One Way or Two Way Globalization?-A Double-learning-network Framework of Chinese R&D Internationalization

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Abstract—In this paper we claim that the phenomenon of R&D internationalization of Chinese firms is an emerging and varied phenomenon. We establish a four-pattern learning model in a double-knowledge-network organization, and propose that both different modes (experiential and cooperative) and different goals (explorative and exploitative) coexist in Chinese R&D internationalization. The evolution of both modes and goals of learning of Chinese MNCs are different from that of the MNCs from developed countries. Our study tends to set the stage for further empirical studies in the causalities and managerial implications.

I. INTRODUCTION

China has worked hard in recent years to attract foreign investment in R&D with the aim of enhancing the technology capabilities of Chinese firms [1]. In addition, Chinese MNCs (Multinational Corporations) have also begun to expand overseas [2].

During the last decade various scholars have adopted a macroscopic perspective to investigate FDI from emerging countries [3], [4], [5]. They found that there are two waves of MNCs from the developing world, each with a different ‘push’. The first wave was driven outward by the difficulties and restrictions local firms faced in their home countries, and the other is mainly the result of the rising pressures of the global economy [6].

The conventional theories, which seek to explain the reasons behind the first wave of MNCs from developing countries, focus on the exploitation of domestic assets abroad with multinationals’ existing advantages [6]. Newer theories explaining the second wave of MNCs investment assert that the latecomer MNCs are seeking strategic assets, resources, and knowledge through internationalization in order to obtain competitive advantages [7], [8], [3], [9], [6]. As a latecomer in the global knowledge economy, Chinese firms have the chance to cultivate their innovation capabilities and move from the position of late-follower to the position of rapid-follower or even leader through different routes [10], [11], [12], [13], [14]. However, few studies offer insights into theoretical discussion of technological (R&D) catch-up strategies of latecomer MNCs. In this study, we try to fill in the theoretical gap in the existing literature in terms of international R&D learning (strategies) of Chinese MNCs.

A large number of studies from developed countries have placed emphasis upon international R&D learning (strategies) of MNCs in a double-network [15], [16], [17], [18]. We see from the literature on theoretical development of MNC’s network structure that the MNCs from developed countries experienced an evolution of organizational learning and of R&D activities in particular [15], [16], [17], [18]. R&D seemed to follow two evolutionary trends. First, they underwent a shift from market-oriented motivations to technology-oriented motivations [19], [17], [20], [21]. Second, MNCs evolved from internal knowledge transfer and creation (HQ-subsidiary) to bi-directional vertical (HQ-subsidiary) and horizontal (subsidiary-subsidiary) knowledge transfer and creation [15], [22], [23]. The research on developed country MNCs shows that traditional organizational learning happens inside the MNC organizations whose headquarter is the knowledge generator, embodying the firm’s competitive advantages, and whose subsidiaries exploit the received knowledge from their HQ [24], [25], [22]. Since the 1990s, subsidiaries have become more active in learning and creating new knowledge through interaction within internal networks, including both parallel units and HQ [15], [18], [23]. More recent literature reveals an explorative learning role of subsidiaries involving collaboration with a variety of external networks to absorb and learn new knowledge [26], [27], [28], [29].

Whereas the literature on R&D internationalization of developed countries abounds, research on the internationalization of R&D among emerging countries is quite limited [30], [12], [9], [31]. And most of this research does not show us how MNCs from emerging countries tap into advanced knowledge resources through dispersed organizational configurations. What is missing is a discussion on international organizational learning and the orchestration of a ‘double-network’ of dispersed R&D units. In this study, we aim to put forward a theoretical framework of a double-learning-network organization for Chinese R&D internationalization.

This paper is organized in four sections. The next section reviews the studies on Chinese R&D internationalization and
looks at the literature on double-network R&D organization; the third section defines research questions and hypotheses; and the fourth section concludes this study.

II. LITERATURE REVIEW

Relevant Studies on Chinese MNC R&D Internationalization

Without doubt, China has become a popular destination not just for low-cost manufacturing but for research and development as well [2]. Reference [32] reveals that in the FDI recipient countries, China’s ranking rose from the fourth place in 2004 to third in 2005. Outward FDI from China has taken off since the mid 1990s [2] and have continued to grow steadily into the early 21st century (see Figure 1). Chinese MNCs can be separated into two generations (see WIR (2006)). According to the report, the first generation of Chinese MNCs was dominated by large state-owned enterprises that controlled 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 and has had diverse ownership structures that differ from the first generation of Chinese MNCs. This generation of MNCs is focused in sectors where international competition is higher, such as electronics, ICT and other high-tech manufacturing industries.

