companies intend to utilize local advanced
R&D infrastructure and take advantage of a better technological environment by conducting R&D close to centers of excellence. Many interviewees of our cases such as case C and case 2 (see table 5-1) mentioned local superiority of R&D infrastructure, facilities and equipment. Apparently, Chinese companies are already aware of the impact of the surrounding environment on their innovation ability.

Second: be close to the development of new technologies. Being close to centers of excellence enables Chinese firms to track the latest technology & product development. Different from the discussion by Chen and Tong (2003), technological scanning is no longer the main task but just one of the necessary components according to the interviewees. According to our cases, an overall grasp of the technology & product development trend in developed countries is quite useful for future R&D project planning and operating.

Third: to partner with technology providers. Proximity to the centers of technological excellence provides Chinese companies with the opportunity to have close interactions with the leading local technology providers. The technology-oriented motive, described by our cases, is to establish new external knowledge networks and to take full advantage of external technological assistance by building/strengthening new/existing local cooperative relationships with famous MNCs as well as local specialized small and medium enterprise (SMEs).

Fourth: acquisition. The fourth reason is to acquire specific technology or to develop a strategic product by acquisition of local companies. In our cases in Europe, many Chinese companies bought local companies and retained the previous R&D facilities, aiming at specific strategic products that are critical for them to have a leg up on the competition. For instance, case G focuses on the R&D of large gantry machining; case H focuses on the R&D of electronic jacquard machinery; and case I focuses on the R&D of high-end motorcycles.

However, this motive is not expressed by case 2 in the U.S. Although case 2 was set up with the same entry mode of M&A as cases G, H, and I, SG reconstructed the acquired R&D center by re-recruiting R&D personnel. “After the acquisition, we only retained the necessary assets based on our company’s requirements since it was
impossible to find a ready-made R&D center, possessing intangible assets and hardware facilities, which was totally suitable for our company. We re-established our R&D team while we retained the whole hardware facilities (interview, case 2).”

“We recruited a new technical director and R&D staff to replace the whole previous R&D team which was not very suited to the R&D projects that we would like to launch\textsuperscript{30}, and so far we are still recruiting (interview, case 2).”

SG has a clear R&D strategic blueprint and a relatively strong technological capability. What they need is not a particular technology or product, but advanced R&D facilities, high skilled R&D specialists, and an acute sense of the technology and market trends.

Last but not least: human resources. High quality specialized human resources are among the most important technology-driven motives for setting up overseas R&D units in Europe and the U.S.. Recruiting and cooperating with local, high-level human resources have been viewed as some of the main reasons for the enhancement of R&D capabilities through the establishment of overseas R&D centers.

In most of our U.S. cases (except for case 1), all the employees are locally recruited, which clearly reflects the reality of the many talents in the U.S. Using local human resources with advanced technological knowledge is the most effective way for the R&D units to tap into the local knowledge networks. Human resource localization helps to achieve local R&D embeddedness.

In addition, plentiful, local, and high-quality human resources also help high-skilled R&D human cultivation of Chinese firms. This motive is quite significant in the European cases such as cases B, C, E, G, H and I.

The evidence gathered in our research among Chinese MNCs in Europe also suggests the co-existence of the two goals of both technological exploration and technological exploitation. In our cases, some have a dual motive, while others are largely motivated by their hunger for advanced technologies. Cases B, C, and E in Europe

\textsuperscript{30} The new employees in the U.S. branch include many Chinese Americans and Chinese students who studied in the U.S.. See http://auto.sohu.com/20090305/n262629933.shtml.
and cases 4 and 5 in the U.S. are representative cases with an exclusive technology-driven motive.

Cases A, D, F, G, H and I in Europe and cases 1, 2, and 3 in the U.S. are pursuing both technology exploration and technology exploitation simultaneously. Cases A, D, F, and I as well as cases 1, 2, and 3 have normally occupied a steady share of the domestic market and have attained a certain degree of independent R&D capabilities.

Expansion into the markets of developed countries has become an integral part of their internationalization strategy, while the pursuit of technological progress is still the major task of the companies. These Chinese companies boldly step out to seek both survival and development in developed countries' markets. However, because they lack in both international market experience and technological know-how, their competitive disadvantages force them to establish R&D branches in developed countries. As for cases G and H, acquisition of local companies have brought them not only technological resources but also market resources. To consolidate and expand the existing market share has become a consequent task for cases G and H after acquisition.

We did interviews with Hisense's R&D units in Europe and the U.S. (case D and case 1), which can shed some light on the “ambidexterity” of motive. The establishments of case D and case 1 have a strong market-driven motive of leveraging self-knowledge stock to support local market exploitation and assist new product development and adaptation for local markets. As the interviewee of case D stated, “At this moment, how to survive in the global market and increase market share have become the primary issues to resolve.” Case 1 was split from Hisense USA in 2008, and the interviewee expressed a similar motive: “We (Hisense) export products, such as TV sets, to the U.S. market. If we didn’t set up a R&D branch here, all the R&D activities would be centralized in China, and you would never know if these products exported to the U.S. are suitable to the local market or meet local demands because first-hand information delivered from the U.S. market lags behind. In this case, both the marketing and sales in the U.S. and even the whole operation of Hisense would be influenced.”
Meanwhile, Hisense clearly recognized their technological deficiencies in the long-term global competition. “In general, the Chinese TV industry hasn’t mastered LCD panel technologies very well, even though our company remains one step ahead in China”, stated by the interviewee of case D. In order to seek new competitive advantages, case D and case 1 also undertake technological exploration tasks. Case D emphasized that “our (Hisense) aim requires us to insist on upgrading our technologies and product quality constantly”. The interviewee of case 1 mentioned the geographical advantage in collecting technological information. “After all, there are many big companies here, launching their latest product/technology in the U.S. market at an early time. We therefore have a good chance to keep a close eye on the latest technologies and products.”

Compared to European counterpart, the R&D unit of Hisense in the U.S. mainly assists the HQ in launching new products and serving for the North American market. Whereas, as we already mentioned before, monitoring and collecting the latest technological information for headquarters is still one of the main functions of the unit.

