A comparison of international R&D strategies of Chinese companies in Europe and the USA

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A Comparison of International R&D Strategies of Chinese Companies in Europe and the U.S.¹

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Abstract

Europe and the U.S. are the two popular overseas R&D investment destinations for Chinese companies. We explore whether there are significant differences or similarities in the comparison of international R&D strategies of Chinese MNCs in Europe and the U.S.. Specifically, we examine how Chinese MNCs implement R&D strategies to facilitate learning. We adopt the method of theory building from case study research to answer this question. Based on 14 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. Our findings have strong managerial and policy implications.

Keywords: Chinese multinational corporations; R&D motive; R&D structure; Learning mode; U.S.; Europe


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1. Introduction

While many multinational corporations (MNCs) have been attracted to China to establish offshore R&D centers, research and development (R&D) by Chinese MNCs outside of China is also a growing phenomenon which requires increasing attention in the academic world. In a global competitive environment, some emerging Chinese MNCs have expanded their technological investments abroad to Europe and the U.S. (Chen, Zhao and Tong, 2011; Deng, 2007; von Zedtwitz, 2006; Xie and White, 2006), which are the two popular overseas R&D destinations for Chinese companies (von Zedtwitz, 2006; fDi market, 2008).

Two waves of outward FDI (foreign direct investment) from the 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 going more into developed countries for augmenting assets and enhancing market power. As an important force of the third wave of outward FDI from emerging countries, Chinese companies that have emerged since the 1990s reveal different characteristics than the developed country MNCs, as well as the first and the second waves of MNCs from emerging and developing countries (Andreff, 2003; Gammeltoft, 2008). It is important to investigate how Chinese MNCs implement international R&D strategies in developed countries such as Europe and the U.S..

In this research, we explore the differences and similarities in the comparison of international R&D strategies of Chinese MNCs in Europe and the U.S. How and why are they similar or different? MNC R&D labs have typically been located in developed countries, especially in places that are on
the cutting edge of innovation in order to learn the latest technologies (Florida, 1997; Kuemmerle, 1999a). For emerging Chinese multinationals, why do they establish R&D centers outside of China?

At the center of our discussion here is how Chinese MNCs implement R&D strategies to facilitate learning. We answer this important question through comparing 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 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.? and (3) Modes of learning – how do Chinese companies in Europe and the U.S. deploy their learning strategies?

The paper is structured into seven 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. Then, we explain our methodology and data collection process in Section 4. In Section 5, we make a comparison between cases in Europe and in the U.S. Meanwhile, several propositions are emerged. In Section 6, we further discuss our findings. Finally, both managerial and policy implications are provided to managers and policy makers in Section 7.

2. Literature review

2.1. R&D motive

In order to keep competitive advantages, companies have to build global R&D networks for both acquisition of new knowledge and product commercialization (Kuemmerle, 1997, 1999b). The early role of MNC R&D subsidiaries was conceptualized as a pure market strategy for product adaptation and manufacturing support in host countries by exploiting firm-specific capabilities at home (Almeida and Phene, 2004; Håkanson, 1990; Kuemmerle, 1999b), i.e. technology exploitation. Soon after,
access to technology, i.e. technology exploration, was identified as another important motive leading to R&D decentralization (Florida, 1997; Kuemmerle, 1999b).

MNCs from developed country usually build R&D capabilities and a strong home base before they locate R&D activities abroad (Patel and Vega, 1999). With this prerequisite, Kuemmerle (1999b) divides the R&D motives into home-base exploiting (HBE) and home-base augmenting (HBA). Some literature show that 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, it is doubtful whether the evidence obtained from developed country MNCs can be applied to the MNCs from emerging countries such as China. As latecomers, Chinese companies lag behind technology frontiers (Xie and White, 2006) as well as lack international market experience. Chinese companies usually have technological disadvantages when they step into global competition. In such a disadvantaged situation, Chinese MNCs are likely to take different R&D strategies with different motives.

2.2. R&D structure: a two-dimensional review

2.2.1. The horizontal perspective: centralization vs. decentralization

The topic of R&D centralization/decentralization has been discussed over the last few decades. Many empirical studies suggest that MNCs have switched from a headquarter(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. Managerial challenges arise because of conflicting demands on the organization, resulting on the one hand, from the need for local responsiveness, and on the other, from the search for global efficiency through integration. (Asakawa, 2001; Bartlett and Ghoshal, 1990; Håkanson, 1990; Lehrer and Asakawa, 2002) As for Chinese or other emerging MNCs, it is important to investigate whether they adopt a decentralized structure to give more autonomy to each R&D branches or a hierarchical structure to help exploit the technological strengths in different locations.

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 labs 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 labs 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). 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, have become central parts of MNCs’ global strategies and are assigned higher value-added R&D activities than in the past (Dossani and Kenney, 2009; Quan, 2005). Old centers of excellence are still attractive and retain dominant 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. Learning mode

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, p. 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: experiential learning and cooperative learning (Hitt et al., 2005; Holmqvist, 2004).

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 and tacit knowledge and exploit their existing knowledge stock by accumulating self-experience in different geographic locations.

Cooperative learning is another effective organizational learning path for MNCs. By developing 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.

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 MNCs in R&D from both inter-organizational and intra-organizational perspectives.