Today, more and more Chinese firms in the high-tech industry are investing overseas. Some of the bolder moves by these companies have garnered significant international attention, such as Lenovo’s acquisition of IBM’s personal computer (PC) business, and TCL’s acquisition of Schneider Electronics.

Compared to the MNCs from developed countries, Chinese firms have made a small but steady step in R&D internationalization. Most are “relatively young (and therefore small) and focused on the domestic market” [31]. Chinese firms “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” [1]. This traditional cooperation pattern causes domestic Chinese firms to depend heavily on the technological support of foreign MNCs.

As Xie and White point out, Chinese firms are “accessing advanced technology abroad by establishing technology listening posts or R&D labs and by forming alliances with multinationals” [5]. This trend began in 1995 but became significant in 1999 when outward FDI from China received a boost [2]. Moreover, Chinese firms are “developing a clear technical competence that contributes both to the local community and to the parent’s international R&D network” [33]. If this is the road ahead, Chinese firms are in their initial stage of R&D internationalization, and it is likely that they will face problems similar to those of MNCs from developed nations. In the next section we will review the main theories found in the literature regarding the evolution of foreign R&D direct investment.

The Evolution of Network Knowledge Organization

Today we see decentralized R&D units not only as knowledge transfer units, but also as knowledge creation centers in a fully integrated network [29]. Many empirical studies suggest that MNCs have switched from a centralized hub organization to a more decentralized federation of units and to integrated networks [34] 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 only as “a one-way movement of methods from headquarters to foreign subsidiaries” [35]. Also, the presence of technological enablers and an ever-increasing pressure to adjust to the demands of the market have triggered such a transformation and are changing the roles of subsidiaries in the MNC organization [36].

In [36], Zanfei suggests that the MNC can be seen as a ‘double network’, which includes both an ‘internal network’ (i.e. headquarter and subsidiaries) and an ‘external network’ (i.e. local partners, suppliers, customers etc.). When applying the double network theory to MNCs, subsidiaries play a crucial role in interacting with a variety of external actors such as universities, companies, research institutions etc. [28], [37], [29], [38], [39], and “each of them might detain resources and capabilities which are critical for MNCs’ strategy” [38]. The integration between the external network and the internal network has been regarded as an important competitive advantage [26], [40], [28]. Through setting up external linkages, overseas R&D subsidiaries can tap into local scientific and technological knowledge pools.

A Four-pattern Learning Model in a Double-knowledge-network

In a decentralized and more open MNC structure, the organization has plenty of opportunities to learn and change through interactions with a variety of networks. This is increasingly seen as one of the main motivations to decentralize R&D investment. Chiesa theorizes that the increasing importance of international R&D is due to the need to access external sources of knowledge relevant to a firm’s innovation process and the related need to shorten the time spent to acquire, internalize, and utilize this knowledge to perform innovations [41]. There are two main motivations for R&D decentralization according to [42] and [37]. They are: (1) home-based exploitation (HBE): exploitation of a firm’s technologies overseas by adapting the technologies to local circumstances in order to get access to foreign markets [1]; and (2) home-based exploration (HBA): 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 [43]. Such learning can take place through various channels, and in particular Hitt et al. isolate two dimensions: cooperative learning and experiential learning. Cooperative learning means creating new knowledge largely or wholly unrelated to the current knowledge stock or enriching the current knowledge through knowledge transfer by cooperation with partners; experiential learning emphasizes ‘learning by doing’ [44] and self-experience accumulation.

If we combine the dimensions of motivations/learning processes (exploitation and exploration) and learning channels (cooperative and experimental), we obtain four different types of learning patterns [44] (see Figure 2). In the context of double-network organization, dispersed R&D units play a learning role both with the external network and the internal network. In the external network, R&D units can learn by 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 modes of international learning we can 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 subsidiaries is to bring new sources of knowledge into the corporate network. This happens through the interaction with foreign external networks.

- **R&D Subsidiaries as ‘remote centers of excellence’**
  (Experiential-exploratory learning)
  In this case, subsidiaries have already learned or acquired the most relevant local resources and the new mission is to generate new technology-related knowledge.

