A Dual Networks Perspective on Inter-Organizational Transfer Of R&D Capabilities: International Joint Ventures in the Chinese Automotive Industry

Zheng Zhao
Department of Corporate Strategy and International Business
University of Michigan Business School, 701 Tappan Street, Ann Arbor, MI 48109-1234
Email: janezhao@umich.edu

Jaideep Anand
Department of Corporate Strategy and International Business
University of Michigan Business School, 701 Tappan Street, Ann Arbor, MI 48109-1234
Email: jayanand@bus.umich.edu
Phone: 734.764.2310

Will Mitchell
The Fuqua School of Business, Duke University
Box 91020, Durham, NC 27708-0120
Email: Will.Mitchell@duke.edu
Phone: 919.660.7994, Fax: 919.681.6244

March 22, 2004 (Version China_Auto_Networks2.doc)

Acknowledgements: We appreciate the funding support of the William Davidson Institute of the University of Michigan Business School, and thank all respondents in China and the U.S. for their assistance and insights. The paper has benefited from insightful comments provided by David Krackhardt, Gabriel Szulanski, attendees at the Academy of Management meetings, the Queen’s University conference on inter-firm alliances, and the Corporate Strategy and International Business seminar at the University of Michigan, where we presented previous versions of this paper.
A Dual Networks Perspective on Inter-Organizational Transfer Of R&D Capabilities: International Joint Ventures in the Chinese Automotive Industry

Abstract

Many studies have examined the transfer of capabilities through international joint ventures (IJVs). However, few studies have examined how the source and recipients networks in which the IJV partners operate influence knowledge flow into or out of the IJV. We study knowledge flows among the firms in MNE source networks and local firms’ recipient networks, which join together through the IJV interface. We use thirty-two interviews with executives from four IJVs and three business group qiye jituan networks to explore the flow of R&D-related capabilities through source and recipient networks in the Chinese auto industry.

The research has several implications for the literature on knowledge flows in emerging economies. First, several patterns of capability transfer stand out. We found a strong flow of both individually carried knowledge and group-level technical and managerial knowledge between the MNEs’ source networks and their IJVs. We found that the knowledge flow between an IJV and its recipient qiye jituan network also occurs, while also identifying substantial barriers to such knowledge flow. We found that asymmetries in terms of capabilities and motives of the source and recipient networks influenced knowledge flows. Second, the distinction between individually carried and group-embedded knowledge strongly influences the nature of knowledge flow. Individually carried capabilities are diffuse easily through the networks via the movement of personnel, while diffusion of group-embedded capabilities requires more complex mechanisms such as vertical relationships. Third, the research helps understand when the recipient network’s knowledge stock serves as absorptive capacity and when it serves as core rigidity such that individual knowledge has a positive influence on absorptive capacity, while organizational experience can create rigidity. The conclusions are important in emerging economies where organizational transformation must accompany technical advance. Recipient networks can facilitate this process by disrupting the old organizations through re-arrangement of personnel within the network, while investing in individual technical training.

Key Words: knowledge transfer, emerging economies, international joint ventures, organizational capabilities, networks.
1. Introduction

Firms in emerging economies increasingly are attempting to use their relationships with multinational enterprises to increase their R&D capabilities (Baranson 1977; Brewer and Nollen 1998). The governments of many emerging economies (EEs) have created policies to solicit not only greater local production but also greater local knowledge content when multinational enterprises (MNEs) operate in their countries. Under increased pressure from the local governments and facing global competition that creates the need for greater local responsiveness in their host countries’ markets, many MNEs have started to transfer R&D capabilities to their business partners in the EEs. An extensive literature suggests that transferring R&D capabilities across firms involved in such international joint ventures (IJVs) requires substantial cultivation of tacit and organizationally embedded knowledge (e.g., Beamish 1993; Child and Yan 2001). This literature offers substantial insights about how characteristics of the joint venture and its partners influence firms’ ability to overcome difficulties in transferring knowledge, but typically focuses on the individual firms involved in an IJV. However, individual firms participate in larger networks of suppliers, distributors, public agencies, and other partners (Tichy, Tushman and Fombrun 1979; Granovetter 1985). Little research considers how such business networks — which in China are referred to as qiye jituan — also shape the knowledge transfer process. This paper studies how source MNEs’ global networks and recipient firms’ local qiye jituan networks shape attempts to transfer knowledge underlying R&D capabilities in the Chinese auto sector.