3. The presence of Chinese outward FDI in Europe and the U.S.

Hong Kong and the Cayman Islands together account for nearly 80% of Chinese outward FDI. Besides the above two world tax havens, Europe and the U.S. are also popular FDI destinations of Chinese MNCs, attracting 1.7% and 1.3% of Chinese outward FDI respectively (Figure 1). Although data do not show a large percentage of Chinese investment there, investment in Cayman Islands or British Virgin Islands may often find its way to the U.S. or European markets with undocumented amount.

The total amount of China’s outward FDI stocks in Europe and the U.S. have grown steadily, even during the economic downturn in 2008 (see Figure 2). More specifically, Europe and the U.S. are the two most popular destinations for R&D investment of Chinese companies (see Figure 3).

No official database can tell the exact story of Chinese global R&D investment. We therefore collect data by combining a variety of secondary sources, such as fDi Markets (http://www.fdimarkets.com/), LexisNexis® Academic, Factiva, world investment reports, and the official websites of Chinese companies. For this research, we identified eighty-eight overseas R&D units established by Chinese companies.

According to this database, Europe (excluding Russia) and the U.S. are attractive R&D investment destinations for Chinese companies. This finding conforms to the databases of fDi markets and von Zedtwitz (2006), though none of the databases can exactly give the whole picture of Chinese global R&D investment. Examples of Chinese MNC R&D units in the U.S. include ZTE, Huawei, Hisense, Lenovo, Holley, etc; and in Europe include Huawei, ZTE, Weichai, Haitian, Qianjiang Motor, etc. For manufacturing and telecommunications, R&D is critical factors in competitive
strength. Our interview cases as described later provide a bit more details of Chinese R&D presence in these two destinations (see Table 1).

4. Methodology

4.1. Multiple case study approach

This paper employs a multiple case study qualitative method, due to the following reasons:

(1) Case studies can well explain the “how” or “why” questions, since “such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence” (Yin, 1994). (2) The international R&D activity of Chinese MNCs is relatively a new phenomenon. The multiple case study method is effective for exploratory studies (Ghauri, 2004). Interview-based research is suited for exploratory and theory-building studies, and where there is a small population of possible respondents. (3) “Multiple case studies are appropriate when attempting to externally validate the finding from a single case study, through cross-case comparisons” (Chiesa and Frattini, 2007; Eisenhardt, 1989). (4) Interview-based case studies allow researchers to develop a deeper relationship with informants (Daniels and Cannice, 2004).

4.2. Case study process and data collection

We adopt the process of theory building from case study research developed by Eisenhardt (1989).

Selecting cases: In order to collect data, we first identified the location and set-up time of the units established in Europe and the U.S. by combining a variety of sources of information including newspapers, and the internet, personal interviews and the database compiled by fDi Markets (www.fdiintelligence.com). After formulating the research question, we followed the logic of theoretical sampling and pre-selected cases, which vary by industry, home and host location, unit size,
set-up time and entry mode, in order to ensure that each case serves as a ‘distinct experiment’ and provides evidence of various perspectives (Creswell, 1998; Eisenhardt, 1989). The construction of the comparative sample in the U.S. was 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 company 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. The fourteen sample cases we selected for the research are listed in Table 1.

Crafting instruments and protocols: Multiple data collection methods are combined in this research. After researchers established relationships with senior managers in the MNCs, twenty-two face-to-face or in-depth telephone interviews were then conducted. Most of the interviewees were senior R&D managers of the R&D unit. Prior to the interview, we asked the respondents to fill out a questionnaire for the quantifiable questions, which were used for pre-testing the survey instruments (Helble and Chong, 2004) and to verify the validity of the interviews’ findings. We cross-checked and integrated the data from the questionnaires and interviews for both qualitative and quantitative evidence combination (Eisenhardt, 1989). Whenever the answers provided in the questionnaire or in the interviews were unclear, the respondents were contacted again and asked for clarification. The information and data that could not be obtained directly from some of the companies were obtained from secondary sources, such as LexisNexis®Academic (http://www.lexisnexis.com/), Factiva (http://www.factiva.com/) and official websites.

Entering the field: We followed the “constant comparison” grounded theory method developed by
Glaser and Strauss (1967) in which data are collected and analyzed simultaneously (Suddaby, 2006). Every interview was taken by making field notes in Mandarin, which were then translated into English.

Analyzing data: First, case description of each R&D unit was made for similarity of within-case data. Then, we did cross-case comparisons for both similarities and differences analysis of within-group data.

Shaping propositions and enfolding literature: Several propositions were put forward for emergent theory building and are compared with existing literature for both internal validity building and theoretical sharpening.

5. Case analysis and comparison

In order to understand how Chinese MNCs implement R&D strategies to facilitate learning, we first examine the motives of the Chinese MNCs doing R&D abroad. Are they going abroad for technology exploration which involves a lot of technological learning or is the main purpose technology exploitation to take advantage of international market? Then we look at the structure of Chinese MNC R&D networks, which may facilitate effective learning. At last, we analyze the mode of learning for Chinese MNCs in Europe and in the U.S. respectively.