- **R&D Subsidiaries as ‘market gatekeepers’**
  (Cooperative-exploitative learning)
  The foreign subsidiaries have to adapt knowledge for a distant market. Close interaction and cooperative development with important customers is necessary.

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

### III. Theoretical Hypotheses

Based on the four learning-pattern models, we explore both modes and goals of R&D internationalization of Chinese firms, and look at their evolutionary dynamics. This paper will therefore shape hypotheses addressing on the following research questions:

- Are Chinese MNCs building up double-network R&D organizations?
- Is Chinese double-network R&D organization guided by home-based exploration or home-based exploitation?
- What are the dynamics of R&D internationalization strategies? How do they develop?

#### A. Experiential Learning and Cooperative Learning

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 [45], [46]. For the multinationals in the early stage of R&D internationalization, both cooperative learning and experiential learning are necessary organizational learning channels.

Self-accumulated experience is an important path of organizational learning. And in particular, international experiences
Fig. 2. Four patterns of international organizational learning

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have been regarded as the prime source of organizational learning for MNCs [42]. The overseas R&D units can enhance their learning capability by obtaining the knowledge stock from the knowledge center (i.e. HQ) [47]. 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 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.

As latecomers, most Chinese firms have only existed for a few decades. Compared with the MNCs from developed countries, Chinese firms are still in their initial development stage. The shortage of both international experience and core technologies encourages Chinese firms to learn by doing as well as to learn by cooperating. According to the above discussion, we make the following research hypotheses:

**Research hypothesis 1A (Experiential learning):** There is evidence in Chinese MNCs of close coordination between HQ and subsidiaries and experiential learning.

**Research hypothesis 1B (Cooperative learning):** There is evidence in Chinese MNCs of collaboration with local/external partners and cooperative learning.

### B. Home-based Augmenting and Home-based Exploiting

As mentioned above, emerging countries lack two main resources when competing with developed countries: lead user markets and technological innovation [48], [14]. Hong and Sun suppose in [3] that external sources of knowledge are increasingly valued by Chinese firms today. Acquiring resources, natural resources in particular, has been one of the key strategic considerations for China’s outward FDI since the beginning of China’s development. Parallel to resource-seeking investments, Chinese firms have been urged to obtain access to advanced foreign technologies and managerial know-how in hopes of establishing themselves in the international markets. In this case, the main motivation of Chinese firms is technology-driven.

The common belief of MNCs from advanced Western countries is that it is better to practice marketing in the host countries and technical innovation in the home country. This means international R&D activities from developed countries are mainly market or technology exploitation-oriented. Technological innovation could be a competitive advantage for the firms from developing countries, which suggests a technology exploration-oriented view of international R&D activities from developing countries. Lee and Lim conclude in [49] that most of the technology-oriented, newly industrialized economies remain in the imitation or listening stage, and that these economies always try to catch up with developed countries by assimilating and adapting the comparatively obsolete technologies of developed countries.

Moreover, human resource driven motivation has been emphasized in many studies that low-cost, and technologically well trained human resources are the main reason for MNCs from developed countries to delocalize R&D activities in China [50], [1]. Similarly, the MNCs from China would also like to use high-quality knowledge-based human resources in the host country [51]. Thus, we propose the following research hypotheses:

**Research hypothesis 2A:** There is evidence in Chinese MNCs of experiential/collaboration learning focused on ex-
exploitation of technological advantages by adapting technologies to local circumstances.

Research hypothesis 2B: There is evidence in Chinese MNCs of experiential/collaboration learning focused on exploration of technological advantages by accessing overseas technologies and know-how.

C. The Evolution of the Modes and Goals of R&D Internationalization of Chinese Firms

The data of R&D investment abroad from developed countries shows that international R&D subsidiaries do not always stay in a state of rest, but experience dynamic evolutionary processes from one pattern to another [16], [52], [29], [21]. MNCs from developing countries also go through an evolution of the modes and goals of R&D internationalization.

As Mathews mentions, “latecomer firms, like latecomer nations, are able to exploit their late arrival to tap into advanced technologies, rather than to replicate the entire previous technological trajectory” [9]. Gao et al. in [12] indicate that from a technical resource-based perspective, using advanced countries as R&D bases is useful in order to (a) acquire local technology and science, and to (b) support local product development [31]. Chen and Tong show some evidence that Chinese firms focused on the domestic market and that their international R&D activities have non market-driven factors [30]. Meanwhile, they also propose a 3-stage evolution pattern that predicts dispersed Chinese R&D units finally developing to a maturity stage aimed at a global market.