Previous research has used several perspectives to study knowledge transfer between partners. Early arguments based on internalization theory (Hymer 1976) and transaction cost economics (Teece 1976; Williamson 1981) emphasized incentives and safeguard mechanisms involved in knowledge transfer, with an underlying assumption of potential opportunism. More recently, resource-based and evolutionary theories (Nelson and Winter 1982; Kogut and Zander 1992, 1996; Teece, Pisano and Shuen 1997) have emphasized organizational cognitive abilities and activities more than concerns about opportunistic behaviour. The main concern of such knowledge-based views is to understand the processes of knowledge generation and coordination that occur within and across organizations. This study combines a knowledge-based approach with an emphasis on the characteristics of source and recipient firms’ business networks. The combination helps provide a deeper understanding of the movement of knowledge among firms that operate in complex business environments.
A business network is a set of firms and other organizations that contribute to and draw from each other’s skills and resources. The study emphasizes two types of networks. MNEs participate in business networks that consist of core firms and multiple subsidiaries and partners worldwide. Local firms, meanwhile, participate in networks of suppliers, technology institutes, production partners, distributors, and public agencies.

The Chinese automotive industry is an effective empirical setting for this study. The setting faces significant technological, cultural, and managerial barriers between source and recipient organizations, yet there is growing evidence of MNEs transferring R&D capabilities to their joint venture partners in the industry. The industry offers a setting to examine the interaction between two previously isolated networks, namely the networks of foreign and local IJV partners, and understand how firms use their inter-partner network structure to overcome knowledge transfer difficulties. We use an inductive design with qualitative data involving interviews and field observations, which we reinforce with archival data (Eisenhardt 1989; Yin 1994; Hoskisson, Eden, Lau, and Wright 2000). The patterns that emerged from the study can help guide future research.

2. Background: Transferring capabilities to emerging economy firms

Our goal is to understand the process of inter-organizational transfer of capabilities from MNEs in developed countries (DCs) to firms in emerging economies. Capabilities are the means by which firms use physical and knowledge-based factor inputs to create goods and services (Richardson 1972). By inter-organizational transfer, we mean that a recipient organization adopts capabilities that a source organization possesses (Baum and Ingram 1998). We will use the terms capability transfer and knowledge flow interchangeably.

Transferring capabilities from MNEs to their partners in EEs differs in several ways from DC-to-DC transfer of capabilities. First, larger technological gaps tend to exist between the source and the recipient organizations in DC-to-EE transfers. For example, the R&D/sales intensity of Chinese auto firms, including international joint ventures (IJVs), typically ranges between 1.0% to 1.5%, much lower than MNE auto company R&D investment, such as Honda’s 8.5% and Toyota’s 6.0% levels. Moreover, MNEs’ R&D activities in EEs usually are simpler than those they undertake at home, with an emphasis on tasks at late stages of the R&D cycle such as debugging, localizing, and adapting existing designs for the local environment (Buckley and Casson 1976). Second, EE environments are socially and culturally distinct from DC
environments. Third, MNE and EE firm networks have grown in relative social and economic isolation, at least until recent rounds of economic liberalization. For an MNE, therefore, host country environments involve new firms and institutions within complex and dynamic settings (Luo and Peng 1999).

In order to transfer capabilities, EE firms and MNEs must bridge technological, cultural, and managerial distances. To achieve this bridging, existing research suggests that the source organizations’ host country experience, multinational experience, and alliance experience as well as the recipient organization’s IJV experience facilitate effective transfer (Johanson and Vahlne 1977; Dunning 1988; Kogut and Singh 1988; Anand and Khanna 2000). In addition, recipient organizations typically possess preexisting routines that must be unlearned in order to develop new routines that underlie desired capabilities, because the large technological and managerial gaps between the source and recipient organizations entail obsolescence of the recipient organization’s preexisting routines (Leonard-Barton 1992).

R&D capabilities, even for the end stage activities such as modification of existing design to fit local conditions, involve many tacit routines, some of which involve single individuals but many of which require organizationally embedded inter-personal and inter-functional activities. Spender (1996) refers to knowledge that is both tacit and organizationally embedded as collective knowledge. Collective knowledge is more complicated to understand and transfer than document-embodied codified knowledge (e.g., blueprints, patents, and testing procedures), individual-embodied tacit skills (e.g., design skills, analytical skills, and testing skills), or physically embodied technology (e.g., analytical and design equipment).