5.1. R&D 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 and similar strategy: Chinese R&D units settled down at locations close to world centers of excellence with specific technological advantages. Based on our database of thirty-one R&D units in the U.S., Chinese companies prefer to invest in
telecommunications, pharmacy, etc., while the thirty-two Chinese R&D units in Europe are more willing to invest in machinery, equipment, and automotive industry (see Table 2).

According to our interviews, all of our 14 R&D case units in the U.S. and in Europe have technology-exploration as their main location motive, while 70% of our case units also mentioned a technology-exploitation purpose (see Table 3). Most Chinese companies are still in infancy in terms of both technology and market knowledge in the global market. In order to catch up and compete with their stronger counterparts from developed countries, they take the initiative in seeking global technological resources abroad. Foreign-market-related motive comes in second place, with 30% of our interviewed cases considered technology exploitation for the global market as an important motive.

As the interviewees stated, proximity to the centers of technological excellence enables Chinese companies to connect with the world’s latest technologies, strengthen R&D capabilities and seize more innovation opportunities. The dominant technology-driven motive of proximity to centers of excellence can be further broken down into the following five sub-motives:

I: 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 mentioned local superiority of R&D infrastructure, facilities and equipment. Chinese firms can now acquire equipment that is not available at home due to U.S. export control or high import costs in the home country.

II: Close proximity to the development of new technologies. Being close to centers of excellence enables Chinese companies to track the latest technology and product development. In contrast to the discussion of 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 and product development trend in developed countries is important for future R&D planning and operating.

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

IV: Acquisition. The fourth aspect is to acquire specific technology or to develop a strategic product by acquiring local companies. In our cases in Europe, many Chinese companies bought local companies and retained their R&D facilities, aiming at specific strategic products that were critical for them to have a leg up on the competition. For instance, Case G, after becoming the main shareholder of F. Zimmermann GmbH, stayed in the state of Baden-Württemberg, Germany, with a focus on R&D of large gantry machining. Case H focused on the R&D of electronic jacquard machinery in Neu-Ulm (Bavaria), Germany; and Case I focused on the R&D of high-end motorcycles in Pesaro, Italy.

V: Human resources. High quality specialized talents 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-skilled talents have been viewed as two 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 were locally recruited, which clearly reflects abundance in 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 and help achieve local R&D embeddedness. In addition, high-skilled talents recruited from host countries also help Chinese MNCs’ R&D personnel training. This motive is quite significant in the European cases such as Cases B, C, E, G, H and I.

Let us use two Hisenese’ R&D units (Case D and Case 1) in Europe and the U.S. as examples. 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 the interviewee in Case D. In order to seek new competitive advantages, Hisenese undertook technological exploration tasks. Case D emphasized that “our aim requires us to keep upgrading our technologies and product quality constantly.” The interviewee of Case 1 in the U.S. mentioned its 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 its European counterpart, the R&D unit of Hisense in the U.S. mainly assisted the HQ in launching new products and serving the North American market, whereas monitoring and collecting the latest technological information for headquarters was still one of the main functions of the unit.

Overall, we found cases B, C, and E in Europe and Cases 4 and 5 in the U.S. representative of an exclusive technology-driven motive, while cases A, D, F, G, H and I in Europe and Cases 1, 2, and 3 in the U.S. pursuing both technology exploration and technology exploitation.

Based on the preceding discussions, we conclude:

**Proposition 1**: Technology exploration appears to be dominant motive for Chinese MNC R&D
units in Europe and the U.S..

5.2. R&D structure

5.2.1. Centralization vs. decentralization

Different R&D structures may have different effects in learning. Existing studies show that different motives can lead to different R&D configurations, and a firm’s market and technology orientations are related to their management styles (Behrman and Fischer, 1980; von Zedtwitz and Gassmann, 2002). In this paper, we use the distribution of decision-making power at HQ/R&D units as the measurement of centralization/decentralization degree of a MNC’s R&D organization (Fischer and Behrman, 1979)³.

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). In this study, we find that most of the Chinese cases had a certain degree of autonomy, while the final decision-making authority was still held by the headquarters (See Table 4). This R&D configuration can be viewed as participative centralization⁴ and has much to do with the R&D project settings, the allocation of R&D resources within Chinese companies, and facilitation of learning. The Chinese R&D units interviewed were small in size and did not possess all the resources needed for entire R&D projects. These

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³ 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).

⁴ Fischer and Behrman (1979) defined four R&D coordination patterns as absolute centralization, 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.”
characteristics determined that Chinese overseas units could not fulfill a whole R&D project independently. In such a case, headquarters started up a new R&D project and assigned tasks to different R&D units. Overseas R&D units took orders from headquarters and worked jointly. A metaphor given by the interviewee of Case C vividly depicted the HQ-subsidiary relationship: “SG launches different projects for the North American market and Chinese market. If the project aims at the North American market, the U.S. 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”.

In most instances, Chinese R&D units utilized their geographical advantages to give weighty advice and proposals to their headquarters on new products/technologies, local human resource recruitment, local partner choosing, etc. They had a certain degree of autonomy on specific matters, especially those businesses related to local operations, though the final decisions still were approved by headquarters.

In practice, participative-centralized R&D structures can facilitate a smooth flow of information between HQ and subsidiaries, which helps the MNC obtain R&D resources and cost efficiency.