Proposition 1: We find that many Chinese overseas R&D units in the U.S. and Europe are acting as ambidextrous organizations motivated by both technology exploitation and technology exploration, though the majority of the cases in the U.S. and Europe suggest that technology exploration appears to be the predominant motive.
<table>
<thead>
<tr>
<th>Technology exploration (technology-driven motives)</th>
<th>The cases in Europe</th>
<th>The cases in the U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity to the centers of technological excellence</td>
<td>Cases A, B, C, D, F, G, H and I</td>
<td>Case 2</td>
</tr>
<tr>
<td>(1) To utilize local R&amp;D infrastructure and take advantage of a better R&amp;D environment</td>
<td>Example: Case C</td>
<td>Example: case 2</td>
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<td></td>
<td>Chang’an decided to set up an automotive R&amp;D center in Turin with a focus on vehicle body shape design which is the technological advantage of Italy. As the vice director of Case C said, “Turin is a world class design center, where the surroundings, infrastructure, supporting facilities are satisfactory”.</td>
<td>SG decided to acquire an existing R&amp;D center since there are available local resources. The acquired R&amp;D center includes a high standard laboratory of new energy technology and SG is able to carry out its independent R&amp;D and design activities, and possess its own intellectual property of core technologies. “After the acquisition, we only retained the necessary assets based on our company’s requirements since it is impossible to find a ready-made R&amp;D center, possessing intangible assets and hardware facilities, which is totally suitable for our company. We re-established our R&amp;D team while we retained the whole hardware facilities.”</td>
</tr>
<tr>
<td>(2) Technological trend monitoring and technological information collection</td>
<td>Cases A, B, C, D, F, and I</td>
<td>Cases 1 and 4</td>
</tr>
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<td></td>
<td>Example: Case F</td>
<td>Example: Case 1</td>
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<td></td>
<td>Case F, the most recently established R&amp;D unit of the 9 European cases, mainly undertakes the tasks of information collection and technology monitoring. It has built informal but close and long-standing audio technological connections with the local senior engineers, R&amp;D and consulting companies, and universities.</td>
<td>When the question that ‘if any technology-related factors have been considered’ was raised, the interviewee answered: “Collecting technological information is also a task for us. After all, there are many big companies here, launching their latest product/technology in the U.S. market at an early time. We have a good chance to keep a close eye on latest technologies/products.”</td>
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</tbody>
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31 Report from Liaoning Daily, 04-29-2009
<table>
<thead>
<tr>
<th>(3) To Strengthen interaction and cooperation with local technological partners</th>
<th>Cases A, B, C, D, E, F, G, H, and I</th>
<th>Cases 2, 3 and 4</th>
</tr>
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<tbody>
<tr>
<td>Example: case E</td>
<td>Example: case 3</td>
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<tr>
<td>Before case E (the European R&amp;D unit) was set up, Weichai already had a close cooperation with large companies such as AVL in Europe. The reason that “facilitating the collaboration and communication with the internationally famous advisory services companies and local parts &amp; components manufacturers” has been stated as the most important motive of case E.</td>
<td>Case 3 has established a cooperative relationship with local chip manufacturers owing to “the U.S. is the world’s most powerful country in chip development and production.”</td>
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<tr>
<th>(4) Acquisition of specific technologies or specific product development</th>
<th>Cases E, G, and H</th>
<th>No evidence</th>
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<tbody>
<tr>
<td>Example:</td>
<td></td>
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<tr>
<td>Case G: large gantry machining center;</td>
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<td>Case H: electronic jacquard machinery;</td>
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<td>Case I: high-end motorcycles</td>
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<tr>
<th>(5) R&amp;D talents recruitment and Chinese talent cultivation</th>
<th>Cases A, B, C, D, E, F, G, H and I</th>
<th>Cases 2, 3, 4 and 5</th>
</tr>
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<tbody>
<tr>
<td>Example: cases B and C</td>
<td>Example: Case 4</td>
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<tr>
<td>Both of the automobile companies take advantage of local plentiful and high-quality R&amp;D human resource to accomplish projects as well as to train their own designers and engineers. Local high-skilled human resource is not only a key factor in finishing R&amp;D projects, but also an effective way to train their own R&amp;D human resources. As the interviewee said, “Our biggest achievement with a project is cultivating our own R&amp;D talents”.</td>
<td>The engineers recruited in the U.S. are quite experienced and have long-term exposed to the unique atmosphere in the Silicon Valley. Their expertise/domain knowledge is valuable for Alibaba. “After all, the technology is very advanced in the Silicon Valley. With the help from our R&amp;D experts, we may avoid detours and take a shortcut during the R&amp;D process. Moreover, these experts bring us some new visions. For example, the coding process in China is not standard, and we hope our U.S.-based engineers may gradually influence our company’s practices during the development process and improve</td>
<td></td>
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<tr>
<td>Technology exploitation (market-driven motives)</td>
<td>Cases A, D, F, G, and I</td>
<td>Cases 1, 2 and 3</td>
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<tr>
<td>(1) To enter local/global market and promptly adapt products for local/global customers</td>
<td>Example: case D  The main task of case D is to develop adapted products for the European market.  “If you hope to develop products that can make the European customers satisfied, you have to find out the situation in the local market regarding technological development, and consumption behaviors.”</td>
<td>Example: case 3  The interviewee of case 3 expressed a strong motive to enter the global market.  “If you want to gain the initiative in the global market, you have to develop new products. Before stimulating the market, you should have developed mature products, and then you’ll stand a chance to have the initiative.”</td>
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<tr>
<td>(2) To support local production and sales</td>
<td>Example: case G  DMTG had considerations for market-related resources while deciding to buy the German company.  “Besides technological consideration, we also wanted to acquire the company’s major brands, market share and sales channels.”</td>
<td>Example: case 1  Before the establishment of the U.S. R&amp;D branch, there were engineers already working in Hisense USA in order to provide technical support for local sales.  “If we didn’t set up a R&amp;D branch in the U.S., we would have never known if these products exported to the U.S. were suitable to the local market or meet local demand since the first hand information delivered from the U.S. market lags behind. In this case, both the marketing and sales in the U.S. market and even the whole operation of Hisense would be influenced.”</td>
</tr>
<tr>
<td>(3) To have close interactions with local/global customers</td>
<td>Cases A, D, F, G and I</td>
<td>Case 1 and 3</td>
</tr>
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<td>----------------------------------------------------------</td>
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<td>Example: case A</td>
<td>“We have to help our headquarters to develop product planning for the global market. This requires us to have a high-end interaction with global operators. We have to understand the various needs of the operators.”</td>
<td>Example: case 1</td>
</tr>
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<td></td>
<td>The marketing staff in Hisense USA takes charge of communication with local customers. Meanwhile, the R&amp;D personnel also needs to interact with the local customers while the U.S. R&amp;D branch participates in the pre- and post-development phase of new products. “On the one hand, we R&amp;D personnel should tell our customers what technologies we have and what kind of products we can offer. On the other hand, we also should understand what our customers need, and then we can make a suggestion to improve the new developed products.”</td>
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<table>
<thead>
<tr>
<th>(4) To monitor market trend and collect market information</th>
<th>Cases A, D, F and I</th>
<th>Cases 1 and 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: case F</td>
<td>New Jialian set up case F in Denmark in order to look for potential projects. “We are now suffering a recession in the global economy, so that we are doing some market research and investigation to see if there are some projects that can make our company have a better development.</td>
<td>Example: case 1</td>
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<tr>
<td></td>
<td>Case 1 behaves as a market information monitor in the U.S. “Hisense USA has specific marketing staff to communicate with local customers and collect market information which will be transferred to us (R&amp;D staff). We also collect local market information by ourselves, though not quite often. Anyway, this R&amp;D branch is (localized) product-centered. It is not enough to rely solely on marketing staff if our company aims to explore local market.”</td>
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</table>
3.2 R&D Structure

3.2.1 Centralization vs. decentralization

In terms of the discussion on R&D structure of MNCs, the existing studies show that different motives lead to different R&D configurations, and firm’s market and technology orientations are related to their management styles (Behrman and Fischer, 1980; von Zedtwitz and Gassmann, 2002). The topic on centralization/decentralization of R&D organization has been discussed in the past decades with different definitions and taxonomies (Asakawa, 2001; Bartlett et al., 1990; Cheng and Bolon, 1993; Chiesa, 1996; Fischer and Behrman, 1979; Gassmann and von Zedtwitz, 1999; Lehrer and Asakawa, 2002). In this chapter, we use the distribution of decision-making power as the measurement of centralization/decentralization of a centralized/decentralized R&D organization where decision-making power is retained at headquarters/R&D units (Fischer and Behrman, 1979).