Prior research suggests that both the tacit and group-embodied characteristics of R&D capabilities impose several related requirements when organizations seek to transfer collective knowledge from source to recipient. First, the source and the recipient must establish close inter-organizational contact, involving groups of people from both source and recipient organizations (Cook and Brown 1999). Transferring tacit knowledge requires direct interaction and first-hand observations including exposure to the source entity’s working environment and socialization processes (Polanyi 1962; Nonaka and Takeuchi 1995; Kimberly and Bouchikhi 1995). In parallel, transferring group-embedded knowledge requires coordinated relationships among members of the knowing community in which people interact to carry out routines or solve problems (Fiol and Lyles 1985; Levitt and March 1988). As Cook and Brown (1999: 386) point out, “the body of
[collective] knowledge is possessed by the group as a whole and is drawn on in its actions, just as knowledge possessed by an individual is drawn on in his or her actions”. Second, transferring collective knowledge arises through experience. Nelson and Winter (1982: 99) pointed out that organizations remember by doing in order to acquire the tacit and routine-based aspects of what we are referring to as collective knowledge. Third, source and recipient organizations must commit to long-term collaboration, because transferring tacit and organizationally embedded knowledge engenders time compression diseconomies (Dierickx and Cool 1989) and thus requires stable relationships (Teece 1986). The joint implication of these requirements is that transfer of collective knowledge via an IJV usually requires long-term interactions that involve extensive hands on contact between groups of personnel from recipient and source organizations, such as ongoing joint R&D projects.

The network context imposes even more-complicated requirements on the transfer of collective knowledge. The existence of source and recipient networks means that relevant people and skills that shape knowledge transfer extend among several organizations that must interact in order to accomplish capability development. Unfortunately, the network context of collective knowledge transfer has received little research attention. Although several theories contribute relevant insights, there is no even close to unified perspective. Therefore, an exploratory study is appropriate for studying how source and recipient networks influence knowledge transfer.

3. Methods

Data collection

We took an inductive multiple case study approach (Yin 1994) for this study. As Hoskisson, Eden, Lau and Wright (2000) note, “Theory development in emerging economies can be problematic. There are major issues to be addressed with respect to replication of tests of hypotheses and research instruments developed and used in developed markets in an emerging market context”.

Three factors create a rationale for using a qualitative inductive approach. First, the study seeks to explore new theoretical ground. Second, the paper deals with detailed firm-specific constructs that quantitative research cannot easily obtain and analyze. Third, the in-depth fieldwork can reveal managerial intentions and causalities of the issues related to R&D capability transfer (Yin 1981; Strauss and Corbin 1990; Rouse and Daellenbach 1999).
Our research involved several stages. We began by reviewing literature concerning transfer of tacit knowledge. We also collected data from yearbooks, industry publications, and other archival sources. Upon establishing an understanding of the basic conceptual and empirical contexts, we proceeded with phone and face-to-face interviews with people in the industry. These open-ended interviews focused on positive and negative influences of source and recipient networks on the knowledge flow within the IJVs and into the local qiye jituan networks.

We then conducted thirty-two open-ended interviews. Fourteen respondents were managers from four IJVs in the Chinese auto industry; each IJV is involved in on-going R&D capability transfer programs. We interviewed at least three people at each of the IJVs. In each case, the respondents included employees of both the Chinese and foreign partners of the IJV. Each respondent has high-level R&D management responsibilities. We also interviewed eighteen people who participate in or are familiar with the broader qiye jituan networks of local Chinese firms: eight managers who work within technological centers of three qiye jituan (at least two people from each qiye jituan), four officials from two government agencies that guide automotive industry management and technology development, and six industry experts. All interviews took place in either English or Chinese as appropriate, with each interview lasting from thirty minutes to two hours.

Each interview followed the same four-part protocol to ensure reliability. First, the interviewer explained the purpose of the research, to ensure that the respondents understood the key concepts. Second, the respondent provided personal background and her/his perception of the development and status of R&D capabilities of the company. Third, the respondent provided detailed chronologies of particular R&D project(s) he/she participated in that involved transferring R&D capabilities from the source firm to the recipient IJV and/or to the recipient or source networks. Fourth, the interviewer asked more specific and probing questions to acquire the respondent’s personal opinions about capability transfer strategies. The interviewer recorded each interview, with the permission of the respondent, and then transcribed the interviews into English.