(1) R&D resources. Cases G, H, I and 2 all found suitable foreign R&D resources such as technologies and equipment that they needed for the HQ. These cases chose first to internalize the relevant R&D resources through local hires or the acquisition of local existing R&D facilities, and then turned to external R&D assistance. Case A, and Cases 2, 3, 4 and 5 all had a high percentage of locally recruited R&D employees, especially local Chinese immigrants, who can teach domestic Chinese employees easily. In such cases, learning will happen, especially in situations where the HQ does not have the same level of sophistication of the subsidiaries.
(2) Cost-efficiency. Cost is another important consideration for some MNCs who decided to keep an external cooperative relationship with local partners in Europe but not to internalize external R&D resources for cost reason. For instance, case E did not want to recruit local high-cost talents on a regular basis. Project subcontracting or temporary specialist hiring from local companies were more cost-efficient for those Chinese companies. A participative-centralized structure helps achieve cost efficiency, and the decision of subcontracting projects can often be decided locally.

**Proposition 2a:** We find similar participative-centralized structure between R&D units and HQ for Chinese MNCs in Europe and in the U.S., and this R&D structure facilitates learning.

5.2.2. Hierarchical division of R&D labor

A recent study argues that MNC R&D organization is hierarchical for the purpose of IP protection (Quan and Chesbrough, 2010). In this paper, we also find evidence that high-value-added R&D activities are placed in Chinese MNCs’ R&D units in developed countries, and low-value-added activities are retained at home. However, IP protection is not the main consideration for Chinese MNCs in our study. Sufficiency of low cost and skilled labor force but unavailability of high-level talents is a picture of technical human resources in China. Therefore, lack of high-end talent and core technologies in China is the most important reason that induces hierarchical division of R&D labor in Chinese MNCs.

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 to create high-value added technologies or products, while their domestic R&D units assume the roles of technological application and development, product commercialization and production industrialization (see Table 5). To a large extent, this division of R&D activities aims to compensate for the disadvantage of the Chinese firms’ low technological 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 (Quan and Chesbrough, 2010).

The case of ZTE exemplified a hierarchical division of labor. The overall planning of global new product development was coordinated by the HQ. All the R&D units cooperated together to develop new products in order to avoid wasteful resource replication. “As for each type of technology, we have specialized teams at various technical levels from junior to senior. When the HQ decides to develop a new product, 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 based on the product’s technological sophistication” (Interview, Case 3).

The specialists in the U.S. unit of ZTE acted as the leader of the projects, taking charge of the overall planning and design of new products, while the detailed implementation and development activities were assumed by the domestic engineers in China. “The R&D human resources we recruited are specialists who always have a strong background and 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 was able to effectively leverage its global R&D resources to utilize not only senior specialists overseas, but also plenty of skilled engineers back home with a cost advantage. 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 U.S. R&D units engaged in chip design, meanwhile buying some core technologies from large local chip manufacturers such as LSI, IBM and ST. The interviewee in Case 3 explained, “the process of
chip design and development involves many IP cores. However, as a peripheral part of chip
development, these IP cores and the subsequent wafer processing are not related to our core
competence. We directly buy IP cores from local firms and outsource wafer processing to the local
specialized chip manufacturers.”

**Proposition 2b:** We also find hierarchical division of R&D labor in Chinese MNCs in both
Europe and the U.S., with Chinese overseas R&D units undertaking high-value-added R&D
activities while domestic R&D activities in China low-value added.

5.3. Modes of learning

China is still a student of high technology, lagging behind developed countries. Learning from
their advanced counterparts located in developed countries was identified as an important strategy
according to our cases. We found evidence of two different modes of learning in the U.S. and in
Europe, and we here describe these two modes of learning by 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 technical school pupils interact with their teachers.

5.3.1. “Technical school model” in Europe

In Europe, we found many cases of “technical school model”, which we define as a short term
learning method aiming to apply learned skills quickly to other places in a relatively independent
manner. Technological immaturity pushes Chinese companies to find their technical schools to learn
new skills. After an initial close collaboration with local partners, Chinese engineers soon pick up
some fundamental skills and then leave with the belief that “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 previously only be
fulfilled by external R&D specialists, and they then disengaged from original European partners. As soon as Cases B, C and E entered Europe, they found their suitable technical schools. For instance, Case B (JAC) found Pininfarina, Case C (Chang’an) found IDEA, and Case E (Weichai) found AVL. Cases B, C, and E brought their students—the R&D employees in China—to these schools to receive training. At the initial stage, these R&D units depended largely on their technical schools. However, after a period of training, Chinese “students” graduated from the “schools” and started to undertake some R&D tasks with the technical skills they had learned.

Once graduated, these students either worked in the R&D units or returned back to the headquarters, performing as the backbone of the R&D force in China. For example, JAC’s mode of external cooperation 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 “technical school” in Case E was run by Weichai and AVL

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5 This training is usually a short-term transfer varying from three months to several years.
LIST GmbH (AVL) in cooperation. Case E had no locally recruited employees but only “visiting students” dispatched from China. The students graduated and returned back to China within two 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 external support from some key component suppliers. AVL also stopped playing the role of internal cooperator for Case E, but later acted as an external partner.