The traditional explanation states that firms with a technology-exploration (technology-driven) motive tend to be more centralized than firms with a technology-exploitation (market-driven) motive (Behrman and Fischer, 1980; Cheng and Bolon, 1993). From an evolutionary perspective, there are two different routes of R&D structure evolution arriving at the same end: (1) the route from centralization to decentralization and to convergence (Asakawa, 2001; Behrman and Fischer, 1980); (2) the route from decentralization to centralization and to convergence (Lehrer and Asakawa, 2002). Here, ‘convergence’ means that an R&D unit is in a state of both embeddedness in local R&D networks in host countries and integration within MNC.

In this study, we find that most of the Chinese cases with greenfield investment entry mode have a certain degree of autonomy, while the final decision-making authority is still held by the headquarters (See table 5-2). This R&D configuration can be viewed as participative centralization and has much to do with the R&D project

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32 Fischer and Behrman (1979) defined four R&D coordination patterns as absolute centralization,
settings and the allocation of R&D resources within Chinese companies. The Chinese R&D units interviewed usually have a small size and do not possess all the resources needed for R&D. These characteristics determine that Chinese overseas units cannot fulfill a whole R&D project independently. In such a case, headquarters starts up a new R&D project and assigns tasks to different R&D units. Overseas R&D units take orders from headquarters and work jointly. Here is a metaphor given by the interviewee of case C that vividly depicts the HQ-subsidiary relationship in Chang’an: ‘The HQ regards our R&D center as a ‘department’ but not a relatively independent subsidiary, because our R&D possesses only part of the resources of the whole Chang’an company. This kind of centralization is better for HQ to do integrative resources allocation.’

In most instances, Chinese R&D units utilize their geographical advantages to give weighty advice and proposals on new products/technologies, local human resource recruitment, local partner choosing etc. to their headquarters. They have a certain degree of autonomous right on specific matters, especially those businesses related to local operations, though the final decisions still need to be approved by headquarters. Here, case 2 shows a lot of initiative in decision-making of new projects or product development in overseas markets. “SG launches different projects for the North American market and Chinese market. If the project aims at the North American market, the US R&D branch will conduct market analyses and determine whether the new technology can be commercialized... We certainly still conform to the HQ since the investment is finally decided by the HQ (interview, case 2).”

Proposition 2a: We find similar participative-centralized structure between Chinese R&D units and HQ. Important decisions must be shared / coordinated with HQ. However, we find that both the European and the American units/subsidiaries take initiative in local R&D operations such as new projects or product development in overseas market.

participative centralization, supervised decentralization and total freedom. Participative centralization is defined as “R&D commitment and total resources used are determined as a result of negotiation between parent and foreign affiliate. Parent decides; foreign affiliate gives its advice or proposes decision”.
A centralized structure can also be viewed as a formal coordination mechanism that is commonly used by HQ to supervise R&D subsidiaries. Moreover, standardized and routinized procedure or planning and report systems submitted by R&D units to headquarters are always utilized by Chinese companies with the purpose of integrating HQ and the subsidiary. Besides formal managerial instruments, informal coordination and communication mechanisms are also used between R&D subsidiaries and HQ to accelerate the internal experiential learning and new knowledge creation, as well as bi-directional transfer of new knowledge and information. From table-6 we find that there is close coordination between the overseas R&D units we interviewed and their Chinese headquarters, and informal coordination mechanisms are commonly used by Chinese companies in order to facilitate learning and knowledge transferring. According to our cases, the most common informal mechanisms used by Chinese companies are communication tools and professional transfer.

(1) Communication tools

In order to solve distance problems and conquer know-how exchanging barriers, informal contacts through internet/intranet, e-mails, telephone and various other IT-related platforms have become the main daily means of communication between R&D subsidiaries and HQs.

In our cases, video meeting/teleconference has become an effective tool to connect R&D subsidiaries and HQ. For example, Qianjiang motor equipped itself with a professional translation team. The Chinese engineers in the HQ are able to communicate smoothly and regularly with their Italian designers and engineers in case 1 through video conference/teleconference. Chinese companies seem quite satisfied with these convenient ways to contact and communicate. As the interview of case 2 said, “We rely on engineering-related IT technology to transfer knowledge back and forth. We communicate with our HQ each month through reporting, teleconferencing, and the company's own office platform. Our communication deals with all aspects including the proposals, discussions, and so on. We have a good communication platform that helps resolve different matters.”
(2) R&D human resource transfer

R&D human resource transfer facilitates close interactions and mutual learning between R&D subsidiaries and HQ. Our cases can be grouped into two situations (see figure 5-3) based on the technology level differences that exist between R&D subsidiaries and headquarters.

**Figure 5-3 Two situations in R&D human resource transfer**

![Diagram showing two situations in R&D human resource transfer](image)

The cases belonging to the first situation, i.e., cases A, G, H and I in Europe and cases 2, 3, 4 and 5 in the U.S., have a relatively higher technology level than their headquarters. Cases A, 2, 3, 4 and 5 stress localized human resource recruitment and have achieved a high degree of foreign embeddedness. Cases G, H and I all retained the preexisting R&D branches, regulars and patented technologies after acquisitions of local firms. For these cases involved in the first situation, large technological gaps exist between R&D units and HQ. Short-term professional transfers from HQ to overseas units are mainly motivated by technological learning and training since the units have stronger R&D capabilities (see figure 5-3, situation 1). Meanwhile, local specialists recruited in R&D units are also sent back to HQ either for specific technology requirements of HQ or for skill training of Chinese R&D employees. In this situation, a reverse intra-firm knowledge flow from R&D unit to HQ occurs when the process of bi-directional R&D human resource transfer continues.
In the second situation, cases B, C, D, E and F in Europe and case 1 in the U.S. have relatively equal technological capabilities compared to their headquarters since the main labor force of these R&D units is Chinese domestic employees who are dispatched from the HQ. Regarding these R&D units, utilizing local technological assistance is necessary owning to their lack of ability in some key R&D capabilities. Due to their proximity to the technological frontiers, a high percentage of Chinese R&D professionals are transferred from headquarters to overseas units with specialized R&D tasks in order to collaborate with external partners or be exposed to external knowledge networks. Compared to the first situation, the cases in the second group foster the strategy of active learning from local technological/market experts in the U.S. and Europe in order to offset their technological/market weakness in China (see figure 5-3, situation 2). Due to the high frequency of R&D personnel transferring, information/know-how can be brought back to HQ easily.

There are three main factors that influence a Chinese company to be in situation 1 or situation 2.

(1) Suitable R&D resources. Cases G, H, I and 2 all aim at the R&D of specific products, and they all find suitable R&D resources such as technologies and equipment that they need. These cases chose to first internalize the relevant R&D resources and then digest internally. Otherwise, Chinese companies have to choose situation 2, turning to external R&D assistance.

(2) Suitable high-quality human resources. Case A, and cases 2, 3, 4 and 5 all have a high percentage of locally recruited R&D employees, especially local Chinese immigrants, who can teach domestic Chinese human resource internally. In such a case, learning will happen in situation 1. Actually, there are plenty of high-quality human resources in both the U.S. and Europe. However, finding suitable R&D employees is still difficult for some Chinese companies. For instance, the case 1 interviewee explained their situation like this, “First, it is not easy to recruit local specialists in the TV industry in the U.S., especially those who meet our specific requirements. Second, the local specialists don’t quite know the situation of R&D in the HQ. Hisense USA has locally recruited marketing staff. They can help us
understand the U.S. market better."