Two criteria determined our choice of the four focal IJVs and the respondents. First, the businesses are major players in the Chinese auto sector, with more than 50% of annual vehicle sales in the country and extensive activity in the country’s automotive supply sector, as well as extensive experience with successful and unsuccessful attempts to transfer R&D capabilities. Second, the first author has personal contacts that provided the trust needed to gain the entry for
the extensive discussions and visits that the research required (Inkpen 1997). The sample covers the primary cases of original equipment manufacturers (OEMs) in the Chinese automotive industry that are involved in extensive R&D capability transfer projects.

We supplemented the interviews with several forms of supporting information. We conducted field observations at the manufacturing facilities and R&D centers of the four IJVs, using the observations to learn more about the ventures’ development and production activities. In addition, we collected public and private documents that discussed the IJVs’ strategies, structures, activities, and performance. This supplemental information helped us understand the context of the information that the respondents provided. We base the patterns that we describe in the following section on the information that we obtained from the interviews.

**The Chinese auto industry**

When China’s auto industry opened to foreign investors in the early 1980s (Buck, Filatotchev, Nolan, and Wright 2000), its R&D capability in passenger vehicle sector was weak. State owned enterprises (SOEs) in this sector initially produced commercial vehicles rather than passenger vehicles. The SOEs undertook low R&D effort (R&D spending was less than 1% of revenue, far lower than MNE R&D investments) and followed very long platform upgrade cycles (usually longer than 20 years).

The auto industry is a considered a pillar industry by the Chinese government. Chinese industrial policy places strong emphasis on developing indigenous R&D capabilities in such pillar industries. Approval guidelines for foreign MNEs’ to establish IJVs in the Chinese auto industry involve several key provisions concerning technical development. The IJV must have an internal technical center, which is capable of developing future generations of products. Moreover, the products of the IJV must quickly reach a technological level at par with global standards. The industrial policy provides three strategic guidelines for developing indigenous R&D capabilities (The State Administration of Machinery Industry 1995). First, vehicle OEMs should include 5% to 10% of total reinvestment for developing or expanding their technological centers. Second, R&D spending should reach at least 2% to 3% of sales within five to ten years. Third, key component suppliers should apply 10% to 20% of their reinvestment to set up their R&D facilities and technical centers. The government also provides financial and taxation support for joint R&D projects.
MNEs have recognized the tremendous potential of the emerging car market in China since the early 1980s (Buck, et al. 2000). AMC-Jeep and Volkswagen (VW) were the first MNEs to enter China. They entered with cautious attitudes about the industrial infrastructure and local market, and established simple vehicle assembly facilities with low local content and almost no local knowledge content. AMC-Jeep had a very low level of initial sales, but VW achieved early success in penetrating the Chinese market, primarily because its first vehicles met market needs better than available domestic products and the venture faced little foreign competition. The commercial success of VW in the late 1980s and early 1990s evoked an inflow of foreign investment throughout the 1990s, from OEMs and first-tier suppliers such as General Motors (GM), Ford, Daimler-Chrysler, Toyota, Honda, Visteon, Delphi, Cummins, and others. In order to earn the approval of entering China, MNEs now must commit to bring in modern product/process technologies and help develop indigenous R&D capabilities at their local operations.

China’s demand for R&D capability transfer is at least partly consistent with the long-term incentives of MNE investors. As competition in the China’s car markets becomes more global and intense, companies must develop new products that suit local tastes and regulations at a faster pace. Transferring R&D capabilities to operations close to local markets thus becomes more beneficial (Buckley and Casson 1976). MNEs’ R&D activities in the EEs are mostly at the end stage of the R&D cycle, with tasks such as adapting the general design to the local environment. The design adaptation/localization process requires varying degree of local knowledge content, ranging from extending the length of the car to re-designing the exterior and interior and fitting a new engine. GM-Shanghai, for example, made 600 engineering changes to tailor the Buick Century to Chinese driving conditions and regulations. Changes included elevating the rear seat, enhancing legroom in the back, fine-tuning the suspension for China’s road conditions. Localization-related engineering work also includes validating the capabilities of local suppliers and certifying product designs to meet local quality, safety, and environmental requirements.