As for those R&D units with the entry mode of M&A (Cases G, H, and I), they gradually shifted part of the R&D activities previously undertaken by the acquired foreign company back to China. Acquisition of a local company allowed Cases G, H and I to build their “technical schools” internally. As the interviewee for Case G said, “we purchase overseas technologies, and more importantly, we try to assimilate the imported technologies.” In order to accelerate the assimilation-process, the previously retained R&D specialists became the tutors of Chinese R&D employees. Along with the internal learning process, the technological capability in headquarters upgraded. Chinese students were then able to undertake some tasks independently. The interviewee in Case G stated, “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 implemented their plans to shift part of the functions of their acquired companies to China, including product development, commercialization and production (see Figure 4). In particular, Hisun shut down the European assembly lines and transformed the acquired company into a dedicated R&D center. All the production resources were integrated into the parent
company in China. Similarly, Qianjiang upgraded its technologies in terms of high-end motorcycles. Many parts and components which had never been produced by Qianjiang before were then able to be manufactured domestically. The interviewee in Case I gave this explanation for technology/manufacturing improvement. “One aspect is manufacturing equipment. We directly buy manufacturing equipment from Europe. Another aspect is technological interaction. The Italian side and the Chinese side continuously keep communicating and cooperating with each other, especially regarding the project progress. Our Italian specialists are also dispatched to personally guide the production in China” (Interview, Case I).

5.3.2. “PhD student model” in the U.S.

In the U.S., we found many cases of what we call “PhD student model”, which has profound interactive learning and presents the PhD students with knowledge capable of catching up with their advisors in the competitive field in the long term. Its main difference from the “technical school model” is that the PhD students here are actively involved in the research of his/her mentor, and upon graduation, they become a colleague of the mentor with continuous learning and collaboration. The students are therefore engaged in an experience that allows them to catch up with the faculty and then join them in their academic world at a competitive level.

In order to constantly integrate with cutting-edge technologies, Chinese companies tried to act as PhD students in the U.S. and embedded themselves in local innovation systems. As the oldest R&D unit among our cases in the U.S., ZTE (Case 3) had been studying for its “PhD degree”, and receiving only one Phd degree could not satisfy ZTE. When ZTE graduated from one major, it started studying for its second doctoral degree (see Figure 5). This is largely because new telecommunication

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technologies are upgraded frequently, and every technology or product has a lifecycle. While new technologies are continuously emerging and old technologies are maturing, these R&D branches go through a functional shift from technological R&D to market service. For instance, the ZTE R&D branch in San Diego lost its original functional position as a high-end CDMA talent base since CDMA technologies matured. These CDMA specialists who work in San Diego gradually changed their role from technological explorer to serve market exploitation in the U.S..

ZTE U.S. now has shifted its focus from telecommunications system and equipment to micro-electronics. At present, China has cultivated a strong R&D capability of system equipment that is competitive with U.S. players. “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).

In comparison, ZTE's European counterpart (case A) remained focusing on telecommunications technology in their collaboration with local Sweden firms, and shifted some of the R&D work to China mostly for cost efficiency. This again illustrates the technical school model of learning in Europe.

The other cases that are relatively newly established in the U.S. (Case 2, 4, 5) all reveal the characteristics of “PhD students model”. These R&D units are integrated into local innovation systems and their ties to the U.S. seem to be closer compared to those in the “technical school model” in Europe.
Proposition 3: Learning for Chinese MNC R&D units in Europe is a “technical school model”, where experiential autonomous learning in Chinese R&D units emerges after an initial close collaboration with local partners in Europe. Meanwhile, learning in the U.S. is a “PhD student model”, where many Chinese R&D units in the U.S. maintain collaborative learning with local partners and are highly embedded in the local innovation system.

6. Further discussion

6.1 Motives and organizational structure

In order to understand how Chinese MNCs implement R&D strategies to facilitate learning, we have examined and analyzed three perspectives: R&D motive, R&D structure, and mode of learning. R&D motive determines whether there will be learning in the overseas R&D units and if so what types of knowledge will be learned. Low level of technology has pushed Chinese MNCs to set up R&D units in Europe and the U.S.. Our research shows that technology exploration is a primary motivation for all of our case R&D units, which means knowledge on technology is the major content of learning. For many Chinese MNCs whose main business is still confined to the domestic market, technology exploration overseas also let them utilize advanced infrastructure, technologies and R&D human resources in developed countries to offset technological weakness at home.

According to our cases, most Chinese companies retain a participative centralized structure with strong negotiation power in the R&D units abroad as a result of their technology advantage. 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 the overseas units’ proximity to advanced technology and market. However, the final decision-making power is still in the hands of the
Chinese headquarters. There can be several reasons for such an authority distribution. In contrast to the mature R&D units of developed country MNCs, we find that many Chinese R&D units keep a small-scale facility (see Table 1 on number of R&D employees) which is only composed of a small number 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 overseas R&D units cannot be independent of 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 achieving cost efficiency at home and reaching advanced but high-cost technologies and specialists in host countries. Chinese companies construct a hierarchical division of R&D labor, where low-value added R&D activities are implemented in China and high-value added R&D works are done overseas. However, the overseas units are usually only responsible for part of high-value added activities in order that the HQ does not lose control over the R&D project. In such a structure, overseas R&D units play as a member of a whole project team. Consequently, how to appropriately allocate R&D resources and coordinate dispersed R&D units has become the key task of Chinese headquarters.