(3) Cost-efficiency. Cost is another important consideration for some cases who decide (e.g., case E) to keep an external cooperation relationship with local partners in Europe but not to internalize external R&D resources such as recruiting local high-cost human resource on a regular basis. Project subcontracting or temporarily hiring specialists from local companies according to the requirements of projects seem more cost-efficient for those Chinese companies who choose to be in situation 2.

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### Table 5-2 R&D structure of Chinese companies

<table>
<thead>
<tr>
<th>Cases</th>
<th>Centralization vs. decentralization</th>
<th>Main coordination &amp; communication mechanisms</th>
</tr>
</thead>
</table>
| Case A | Case A participates in the decision-making process.  
“Since we are close to the European market, the HQ has to consider our suggestions. Our center participates in the discussion of product planning and personnel demand plan held in the headquarters every year.”  
“After the personnel demand has been made clear, we have a considerable autonomy to find the suitable personnel by ourselves. Finally, we will report the candidates to the headquarters and the headquarters will do interviews with the candidates on certain technological fields.” | 1. A direct contact channel from senior management in HQ to junior technicians  
2. Project report/suggestion to the HQ on a regular base  
3. Formal conference for project/product planning  
4. Formal regulation |
| Case B | The headquarters takes charge of platform planning, grasping the overall situation. The R&D subsidiary takes charge of sub-project planning, grasping the details.  
“HQ gives us more authorities, we have more space to bring into play. As our Chinese company deepens the collaboration with the western technological experts, we believe that they also will have more understanding of the Chinese market, and they will make the correct choices. I am basically satisfied with the autonomy degree of our R&D center.” | 1. Integrating department in HQ  
2. Project schedules  
3. Specific project manager who is in charge of communication between HQ and R&D center in terms of a specific project  
4. Human resource transfer |
| Case C | The R&D unit has a low autonomy degree  
“Our R&D center doesn't have much autonomy degree. We cannot decide which project to do. If we want to do a project, we can prepare a plan and submit it to the HQ, which will decide and arrange the project.” | 1. Manager/engineer transfer  
2. Time schedule for each project  
3. Report system  
4. Skill training with HQ employees |
| Case D | “We have a better understanding of local technological suppliers and a better grasp of local products. We are able to make a judgment on which technology/product can better adapt to the European market. We should give our professional feedback to our headquarters. If we already have made a decision, we should report to our headquarters, if we are between two opinions, the headquarters will help us make our decision.”  
“Our HQ controls the whole product development process. We co-develop new products with our HQ, and most of the work is undertaken by the HQ.” | 1. Time schedule for each project  
2. Manager/engineer transfer  
3. Telephone/email  
4. Integrating person in HQ  
5. Technical analysis report to HQ on a regular base |
<table>
<thead>
<tr>
<th>Case</th>
<th>Description</th>
<th>Methods</th>
</tr>
</thead>
</table>
| E    | Big plans are decided by the headquarters. Case E does not have the right to make decisions but comply with the orders given by the HQ. Each discussion has to be passed by the headquarters. The local cooperative partners are also decided by the headquarters. As for the specific contacts, the HQ will give the unit a specific authority. The R&D units will take charge of the concrete communication and operation within the scope of the authority's power. | 1. Engineer transfer  
2. Teleconference  
3. Email/telephone  
4. Manager' direct, personal surveillance of the R&D unit's behavior |
| F    | "We report and discuss the results of local market investigations with our HQ. The decision-making power is held by the general manager in the HQ." | 1. Regular report to HQ |
| G    | "The subsidiary can make decisions on the cooperation with local partners itself. The headquarters only controls the cost. Before launching a project, the subsidiary will firstly report to the headquarters. A budget should be developed and submitted to the headquarters. The headquarters will make decisions based on the budget, and the subsidiary handles the details of the project." | 1. Formalized rules and regulations  
2. Short-term transfer  
3. Budget control |
| H    | "The latest generation of products is developed by the German side. Hence, the German side takes the lead. The German side sends technical specialists to headquarters for the cooperation on key component production in China. Our Chinese side mainly participates in providing components to the German side for new products:"  
"I think the Chinese side should participate more in decision-making and decrease the degree of autonomy on the German side. | 1. Manager/engineer transfer  
2. Report to HQ |
| I    | Qianjiang Motor entered the high-end motorcycle market in developed countries via the acquisition of Benelli.  
"We have a high degree of autonomy in terms of high-end motorcycle projects. However, the final decision is still made by the headquarters." | 1. Project planning and schedule  
2. Teleconference  
3. Email  
4. Manager/engineer transfer |
| 1    | "Normally, our HQ makes decisions for us, and we participate in the decision. We tell our HQ which new products are relatively popular. Certainly, we really hope more projects will be moved to the U.S. R&D branch, and then we will make a more rapid response to local customers. Moreover, market information can be directly collected through face-to-face communication with our customers. However, we should never go too fast since Hisense always maintains a stable and steady operating style. The U.S. R&D branch won't suddenly expand to a larger scale. That's too dangerous." | 1. Intranet/public information platform  
2. Teleconference  
3. Short term engineer transfer from China to the U.S. |
| Case 2 | “SG launches different projects for the North American market and Chinese market. If the project aims at the North American market, the US R&D branch will conduct market analyses and determine whether the new technology can be commercialized.” “We certainly still conform to the HQ since the investment is finally decided by the HQ.” If the project aims at the Chinese domestic market, the whole R&D platform will accordingly be located in China. The US R&D branch will provide recommendations/suggestions to the HQ, and the finally decision will be made by the HQ.” |
| Case 3 | ZTE have a product management division in HQ which takes charge of project approval and strategic decision making. When the division decides to start a new product project, it will make a specific plan on the project including the expected global sales, the project schedule, and the human & material resource to be devoted, etc. Then, the project will be allocated to R&D branches. “There is an expert panel to tell us the specific tasks. And we organize a cross-regional R&D project team according to the key technologies and R&D personnel involved. The HQ will track and manage the whole project. The project team will be dismissed when the project is finished.” |
| Case 4 | “Data unavailable” |
| Case 5 | “Data unavailable” |
Proposition 2b: We find similar informal coordination and communication mechanisms used by Chinese companies to coordinate their R&D units in Europe and the U.S. and to facilitate knowledge learning and transfer.

3.2.2 Hierarchical division of R&D labor

A recent study argues that R&D organization is hierarchical for the purpose of IP protection (Quan and Chesbrough, 2010). In this chapter, we find similar evidence that Chinese companies place high-value-added R&D activities in their R&D units in developed countries, and the low-value-added activities are retained at home.