Networks associated with the Chinese auto IJVs

Like other business organizations, IJVs are not isolated islands, but are deeply embedded in a nexus of socioeconomic relationships of related organizations. Granovetter (1985) argues that virtually all economic behaviors in modern life embedded within networks of social relations that condition economic process. Network ties entail mutual influence between an organization and its network contacts in terms of information, power, resource, and trust. Such ties provide benefits
such as trustworthy relationships, fine-grained information sharing, and joint problem-solving arrangements (Burt 1992; Gulati 1998).

Due to its multi-partner nature, an IJV participates in two networks. That is, the IJV participates in both its foreign partner’s MNE network and its local partner’s qiye jituan business group. Figure 1 contrasts this multi-network perspective on IJVs and knowledge flow with the traditional unitary-actor perspective. In the EE context, because the technical knowledge primarily flows from the MNE to the local firm, we term the MNE network of the IJV’s foreign partner as the source network and the business group of the local partner as the recipient network.

********** Figure 1 about here **********

Most previous studies of IJV knowledge transfer have focused on the attributes of the two IJV partners. The research has not studied how the IJVs’ networks affect knowledge transfer and treats the MNE as an aggregated knowledge source (e.g., Lyles and Salk 1996; Dussauge, Garrette, and Mitchell 2000; Lane, Salk, and Lyles 2001). Even when studies have used a network perspective to study knowledge flow between firms, the research typically is limited to studying inter-member knowledge transfer in areas such as product and process design, distribution, marketing, and alliance experiences within a single MNE network (e.g., Gupta and Govindarajan 2000).

When an IJV is embedded in both a source network and a recipient network, the knowledge flow through the IJV is not limited to a one-to-one setting (foreign partner-to-local partner) setting, but includes a network-to-network setting. Such network-to-network transfers can have far-reaching implications for the diffusion of knowledge in an emerging economy. Therefore, this study explores the patterns of knowledge flow between the two networks of an IJV.

Source networks of MNE auto firms

Since the early 1980s, automotive assemblers and component suppliers worldwide have been forming alliances and a few large MNE networks have emerged as a result (Nohria and Garcia-Pont 1991, Garcia-Pont and Nohria 2002). Most of the multinational firms that have entered the Chinese auto industry are large MNEs with multiple alliances and wholly owned subsidiaries in different countries. For example, General Motors, the world's largest vehicle manufacturer, employs about 325,000 people around the world, has manufacturing operations in 32 countries, and sells its vehicles in 192 countries. The GM Group of global partners includes Fiat Auto SpA of Italy, as well as Fuji Heavy Industries Ltd., Isuzu Motors Ltd. and Suzuki Motor
Corp. of Japan, which are involved in various product, power train, and purchasing collaborations. In addition, GM is the largest shareholder in GM Daewoo Auto & Technology Co. of South Korea. GM also has technology collaborations with BMW AG of Germany and Toyota Motor Corporation of Japan, and vehicle manufacturing ventures with several automakers around the world, including Toyota, Suzuki, Shanghai Automotive Industry Corp. of China, AVTOVAZ of Russia, and Renault SA of France.

**Recipient networks (qiye jituan) in the Chinese auto industry**

The local partners of most IJVs in the Chinese auto industry are affiliated with local business groups (qiye jituan). These business groups are coalitions of firms, interwoven with complex legal, administrative, financial, and transactional ties under the control of a core firm (Kister 1998). There are a total of 21 automotive qiye jituan in China. They represent over 90% of total Chinese automotive firms and revenues. As the government has gradually reduced its control over the auto industry since the mid-1980s, the core firms of these qiye jituan serve as intermediaries between the state and the firms and have extensive administrative influence over their member firms. The member firms are either state-owned enterprises (SOEs) or joint ventures. Each qiye jituan has its own technological center or centers. Appendix 1 lists detailed descriptions of the three largest automotive qiye jituan. By the mid-1990s, many business groups in China had interlocking directorates and finance companies, while fewer firms remained rigidly hierarchical (Kister 1998).