6.2 Cross-border learning

In order to catch up on technology development, Chinese MNC R&D units abroad have formed their learning strategies. 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 “technical school model” while the cases in the U.S. choose the “PhD student model.” There is continuous cooperative-learning going on in the U.S. cases, while a process of ‘substitution’ has started in the E.U. cases. The “technical school model” cases train their Chinese R&D employees by
cooperating with local advanced counterparts. However, this kind of cooperation is weakened when Chinese employees’ R&D capabilities enhance. 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 “PhD student model” cases in the U.S. are locally embedded, employing local employees as well as cooperating with local partners. 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:

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

Second, we propose that such different learning modes reflect certain differences, such as different knowledge levels and institutional environments, in the U.S. and the European markets.

(1) This could be a 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. a more innovative and open environment. Chinese companies in the U.S. are continuously catching up since the U.S. has a more innovative and open environment 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\(^7\), such as the ICT-related industry and the Pharmaceutical & Biotech industry, which account for 69% of the U.S. 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\(^8\) (European Commission, 2010). High knowledge and technology intensity in the U.S. with an open environment provides a good condition for continuous learning and collaborations.

(2) This could be a result of the cross border movement of talents from China to the U.S.. The U.S. is traditionally a 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, Motoyama, and Quan, 2002). Chinese immigrants have various professional ties to their native countries, and are prone to keep a close relationship with Chinese companies and the Chinese government. In this case, we believe that the collaborative climates in the U.S. are more specific and suitable for Chinese companies than in Europe.

7. Conclusions and implications

Recently, more and more MNCs from emerging and developing countries are investing in developed countries. 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 paper, we focused on the advanced stage of FDI from China, and investigated Chinese companies’

\(^{7}\) R&D intensity above 5%

\(^{8}\) R&D intensity between 2% and 5%
R&D strategies in Europe and the U.S. and how the strategies facilitate learning for the Chinese MNC R&D units. Our research is limited by the small size of the cases, and also is limited by the inability to use exactly matching cases to compare Chinese MNC R&D strategies in Europe and in the U.S..

Our findings have significant managerial and policy implications for both developing and developed countries.

7.1. Managerial implications

As we analyzed earlier, many Chinese overseas R&D units in the U.S. and Europe are driven primarily by technology exploration, and some 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 and facilitate effective learning under different motives.

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.

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 overseas do not have to grow to a complete and large scale R&D center, but can 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. How to effectively 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 MNCs from other developing countries as well.

7.2. 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 countries. The economic concerns as well as national security impacts of Chinese investments have received increasing attention from policymakers in Europe and the U.S. (Burghart and Rossi, 2009; Globerman and Shapiro, 2009; Mathieu, 2006; Nicolas, 2010; Rabellotti and Sanfilippo, 2008; Guimón, 2011).

Our findings demonstrate that many 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 do not 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?

We propose that (1) maintaining leadership in cutting-edge technologies, and (2) maintaining attractiveness for high-skilled immigrants are important reasons for the U.S. to attract 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 China’s even larger domestic market. While Chinese companies are increasingly involved in learning and cooperation in Europe and the U.S., they also open a window toward the China market 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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Figure 1. Distribution of China's outward foreign direct investment stock in 2008

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

Source: Our elaboration of the 2008 Statistical Bulletin of China's Outward Foreign Direct Investment
Figure 3. A brief description of global Chinese R&D units

<table>
<thead>
<tr>
<th>Location</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>18</td>
</tr>
<tr>
<td>The other</td>
<td>12</td>
</tr>
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</table>

Source: Authors’ database
Figure 4. “Technical School Model” of cases G, H and I

<table>
<thead>
<tr>
<th>R&amp;D</th>
<th>Basic &amp; applied research</th>
<th>Shift</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Product development &amp; commercialization</td>
<td>Shift</td>
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<tr>
<th>Production</th>
<th>Shift</th>
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<tbody>
<tr>
<td>Sales and marketing</td>
<td>Shift</td>
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</table>

Source: compiled based on interview notes.
Figure 5. The “double Ph.D. degree model” of ZTE in the U.S. (Case 3)

Source: compiled based on interview notes.
Table 1. Some information of the interviewed Chinese MNCs and R&D units in Europe and U.S.