Table 5-3 Hierarchical division of R&D labor in Chinese companies

<table>
<thead>
<tr>
<th>Hierarchical division of R&amp;D labor in Chinese companies</th>
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<tbody>
<tr>
<td>Domestic R&amp;D activities in China</td>
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<tr>
<td>Product development for domestic markets</td>
</tr>
<tr>
<td>- Technology commercialization</td>
</tr>
<tr>
<td>- Industrialized production</td>
</tr>
<tr>
<td>- Technical adjustment/adaptation</td>
</tr>
<tr>
<td>Overseas R&amp;D activities in the developed countries</td>
</tr>
<tr>
<td>Basic/applied research on new technologies</td>
</tr>
<tr>
<td>- Conceptual/prototype design</td>
</tr>
<tr>
<td>- New product development for local/global markets</td>
</tr>
<tr>
<td>Local partners/suppliers in developed countries</td>
</tr>
<tr>
<td>Technological assistance and supply:</td>
</tr>
<tr>
<td>(1) Core technologies/components</td>
</tr>
<tr>
<td>(2) Peripheral technologies/components unrelated to the core competence of the company</td>
</tr>
</tbody>
</table>

However, IP protection is not the main consideration of Chinese companies according to our evidence. Sufficiency of low-cost and skilled labor force but insufficiency of
advanced talents is a real picture of technical human resources in China. Therefore, the lack of labor skills and core technologies in China is the most important reason that induces hierarchical division of R&D labor in Chinese companies.

For many of our cases, such as cases A, B, C, E, G, and H as well as cases 2, 3, 4, and 5, their primary mission is high-value added technologies/products, while their domestic R&D sectors assume technological application and development, product commercialization and production industrialization (See table 5-3). To a large extent, this division of R&D tasks aims to compensate for the disadvantage of the Chinese firms’ low technological/design level, while taking full advantage of the low-cost of production. This is different from developed-country-based MNCs that put low value-added R&D activities in China due to IP concerns, as found in the previously mentioned research. (Quan & Chesbrough, 2010)

The case of ZTE shows a hierarchical division of labor. The R&D organization of ZTE can be viewed as a matrix (see figure 5-4). The overall planning of global new product development is coordinated by the HQ. All the R&D units cooperate together to develop new products in order to avoid wasteful resource replication.

“As for each type of technology (see the columns), we have specialized teams of various technical levels from junior to senior. When the HQ decides to start a new product project (see the rows), we will select the appropriate R&D personnel from not only domestic R&D centers but also our global R&D units to organize a R&D team according to technological sophistication since the development of new product needs multiple technologies (interview, case 3).”

The specialists in the U.S. unit act as the leader of the projects, taking charge of the overall planning and design of new products, while the detailed implementation and development activities are assumed by the domestic engineers in China.

“The R&D human resources we recruited are specialists who always have a strong background and an overall point of view (or a broad perspective) in a particular technological field. In fact, these specialists or talents are appointed to important positions such as senior system engineer, project manager or trailbreaker in specific technological fields to take charge of new product design (interview, case 3).”
In such an arrangement, ZTE can effectively leverage its global R&D resources to utilize not only specialists at a senior level for integrated planning, but also plenty of skilled engineers with a cost advantage.

**Figure 5-4** The matrix organization of new product development of ZTE

Moreover, technological assistance and supply from local partners in host countries are necessary since a company cannot internalize all of the relevant knowledge resources. Therefore, ZTE US R&D units engage in chip design, and meanwhile buy some core technologies from large local chip manufacturers such as lsi, IBM and ST. The interviewee of case 3 explained: “The process of chip design & development involves many IP cores. However, as a peripheral (although important) part of chip development, these IP cores and the subsequent wafer processing are not related to our core competence. Therefore we directly buy IP cores and outsource wafer processing to the local specialized chip manufacturers.”

Proposition 2c: We find hierarchical division of R&D labor in Chinese companies. Chinese overseas R&D units undertake high-value added R&D activities while domestic R&D activities in China are relatively low-value added.
3.3 Modes of Learning

China is still a “student” of high technology, lagging far behind developed countries/economies such as Europe and the U.S. Mainland China ranked 37 in the Global Innovation Index 2008-2009, where the U.S. occupied first place, and another 5 European countries, including Germany (2nd), Sweden (3rd), the U.K. (4th), Switzerland (7th), Denmark (9th) and Holland (10th), also reached in the top 10.

Figure 5-5 Distribution of 21 Chinese companies in top 1000 non-EU companies by level of R&D investment

According to the 21 Chinese companies on the list of 1000 non-EU companies by level of R&D investment, more than 60% of the Chinese companies with a high R&D investment level belong to low or medium-low R&D intensity sectors (see figure 5-5).

Learning from their advanced counterparts located in developed countries has been identified as an important strategy according to our cases. We find evidence of two different modes of learning in the U.S. and in Europe, and we describe these two modes of learning in this section referring to an analogy: Chinese companies engage with their learning environment in the U.S. as Ph.D. students would do, while their attitude in Europe is closer to the way that vocational school/technical school pupils interact with their teachers.
3.3.1 “Vocational/technical school model” in Europe

In Europe, we found many cases of “vocational school model”/ “technical school model”. Technological immaturity pushes Chinese companies to enter “vocational / technical schools”, engaging in local partnership-building with the purpose of learning new skills. After initial very close collaboration with local partners or deep embeddedness in local R&D networks, we notice the emergence of experiential learning directed by the headquarters in the European cases, i.e., after graduation from vocational schools/technical schools, Chinese engineers soon pick up some fundamental skills and they can say “we can do this by ourselves”.

These R&D units with the entry mode of greenfield investment (cases B, C, and E) let their Chinese R&D employees gradually undertake more R&D activities that could only be only fulfilled by external R&D specialists.

As soon as cases B, C and E entered Europe, they found suitable “vocational/technical schools” respectively. For instance, case B (JAC) found Pininfarina, case C (Chang’an) found IDEA, and case D (Weichai) found AVL. The insufficiency of in-house technological capabilities led to a state of “walking on crutches” since the very beginning. Cases B, C, and E bring their “students”, i.e., the R&D employees in China, to these “schools” to receive training. In the initial stage, cases B, C and E depend largely on the “vocational/technical schools”. However, after a period of training, Chinese “students” graduate from the “schools” and start to undertake some R&D tasks with the technical skills they’ve learned. These graduated “students” can either work in the R&D units or return back to the headquarters, performing as the backbone of the R&D force in China. JAC’s mode of external cooperation has shifted from whole project outsourcing to subcontracting. “At this moment, we turn more to our own R&D capabilities and undertake the majority of the tasks. We control the operation of the entire project which our designers and engineers are increasingly involved in. We cooperate with local companies when we are shorthanded or run into technical difficulties. We now have cooperation with large companies such as Pininfarina, as well as local cost-effective SMEs. Actually, our
cooperation with Pininfarina has relatively decreased since our cooperation mode has changed from outsourcing to project cooperation (interview, case B).”

“We have a close cooperative relationship with the headquarters because we do the same projects. Meanwhile, we undertake more responsibilities since we’ve built some degree of R&D capacity (interview, case B).”

Another example is Weichai. The vocational/technical school of case E is run by Weichai and AVL in cooperation. Case E has no local recruited employees but only “visiting students” dispatched from China. The “students” usually graduate and return back to China within 2 years. After the “diploma project” of Euro III series diesel engines, Weichai independently designed and developed Euro IV and V series diesel engines with only the external support from some key component suppliers. Moreover, AVL also stopped playing the role of co-operator of case E, but acts as an external cooperator.