Some scholars assert that Chinese latecomers should expand into external resource networks to narrow the resource gaps (e.g. [30], [12], [31]).

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

Here, we propose the following research hypothesis:

Research hypothesis 3: Chinese MNCs first start from explorative learning and cooperative learning, and then move into exploitative learning and experiential learning.


In this study, we first build a four-pattern international R&D learning/strategy model based on a framework of double-learning-network knowledge organization. We propose that Chinese MNCs are building up double-network R&D organizations through experiential/collaboration learning with the motivations of technological advantages exploration and technological advantages exploitation. Different modes and goals coexist in Chinese dispersed R&D units, and some R&D units are evolving from one combination of mode/goal to another.

From Cooperative Learning to Experiential Learning

The traditional evolution of organizational learning of MNCs is from experiential learning to cooperative learning [15], [22], [23]. Lehrer and Asakawa viewed [29] the R&D subsidiary evolution from a perspective of organizational configuration and concluded the 'classic evolution' path of foreign R&D subsidiaries is from knowledge transferor to fully integrated knowledge creator. More explicitly, traditional organizational learning channels inside MNC organization emphasize internal knowledge learning, transferring, sharing, integrating and synthesizing [53], [24], [25], [22], [23]. Gradually, external knowledge networks are regarded as an important competitive advantage and “serve as sources of learning” [26]. The ultimate state of integrated network configuration is one that facilitates bi-directional flow of both internal and external knowledge [54].

We propose the first different R&D internationalization pattern of Chinese overseas R&D units from cooperative learning to experiential learning (See Figure 2, Arrow1). Due to a low level of knowledge accumulation at home, Chinese R&D units are supposed to perform as knowledge learners that absorb and transfer knowledge from external knowledge stock. In this case, Chinese firms will firstly quest for external knowledge sources through cooperative learning, where reverse knowledge flow from external knowledge network to internal knowledge network mainly happens. Along with internal knowledge accumulation, Chinese firms are diffusing and integrating their learning within multinational organization. Internal reinforcement of technological strength also stimulates self-learning and self-experiencing of R&D subsidiaries in the host knowledge environment. Finally, both cooperative learning and experiential learning will be utilized simultaneously by Chinese firms in a double-knowledge-network.

Motivation: from HBA to HBE

Another traditional explanation of R&D internationalization motivations of MNCs is from home-base exploiting (HBE) to home-base augmenting (HBA) [19], [16], [17], [20], [29], [21]. As Asakawa in [16], Lehrer and Asakawa in [29] conclude, there is a ‘classic evolution path’ for R&D internationalization. First, the overseas R&D units learn to adapt in the host country the firm-specific knowledge they’ve gained in their home country. These R&D units undertake more and more research tasks in the evolution process.

The early international business literature explain that firm-specific monopolistic advantages are transferred across borders through subsidiaries and exploited in the local markets of host countries [55], [25], [56]. More recent studies show that knowledge augmenting by establishing a new presence in advantageous locations is becoming the dominated motivation of global FDI [17], [57]. However, Almeida in [19] has found differences in the motivations of MNCs from different countries and has argued that foreign firms should be viewed as technological knowledge contributors rather than technological...
knowledge absorbers. The European and Korean firms are motivated by offsetting home country technological and perform as U.S.-technology absorbers, while the Japanese firms perform more as U.S.-technology participants that contribute to inter-firm knowledge flow with domestic firms. Also, Patel and Vega in [58] reveal the evidence that product adaptation and technical support to local markets remain the major factors promoting R&D internationalization.

We propose the second different R&D internationalization pattern of Chinese overseas R&D units than the traditional HBA to HBE (See Figure 2, Arrow2). Different from the MNCs from developed countries, most Chinese firms possess comparatively weak innovative capabilities in headquarters and there are not enough internal competitive advantages to be exploited for R&D subsidiaries to compete in host countries. Tapping into external knowledge networks to explore new technological advantages and augment previous home-based knowledge turns into the initial motivation for Chinese firms to expand R&D activities internationally. As technological capabilities get continuously upgraded, the motive of technology exploitation and participation of host market competition will gradually emerge and coexist with the motive of technology exploration.

REFERENCES