<table>
<thead>
<tr>
<th>Chinese companies</th>
<th>R&amp;D sub.</th>
<th>Set-up Time</th>
<th>Sub. location</th>
<th>HQ location In China</th>
<th>Entry mode</th>
<th>R&amp;D employees</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Europe basket</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ZTE</strong> Case A</td>
<td>2002</td>
<td>Sweden</td>
<td>Guangdong</td>
<td>Greenfield investment</td>
<td>10-20</td>
<td>Telecommunications</td>
<td></td>
</tr>
<tr>
<td><strong>JAC</strong> Case B</td>
<td>2005</td>
<td>Italy</td>
<td>Anhui</td>
<td>Greenfield investment</td>
<td>27-28</td>
<td>Automotive</td>
<td></td>
</tr>
<tr>
<td><strong>Chang’an</strong> Case C</td>
<td>2005</td>
<td>Italy</td>
<td>Chongqing</td>
<td>Greenfield investment</td>
<td>approx. 40</td>
<td>Automotive</td>
<td></td>
</tr>
<tr>
<td><strong>Hisense</strong> Case D</td>
<td>2007</td>
<td>Holland</td>
<td>Shandong</td>
<td>Greenfield investment</td>
<td>10-15</td>
<td>Consumer electronics</td>
<td></td>
</tr>
<tr>
<td><strong>Weichai</strong> Case E</td>
<td>2003</td>
<td>Austria</td>
<td>Shandong</td>
<td>Greenfield investment</td>
<td>Max. 30-40</td>
<td>Diesel engines</td>
<td></td>
</tr>
<tr>
<td><strong>New Jialian</strong> Case F</td>
<td>2008</td>
<td>Denmark</td>
<td>Zhejiang</td>
<td>Greenfield investment</td>
<td>1-5</td>
<td>Acoustic equipment</td>
<td></td>
</tr>
<tr>
<td><strong>DMTG</strong> Case G</td>
<td>2006</td>
<td>Germany</td>
<td>Shenyang</td>
<td>M&amp;A</td>
<td>16-17</td>
<td>Machine tools</td>
<td></td>
</tr>
<tr>
<td><strong>Hisun</strong> Case H</td>
<td>2005</td>
<td>Germany</td>
<td>Zhejiang</td>
<td>M&amp;A</td>
<td>40-50</td>
<td>Electromechanical products</td>
<td></td>
</tr>
<tr>
<td><strong>Qianjiang</strong> Case I</td>
<td>2005</td>
<td>Italy</td>
<td>Zhejiang</td>
<td>M&amp;A</td>
<td>20-30</td>
<td>Motorcycle s</td>
<td></td>
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<tr>
<td><strong>The U.S. basket</strong></td>
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<tr>
<td><strong>Hisense</strong> Case 1</td>
<td>2008</td>
<td>Atlanta</td>
<td>Shandong</td>
<td>Greenfield investment</td>
<td>3</td>
<td>Consumer electronics</td>
<td></td>
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<tr>
<td><strong>Shuguang</strong> Case 2</td>
<td>2008</td>
<td>Detroit</td>
<td>Liaoning</td>
<td>M&amp;A</td>
<td>8</td>
<td>Automotive</td>
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<td><strong>ZTE</strong> Case 3</td>
<td>1998</td>
<td>New Jersey</td>
<td>Guangdong</td>
<td>Greenfield investment</td>
<td>30+</td>
<td>Telecommunications</td>
<td></td>
</tr>
<tr>
<td><strong>Alibaba</strong> Case 4</td>
<td>2000</td>
<td>San Diego</td>
<td>Hangzhou</td>
<td>Greenfield investment</td>
<td>7-20</td>
<td>E-commerce</td>
<td></td>
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<tr>
<td>2000</td>
<td>Dallas</td>
<td>Hangzhou</td>
<td>Greenfield investment</td>
<td>7-20</td>
<td>E-commerce</td>
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<tr>
<td>2009</td>
<td>Silicon Valley</td>
<td>Hangzhou</td>
<td>Greenfield investment</td>
<td>7-20</td>
<td>E-commerce</td>
<td></td>
<td></td>
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<tr>
<td><strong>China mobile</strong> Case 5</td>
<td>2009</td>
<td>Silicon Valley</td>
<td>Beijing</td>
<td>Greenfield investment</td>
<td>10</td>
<td>Telecommunications</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Industry distribution of Chinese R&D investments in the U.S. and in Europe

<table>
<thead>
<tr>
<th>U.S.</th>
<th>31</th>
<th>Europe</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunications</td>
<td>7</td>
<td>Machinery and equipment</td>
<td>6</td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>5</td>
<td>Automotive</td>
<td>5</td>
</tr>
<tr>
<td>Automotive</td>
<td>4</td>
<td>Domestic appliance</td>
<td>4</td>
</tr>
<tr>
<td>Consumer electronics</td>
<td>4</td>
<td>Telecommunications</td>
<td>3</td>
</tr>
<tr>
<td>Domestic appliance</td>
<td>3</td>
<td>Machine tool</td>
<td>3</td>
</tr>
<tr>
<td>Computing platforms and IT app solutions</td>
<td>2</td>
<td>Consumer electronics</td>
<td>2</td>
</tr>
<tr>
<td>Diesel engine</td>
<td>1</td>
<td>Wind equipment</td>
<td>2</td>
</tr>
<tr>
<td>Digital display</td>
<td>1</td>
<td>Acoustic equipment</td>
<td>2</td>
</tr>
<tr>
<td>Optoeletronics</td>
<td>1</td>
<td>Pharmaceutical</td>
<td>1</td>
</tr>
<tr>
<td>E-commerce</td>
<td>1</td>
<td>Motorcycle</td>
<td>1</td>
</tr>
<tr>
<td>Personal computer</td>
<td>1</td>
<td>Diesel engine</td>
<td>1</td>
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<tr>
<td>Pneumatic tools</td>
<td>1</td>
<td>Photographic accessory</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td>Steel</td>
<td>1</td>
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</tbody>
</table>

Source: Authors’ database
Table 3. The motivations of the cases in Europe and the U.S.