As for those R&D units with the entry mode of M&A (cases G, H, and I), part of the R&D activities previously undertaken by the acquired foreign company gradually shift back to China. Acquisition of local company allows cases G, H and I to build their “vocational/technical schools” internally. As the interviewee of case G said, “We purchase overseas technologies, and more importantly, we should assimilate the imported technologies.” In order to accelerate the assimilation-process, the retained previous R&D specialists become the “tutors” of Chinese R&D employees, and both “tutors” and Chinese “students” have a bi-directional transfer for technological teaching and learning. Along with the internal learning process, the technological capability in headquarters has upgraded. Chinese "students" are now able to undertake some tasks autonomously that they cannot complete before. The interviewee of case G stated that “At the moment, we can already develop some of the key components by ourselves even though the specification is still incomplete and the components are of average quality. We’ve made large technological progress in contrast to our former selves.”

DMTG, Hisun and Qianjiang all implement their plan to shift part of the functions of their acquired companies to China, including product development,
commercialization and production (see figure 5-6). In particularly, Hisun shut down the European assembly lines and transform the acquired company into a dedicated R&D center. All the production resources have been integrated into the parent company in China. Similarly, Qianjiang has upgraded its technologies in terms of high-end motorcycles. Many spare parts & components which were never produced by Qianjiang before, therefore, are domestically manufactured now. The interviewee of case I gave the explanation for technology/manufacturing improvement. “One aspect is manufacturing equipment. We directly buy manufacturing equipments from Europe. Another aspect is technological interaction. The Italian side and the Chinese side continuously keep communicating and cooperating with each other, especially regarding to the project progress. Our Italian specialists will also be dispatched to personally guide the production in China (interview, case I).”

3.3.2 “Ph.D. students model” in the U.S.

In the U.S. we found many cases of what we call “PhD student learning models”. During the PhD programme, a student is receiving training and learning new skills. However, the main difference with a “vocational/technical school” is that the doctoral student is actively involved into the research of his/her mentor, and upon graduation he/she is now a colleague of the teacher. The student is therefore engaged into an experience to catch up with the faculty and then join them in their academic world. In order to keep a constant level of integration with cutting-edge technologies, Chinese companies act as “Ph.D. students” in the U.S. and try to be embedded in local innovation system. Moreover, US-based R&D units open a window

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to let Chinese engineers interact and collaborate with their “professors” directly, and not merely absorb their knowledge.

As the oldest R&D unit(s) among our cases in the U.S., ZTE (case 3) is still “working for its doctorate” since receiving only one doctoral degree cannot satisfy ZTE anymore. When ZTE graduates from one major, it will study for the next doctoral degree (See figure 5-7). This is largely because new telecommunication technologies are upgrading frequently, and every technology or product has a lifecycle. While new technologies are continuously emerging and old technologies are maturing, these prior R&D branches are going through a functional shift from technological R&D to market service. For instance, the R&D branch in San Diego has lost its original functional position of high-end CDMA talent base since CDMA technologies have matured. These CDMA specialists who work in San Diego gradually changed their role of technological explorer to serve market exploitation in the U.S.

Figure 5-7 The “double Ph.D. model” of ZTE in the U.S. (Case 3)

ZTE US now has shifted their focus from telecommunications system and equipment to micro-electronics. At present, China has cultivated a strong R&D capability of system equipment and even goes beyond the U.S.

“At this moment, micro-electronics has turned into the core competitiveness of the telecom industry. We have to possess the R&D capability to develop microelectronic components, microelectronic chips, etc. in order to take leadership in system equipment. We have many low-end microelectronic chip providers but lack high-end microelectronic chip providers. If we wait for someone else’s R&D outputs, we will lag
behind. Therefore, we now have put considerable efforts into the R&D of high-end chips (interview, case 3)."

The other cases (except for case 1) we observed in the U.S. are newly established compared to ZTE. However, these cases all reveal the characteristics of “Ph.D. candidates”. These R&D units are integrated into local innovation systems and their ties to the U.S. seem to be closer compared to the “vocational school model”/“technical school model”.

First, “Ph.D. candidates” recruit local high-level specialists in certain technological fields but do not dispatch Chinese engineers from headquarters to form their R&D team. An example is Alibaba. Currently, all the R&D employees in the U.S. are locally recruited. “Actually, we had intended to bring all the recruited specialists back to China. It is very challenging if the R&D team disjoints with our mainstream business operations. However, we have to consider their ties to the U.S. (e.g. family). In addition, there is also the advantage that we can keep a breath with the latest technology if we set up an R&D branch in the Silicon Valley (interview, case 4).”

“If possible, we still hope these specialists can stay in China for one year in order to bring back technologies from the U.S. It is an overall goal. Anyway, our knowledge center is based in China (interview, case 4).”

Second, “Ph.D. candidates” also interact with local technological “mentors” with a long-term perspective.

After the acquisition of the U.S. subsidiary, SG on the one hand replaced the whole previous R&D team with a newly recruited technical director and R&D staff, and on the other hand built up a long-term collaborative relation with local technological providers. In order to maximize business benefits, SG’s US unit introduces local technological partners into the new product development process at an early stage, and these technological cooperators will finally become the future suppliers of SG US when the co-developed new products are put into production.

“Our local partners participating in the development of our new products at an early stage are our potential suppliers. Our cooperation with these potential suppliers mostly can be viewed as a simple buyer-seller relationship so that both sides
maintain a certain degree of independence with a mutual objective. In a vehicle system project, our partners focus on their expertise such as some core automotive technologies, and we specialize in our areas of competence (interview, case 2).”

Through such cooperation, SG US R&D branch obtains multiple advantages: (1) cost advantage. “First of all, such a cooperative approach is appropriate from a cost perspective. We can make the best of external human resources without expanding the scale of our current R&D team, and consequently we also gain cost advantages (interview, case 2).” (2) Face-to-face interaction with “professors”. “Secondly, our own resources are limited, and we need external ideas and comments. During cooperation with external partners, i.e., potential suppliers, we broaden our thinking and enlighten our minds (interview, case 2).”

Last but not least, for the Ph.D. student model, technology exploitation of the local market is also an important goal for some Chinese companies in the U.S.. For example, SG’s US unit plans to further enlarge the scale in order to implement integrative operation from R&D to production and sales. “After we establish this R&D center, our next step in the U.S. is to embark on assembling production. In this case, we will first realize industrial application of new technologies in the U.S., which will be later copied to China for further large-scale production (interview, case 2).”

In such a case, knowledge learned by the “Ph.D. students” is kept and applied to the U.S. market firstly by the Chinese R&D branches and later transferred back and applied in China due to the different levels of market maturation between the U.S. market and China’s domestic market. This is different from the “vocational/technical school” model.

Proposition 3: We find many cases of “vocational/technical school model” in Europe, from which we notice the emergence of experiential autonomous learning in Chinese R&D units after initial close collaboration with local partners in Europe. Meanwhile, we also find the “Ph.D. students model” in the U.S., from which we notice that many Chinese R&D units in the U.S. maintain collaborative learning with local partners and are highly embedded in the local innovation system in the U.S.
4. Summary and Discussion

4.1 R&D Motive

Two R&D strategies used by Chinese companies have been identified: (1) A strategy of technology exploration in industrialized countries/economies where technological capability is relatively stronger can be adopted by young Chinese companies at an early stage of globalization in order to offset technological weakness at home. This strategy is contracted to the traditional internationalization theory that a strong 'home base' with both developed product strategies and core technologies is a necessary precondition for overseas knowledge exploiting and augmenting in those destinations where technological capability is superior to that of MNCs (Kuemmerle, 1999). Utilizing advanced infrastructure, technologies and R&D human resources in developed countries to offset technological weakness at home is applicable for many Chinese companies whose main business is still confined to the domestic market. While facing ever-growing competitive pressure from both home and abroad, how to maintain and enlarge market share in China and seek technology development have become a centrifugal force which accelerates the R&D decentralization process of Chinese companies even before a strong 'home base' is built up.