Since the late 1990s, Chinese auto firms have faced strong competitive challenges from MNEs due to China’s entry into the WTO. In response, the business groups firms have undertaken a wave of restructuring and consolidating local firms, for several reasons. First, many small assemblers and component suppliers are highly inefficient. There were 119 automotive assemblers and 1,628 automotive component suppliers in China in 1998. Individually, few of them are capable of surviving foreign competition. Joining a qiye jituan can increase the odds of survival by enhancing economies of scale. Second, a qiye jituan can provide an internal market for its members and thus help shield them from foreign competition. Third, when forming joint ventures or negotiating technology transfer issues with foreign firms, large qiye jituan represent greater bargaining power than individual Chinese firms. Fourth, a qiyejituan can gather R&D resources from its members and conduct larger R&D projects than an individual firm would be able to conduct alone. Fifth, qiyejituan provide an open field in which technological and managerial
knowledge and experiences exist as public goods and can diffuse from initial learners to other members of the group.

Despite the benefits of qiye jituan, some firms, especially recently privatized auto firms, find that the networks are rigid and restrictive. The most successful private auto assembler has recently left its qiye jituan in order to gain greater autonomy in making business decisions. As China transforms further into a market economy, the administrative power of qiye jituan may weaken further.

Case studies of IJVs

We undertook field observations at the R&D centers and manufacturing facilities of the four IJVs, which we will refer to as A, B, C, and D due to confidentiality requirements. These IJVs involve three OEMs (A,B,C) and one supplier (D). Control of the four IJVs is split 50-50 between foreign and local partners. B and D’s foreign partners are auto MNE groups based in the U.S., whereas A and C’s foreign partners are based in Europe. The Chinese partners of all four cases are drawn from the three largest Chinese auto qiye jituan listed in the Appendix 1. A, B, C accounted for 51% of the total passenger car market in 2002. D ranks very high in market share in auto parts, particularly car engines.

Our goal is to find common patterns of knowledge flow in the cases and network attributes that facilitate or inhibit the flow. Because we are developing theory through inductive study rather than testing propositions drawn from existing theory, commonality among cases in knowledge transfer patterns, mechanisms, and outcomes, which Yin (1994) refers to as literal replication, is more relevant than variance among cases.

Several patterns of knowledge flow between source and recipients networks were common among the four IJVs. In addition, we found that several attributes of the networks commonly facilitated or inhibited knowledge flow.

We interpreted the information from the interviews in a series of discussions among the three authors. Common themes emerged from different interviewees and different cases during these discussions. In some cases, where we found inconsistencies, we sought clarification from respondents. Such instances typically stemmed from miscommunication or differences in interpretation of questions. We also discussed our preliminary conclusions with people who are knowledgeable about the Chinese auto industry, which helped us refine our interpretations. Thus,
the conclusions that we report in this paper emerged as an iterative process from this series of internal and external discussions.

4. Capability Transfer Patterns

The following section discusses the patterns that emerged regarding the MNE source networks, the recipient qiye jituan networks, and the relationship between these two types of networks.

**MNE source network to IJV**

When an MNE firm and a local firm establish an IJV, the venture becomes a new member of the MNE network. All members of an MNE network can be potential contributors of technical and/or managerial knowledge to this IJV node of the network. As a member of the MNE network, the IJV may gain access the network’s databases, training courses, and information technology infrastructures that link MNE network members. Therefore, in the perspective of an IJV, its MNE partner is not a single source organization, but a source network.

In our cases, extensive knowledge flows from the MNE source network to the IJV occurred in all cases at the onset of IJV and at the beginning of new projects within established IJVs. Soon after Case A was established, for instance, the core firm of the MNE partner took on the overall R&D coordination role and implemented a comprehensive training plan aimed at improving the technical and managerial skills of the IJV’s local engineering personnel. This training plan was based on accumulated experiences of many members of the MNE in transferring knowledge to EE firms. At the beginning of almost every new vehicle project in Case B, meanwhile, the core firm of the MNE partner sends groups of expatriates from different functional areas to the IJV, who work jointly with local engineers and managers. Respondents from these two IJVs spoke positively about the effectiveness of these two mechanisms on transferring technical and managerial knowledge from the core firm of the MNE partner to IJVs.