<table>
<thead>
<tr>
<th>The cases in Europe</th>
<th>The cases in the U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology- exploration- orientated (technology-driven): Proximity to the centers of technological excellence</strong></td>
<td><strong>Technology- exploitation- orientated (market-driven)</strong></td>
</tr>
<tr>
<td>1. To utilize local R&amp;D infrastructure and take advantage of a better R&amp;D environment</td>
<td>1. To enter local/global market and promptly adapt products for local/global customers</td>
</tr>
<tr>
<td>Example: case 2 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. &quot;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.&quot;</td>
<td>Example: case D The main task of case D is to develop adapted products for the European market. &quot;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.&quot;</td>
</tr>
<tr>
<td>2. Technological trend monitoring and technological information collection</td>
<td>2. To support local production and sales</td>
</tr>
<tr>
<td>Cases A, B, C, D, F, and I</td>
<td>Cases A, D, F, G, H and I</td>
</tr>
</tbody>
</table>
| Example: Case F Case F, the most recently established R&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 local senior engineers, R&D and consulting companies, and universities. | Example: case 1 Before the establishment of the U.S. R&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&D branch in the U.S., you would never know if these products exported to the U.S. are 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."
| 3. To Strengthen interaction and cooperation with local technological partners | 3. To have close interactions with local/global customers |
| Cases A, B, C, D, E, F, G, H, and I | Cases A, D, F, G and I |
| Example: case 3 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." | Example: case A "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." |
| 4. Acquisition of specific technologies or specific product development | 4. To monitor market trend and collect market information |
| Cases E, G, and H | Cases A, D, F and I |
| Example: Case 4 The engineers recruited in the U.S. are quite experienced and have been 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&D experts, we may avoid detours and take a shortcut during the R&D process. Moreover, these experts bring us some new visions. For example, the coding process in China is not standard. We hope our U.S.-based engineers may gradually influence our company's practices during the development process and improve the abilities of domestic R&D human resources." | Example: case 1 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&D staff). We also collect local market information by ourselves, though not quite often. Anyway, this R&D branch is (localized) product-centered. It is not enough to rely solely on marketing staff if our company aims to explore local market." |
| 5. R&D talents recruitment and Chinese talent cultivation/training | |
### Table 4. R&D structure of our interviewed Chinese companies

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<thead>
<tr>
<th>Cases</th>
<th>Centralization vs. decentralization</th>
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<tr>
<td>Case A</td>
<td>Case A participates in the decision-making process. “Since we are close to the European market, the HQ has to consider our suggestions. Our centre 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.”</td>
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<td>Case B</td>
<td>The headquarters takes charge of platform planning, grasping the overall situation. And the R&amp;D unit takes charge of sub-project planning, grasping the details. “HQ gives us more autonomy so that we have more space to bring into play our capability. As our company deepens the collaboration with the western technological experts, we believe that they also will have more understanding of the Chinese market. I am basically satisfied with the autonomy degree of our R&amp;D centre.”</td>
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<td>Case C</td>
<td>The R&amp;D unit has a low autonomy degree. “Our R&amp;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.”</td>
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<td>Case D</td>
<td>“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 feedbacks to our headquarters. If we already have made decision, we should report to our HQ, if we halt between two opinions, the headquarters will help us make decision.” “Our HQ controls the whole product development process. We co-develop new product with our HQ, and most of the work are undertaken by the HQ.”</td>
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<td>Case E</td>
<td>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&amp;D units will take charge of the concrete communication and operation within the scope of the authority’s power.”</td>
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<td>Case F</td>
<td>“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.”</td>
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<td>Case G</td>
<td>The subsidiary can make decisions on the cooperation with local partners itself, and the HQ only controls the cost. “Before launching a project, the subsidiary will firstly report to HQ with a budget plan. After the HQ makes a decision based on the budget, the subsidiary will handle the details of the project.”</td>
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<td>Case H</td>
<td>“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.”</td>
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<td>Case I</td>
<td>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.”</td>
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<tr>
<td>Case 1</td>
<td>Normally, our HQ makes decision 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&amp;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 communications with our customers. However, we should never go too fast since Hisense always maintains a stable and steady operating style.”</td>
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<td>Case 2</td>
<td>“5G launches different projects for the North American market and Chinese market. If the project aims at the North American market, the US R&amp;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&amp;D platform will accordingly be located in China. The US R&amp;D branch will give suggestions to the HQ, and the finally decision will be made by the HQ.”</td>
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<td>Case 3</td>
<td>ZTE has 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, the human &amp; material resource to be devoted, etc. “There is an expert panel telling us the specific tasks. And we organize a cross-regional R&amp;D project team according to the key technologies and R&amp;D personnel involved. The HQ tracks and manages the whole project, and the project team will be dismissed when the project is finished.”</td>
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<td>Case 4</td>
<td>Alibaba has a centralized R&amp;D system. The central R&amp;D aims to aggregate the basic and common technologies. These basic and common technologies will be shared and further deployed by business units. “We have different R&amp;D teams in Hangzhou, Beijing and Silicon Valley, taking charge of different tasks. Although we are in different teams, we only have one road map, and one common goal. One project fails, everybody fails. Our U.S. branch is a component of the whole R&amp;D group, and we have a close cooperation with the teams in Hangzhou and Beijing.”</td>
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<td>Case 5</td>
<td>“Data unavailable”</td>
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Table 5. Hierarchical division of R&D labor in Chinese companies

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