(2) An ambidextrous R&D strategy of pursuing a dual motive, i.e., technology exploration and technology exploitation, at the same time. During the international expansion process of emerging multinationals, an ambidextrous behavior has been identified as a unique strategy for simultaneously achieving two different goals (Luo and Rui, 2009; O'Reilly III and Tushman, 2004). Our evidence is quite similar to the co-orientation dimension of the ambidextrous model that was put forward by Luo and Rui (2009) who stated that Chinese companies set both short-term and long-term goals for technology exploration and technology exploitation. On the one hand, short-term financial pressure forces them to seek survival and strive for economic benefits in developed country markets, leveraging their existing competitive advantages at home, such as cost advantage. In this case, Chinese R&D
units are responsible for adapting their technologies/products to the local market and providing technical support for sales. On the other hand, Chinese companies also clearly recognize that the pacing factor for long-term sustainable development is to obtain core technologies. We think this is an important reason to explain why we didn’t find any cases that play a pure strategy of technology exploitation.

4.2 R&D Structure

We discuss the R&D structure of Chinese companies from both horizontal and hierarchical perspectives. According to our cases, no matter if it is the oldest R&D unit or the youngest one, most Chinese companies remain a participative centralized structure while seeking a balance between internal connectivity and external autonomy. In most of our cases, the overseas R&D units take initiatives in local human resource recruitment and local partners-seeking as well. Moreover, they also have much say in starting a new project. Based on the interviews, such an autonomy arrangement has much to do with their proximity to technology and market. However, the final decision-making power is still in the hand of the Chinese headquarters. There could be several reasons for such an authority distribution. Different from the mature R&D units of developed country MNCs, we found many Chinese R&D units keep a small-scale structure (see table 4, the row of R&D employees) which is only composed of a small amount of elites in certain technological fields, while the majority of R&D resources, including a large number of low-cost as well as skilled R&D labor force are stored by HQ in China. These R&D units cannot to be independent of their HQ though they are close to advanced technology and human resource.

Such a small-scale structure is designed in order to have the advantages of both cost efficiency at home and advanced as well as high-cost technologies and specialists in host countries. Chinese companies therefore construct a specialized hierarchical division of R&D labor that low-value added R&D activities are implemented in China and the overseas R&D units are only responsible for part of high-value-added activities. In such an inverted pyramid structure, overseas R&D units play as a
member of a whole project team and only can undertake part of the high-value added activities. Consequently, how to appropriately allocate R&D resources and coordinate dispersed R&D units has become the key task of Chinese headquarters. Our evidence shows the common managerial methods used by Chinese companies to coordinate overseas R&D units. Besides formal coordination mechanisms, informal coordination and communication mechanisms, including IT-related communication tools, human resource transfer and project-based teamwork are more effective for learning and knowledge transferring.

4.3 Learning Modes

We find different learning modes of Chinese companies when they invest in R&D in the U.S. and Europe. According to our cases, many Chinese companies in Europe prefer to take the “vocational/technical school model” while the cases in the U.S. choose the “Ph.D. student model”. There is continuous cooperative-learning going on in the U.S. cases, while a process of ‘labor substitution’ has been started in the E.U. cases.

The "vocational/technical school model" cases train their Chinese R&D employees by cooperating with local advanced counterparts. However, this kind of cooperation weakens along with the enhancement of Chinese employees' R&D capabilities. Chinese indigenous labor forces gradually substitute European partners. As collaboration weakens, these R&D units become more insulated, less engaged in cooperative-explorative learning, and more active in experiential-exploitative learning, starting from the knowledge base already accumulated at home and abroad. By contrast, we see the "Ph.D. student model" cases are locally embedded, employing local employees as well as cooperating with local partners. Moreover, we don’t find evidence that these cases become isolated from local innovation systems. For some cases, technological advantages also lead to direct exploitation of local markets even before the new technologies are applied in China's domestic market.
In order to seek the reasons why different learning modes are used by Chinese companies in Europe and the U.S., we try to use secondary sources of data to give some reasonable explanations from a macro-perspective.

We propose that learning mechanisms (both static and dynamic) of Chinese R&D abroad is inferred by other variables as follows:

1. First of all, we have to admit that our cases in the U.S. (except for ZTE) are younger than the cases in Europe. It is hard for us to observe the long-term evolutionary process of Chinese companies in the U.S..

2. We propose that such different learning modes reflect certain difference, such as different knowledge levels, in the U.S. and the European market.

(1) This could be the result of the American business and innovation system that is more conducive to the development of long-term technological collaboration with international partners. A vast literature considers the U.S is a more innovative and open environment. Chinese companies in the U.S. are still catching up in cutting-edge technologies. According to the 2009 industrial R&D investment scoreboard, the total amount of R&D investment from the U.S. companies is €159.2bn which is higher than the total amount of €122.3bn invested by the E.U. companies. Moreover, The U.S. reinforces its leading position in high R&D-intensity sectors such as the ICT-related industry and the pharmaceutical & Biotech industry, which account for 69% of the US companies’ R&D investment. By comparison, almost half of the R&D investment from the E.U. companies derive from medium-high R&D sectors (EC, 2010).

(2) This could be the result of the cross border movement of qualified human resource from China to the U.S.. The U.S. is a traditional country of immigrants, which is an attractive place for Chinese intelligentsia. For example, Chinese and India immigrants have become the largest groups of high-technology, high-skill immigrants and have recently increased substantially in the Silicon Valley (Hart, 2007; Saxenian et al., 2002). Chinese immigrants have various professional ties to their native

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34 R&D intensity above 5%
35 R&D intensity between 2% and 5%
countries, and are prone to keep a close relationship with Chinese companies and even the Chinese government. In this case, we propose that the collaborative climates in the U.S. are more specific and suitable for Chinese companies than in Europe.

5. Conclusions and Implications

Recently, more and more MNCs from emerging and developing countries are investing in developed countries rather than other developing countries. International business scholars have noticed this new phenomenon and are urged to systematically explore the differences between the new wave of third-world-MNCs and the old waves, as well as the differences between third-world-MNCs and developed country MNCs (Ramamurti, 2004).

In this chapter, we focus on the advanced stage of FDI from China which is a prominent emerging country, and therefore investigate Chinese R&D strategies in Europe and the U.S.. We not only compared Chinese R&D investments in different locations, but also enfold our findings with the current studies on R&D investments from developed country MNCs. We start a discussion on a new model of R&D internationalization, which has significant managerial and policy implications for both emerging/developing and developed countries.

5.1 Managerial Implications

As we analyzed earlier, many Chinese overseas R&D units in the U.S. and Europe are acting as ambidextrous organizations with a dual motive driven by both technology exploitation and technology exploration. At the initial stage, seeking survival is quite urgent for the Chinese companies that have just stepped into developed country markets, and overseas R&D units have to adjust their strategy for the short-term goal and assist in technologies/products adaptation for the local market. Meanwhile, they should keep in mind that their predominant task is to explore advanced
technologies for a long-term development. It is necessary for Chinese managers to balance the two-sided motives strategically.

We identify several strategies used by Chinese companies when they face the managerial dilemma to reach an equilibrium state of R&D structure with both internal integration and external embeddedness. On the one hand, Chinese companies give overseas R&D units sufficient autonomy to participate in decision-making processes since they have full exposure to centers of excellence. On the other hand, Chinese companies centralize the power while making important decisions for the sake of optimum allocation of R&D resources in both R&D units and headquarters. Besides the participative-centralization-strategy, informal coordination and communication mechanisms are more effective than formal mechanisms to facilitate bi-directional learning and knowledge transfer.

Moreover, we find a distinctive hierarchical labor division in Chinese companies enabling R&D cost minimization and R&D efficiency maximization. Since emerging and developing countries usually have a large pool of inexpensive labor forces, R&D units don't have to grow to a complete and large scale R&D center, but keep a small number of elites as an upstream link in the R&D chain, where the downstream links remain in the home country.

Learning has become the main theme of Chinese overseas R&D units. However, the question of how to efficiently learn from external knowledge networks still needs to be further investigated. In our cases, we see various learning and cooperation modes, which can be used as a reference by other MNCs from emerging and developing countries as well.

5.2 Policy Implications

Europe and the U.S. are two of the world’s most developed regions that attract more and more investments, especially technology-related investments, from China as well as other emerging and developing countries. The economic concerns as well as national security impacts of Chinese investments have received increasing attention
Our findings demonstrate that many Chinese companies invest in R&D with similar business-related motives but not political or government-driven motives. We also find that Chinese companies deploy different learning modes in Europe and the U.S.. Some cases in Europe tend to insulate themselves from their original partners and increasingly rely on good indigenous labor after a period of collaboration and learning from their local partners. However, we don't find evidence that Chinese companies in the U.S. are isolating themselves from local innovation systems. On the contrary, the cases in the U.S. continuously deepen their local embeddedness by consolidating cooperation with local partners or establishing new partnerships as well as recruiting local employees. This deserves special attention from both European and American policy makers. What does this mean for Europe and the U.S.? Why do Chinese R&D investments in Europe and the U.S. show different dynamics? Should policy makers encourage Chinese companies to maintain high level of engagement with local partners?

In addition to the shorter presence of Chinese R&D units in the U.S. than the ones in Europe, we propose that (1) maintaining leadership in cutting-edge technologies, and (2) maintaining attractiveness for high-skilled immigrants are important reasons for Chinese companies to choose a more active and long-lasting learning mode in the U.S.. Moreover, policymakers should not ignore that behind these Chinese companies lies an even larger China’s domestic market. While Chinese companies are increasingly involved in learning and cooperation in Europe and the U.S., they also open a window toward China for their local collaborative partners.

Technology-related FDI from emerging and developing countries brings both opportunities (e.g., increasing employment opportunities and public revenue) and challenges (e.g., protection of intellectual property and national security) to developed countries and this phenomenon urges policy makers to give timely responses.
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## APPENDIX 1: Chinese R&D units in the U.S.

<table>
<thead>
<tr>
<th>No.</th>
<th>Setup time</th>
<th>Company name</th>
<th>destination</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2005</td>
<td>Lenovo</td>
<td>North Carolina (Research Triangle Park)</td>
<td>Personal computers</td>
</tr>
<tr>
<td>2</td>
<td>2008</td>
<td>Hisense</td>
<td>Atlanta</td>
<td>Consumer electronics</td>
</tr>
<tr>
<td>3</td>
<td>2002</td>
<td>Hisense</td>
<td>Chicago</td>
<td>Consumer electronics</td>
</tr>
<tr>
<td>4</td>
<td>2007</td>
<td>Greatsource</td>
<td>San Francisco</td>
<td>LCOS</td>
</tr>
<tr>
<td>5</td>
<td>2008</td>
<td>Liaoning SG</td>
<td>Troy, MI</td>
<td>Automotive</td>
</tr>
<tr>
<td>6</td>
<td>N.A.</td>
<td>Harmony Technologies</td>
<td>Cambridge, MA</td>
<td>Computing platforms and IT application solutions</td>
</tr>
<tr>
<td>7</td>
<td>N.A.</td>
<td>Weichai</td>
<td>Chicago</td>
<td>Diesel engine</td>
</tr>
<tr>
<td>8</td>
<td>1998</td>
<td>ZTE</td>
<td>New Jersey</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>9</td>
<td>2000</td>
<td>ZTE</td>
<td>Dallas</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>10</td>
<td>2001</td>
<td>ZTE</td>
<td>San Diego</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>11</td>
<td>2000</td>
<td>Huawei</td>
<td>Silicon Valley</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>12</td>
<td>2000</td>
<td>Huawei</td>
<td>Dallas</td>
<td>Telecommunications</td>
</tr>
<tr>
<td>13</td>
<td>N.A.</td>
<td>Haier</td>
<td>Los Angeles, CA</td>
<td>Domestic appliance</td>
</tr>
<tr>
<td>14</td>
<td>N.A.</td>
<td>Haier</td>
<td>South Carolina</td>
<td>Domestic appliance</td>
</tr>
<tr>
<td>15</td>
<td>1997</td>
<td>Galanz</td>
<td>Naperville, IL</td>
<td>Domestic appliance</td>
</tr>
<tr>
<td>16</td>
<td>1999</td>
<td>Skyworth</td>
<td>Silicon Valley</td>
<td>Consumer electronics</td>
</tr>
<tr>
<td>17</td>
<td>N.A.</td>
<td>TCL</td>
<td>Indianapolis, IN</td>
<td>Consumer electronics</td>
</tr>
<tr>
<td>18</td>
<td>N.A.</td>
<td>Inspur</td>
<td>Seattle, WA</td>
<td>Computing platforms and IT application solutions</td>
</tr>
<tr>
<td>19</td>
<td>2001</td>
<td>Holley</td>
<td>Dallas</td>
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<td>Detroit, MI</td>
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<tr>
<td>25</td>
<td>2007</td>
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<td>New York</td>
<td>Pharmaceutical</td>
</tr>
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<td>26</td>
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<td>Kanglaite Group</td>
<td>Alameda, CA</td>
<td>Pharmaceutical</td>
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<tr>
<td>#</td>
<td>Year</td>
<td>Company</td>
<td>Location</td>
<td>Industry</td>
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<td>Telecommunications</td>
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Source: Our elaboration of various secondary sources such as fDi markets, LexisNexis® Academic, Factiva, world investment reports, official websites of Chinese companies, etc.
### APPENDIX 2: Chinese R&D units in Europe

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</tr>
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<td>Sweden</td>
<td>Telecommunications</td>
</tr>
<tr>
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<td>Italy</td>
<td>Domestic appliances</td>
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<td>Demark</td>
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<td>Germany</td>
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<td>Germany</td>
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Source: Our elaboration of various secondary sources such as fDi markets, LexisNexis® Academic, Factiva, world investment reports, official websites of Chinese companies, etc.
APPENDIX 3: Chinese R&D units in the other locations (except for Europe and the U.S.)

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Source: Our elaboration of various secondary sources such as fDi markets, LexisNexis® Academic, Factiva, world investment reports, official websites of Chinese companies, etc.