The respondents also identified significant knowledge flows between subsidiary firms in the MNEs’ networks and the IJVs in all four cases. For example, the MNE source network’s global R&D knowledge stock resident in the global technological centers and engineering branches provides a reservoir of R&D skill and localization experiences that the IJV can draw from. In case B, engineers from a subsidiary in another EE country frequently traveled to the focal IJV to help local engineers implement an R&D procedure aimed at localization of the MNE core firm’s vehicle design. As a manager from this focal IJV told us, “[this subsidiary] does very
similar localization work as what we do here. Their experiences were more relevant than those of [the core firm’s R&D center]. Their engineers come here and work with us on a regular base. We also send people to get on-job training in their site whenever needed.” In cases C and D, meanwhile, personnel from the IJVs went to work and study in their MNE partners’ subsidiaries in other Asian countries and regions, such as Singapore and Taiwan, where Chinese culture and language dominate and the technological level is advanced, in order to reduce the cultural distance between the MNE partner and the IJV.

We found that MNEs’ regular group-wide conventions and forums that allow members from different subsidiaries that face similar issues to meet and communicate can be effective in transferring knowledge. In Case B, the MNE partner had quarterly conventions among top management and chief engineers from all subsidiaries. A manager in this IJV commented: “Those meetings allow us to discuss common technical issues with other member firms and form collaborative relationships with those that have complementary resources.” An engineering manager from Case A mentioned that when a group of Chinese engineers worked in the technological center of the MNE’s core firm, they met engineers from many other countries who worked in the same building. The technical tasks among them are similar, e.g., to modify the vehicle design of the core firm to meet local needs. As a result, in addition to learning from the engineers of the core firm, Chinese engineers also acquired relevant knowledge from engineers from other countries.

These observations concerning knowledge flows from the MNE source networks to the IJVs suggest an initial pattern.

**Pattern 1.** Knowledge flow from an MNE source network to an IJV increases with the establishment of integrative training programs, as well as interaction by IJV personnel with other subsidiaries of the MNE that share technical and cultural issues with the IJV.

We also observed an occasional outflow of knowledge from the Chinese IJV to other IJVs in EE countries. In Case B, for instance, interviewees noted that engineers from a new IJV in another EE had visited their engineering and manufacturing facilities in China to learn about design and process localization approaches. As IJVs in China become more established, this outflow may become even stronger.

It is also important to consider barriers to knowledge flow. While there was substantial flow of knowledge from the MNE source networks to the IJVs, two factors inhibited such knowledge flow, including hierarchical rigidity and knowledge content restrictions. We define
hierarchical rigidity as the presence of strict guidelines that direct how information flows through a network. An engineering manager from Case D mentioned that their MNE parent firm has a hierarchy of information flow and decision that goes from the engineering unit of each country to the technological center of the region and only then reaches the decision-making layer of the MNE. Because of the many links in this chain, approval of engineering requests may take weeks. As the competition in China’s auto market intensifies and the need to react to the change of the market becomes more important, such obstacles can create significant barriers. Similarly, a manager from Case C complained about the large number and rigidity of MNE procedures, some of which are difficult to adapt locally: “The engineering modification procedure specifies more than ten steps that we need to go through to get an approval. But things change so quickly here, we just cannot afford the time to follow all these steps. I wish [the MNE parent firm] would do something to relax its procedures here.”

The second inhibitive factor for knowledge flow arises from knowledge content restrictions that limit which knowledge a source network will provide to firms in the recipient country. Such restrictions often stem from an MNE’s global R&D strategies. Since full-scale vehicle development can cost over US $10 billion, it makes business sense for an MNE to keep a relatively centralized vehicle R&D force in its core R&D center and to maintain few other technical centers worldwide. MNEs can achieve economies of scale of R&D by using the same vehicle design in as many countries as possible. However, because local regulations and consumer tastes differ from country to country and among regions, each context requires modifications and readjustment of vehicle design. MNEs do not have the human resources or knowledge needed to perform these design localization tasks centrally. Instead, they allocate such product/process localization tasks to their technological centers in various countries or regions. As a result of this global R&D layout, the parent firm of the MNE maintains most of its early and mid-stage R&D capabilities centrally, while distributing end-stage R&D capabilities such as minor and peripheral design/process modifications more broadly.

Several examples illustrate this point. One of the managers of an IJV we studied stated: “Of course, our foreign partner did transfer a great deal of engineering and managerial knowledge to us. But we feel that our engineers’ abilities to design a vehicle from initial concept stage have shrunk tremendously. We cannot even make any decisions on engineering changes by ourselves. All we are doing now is to technically support the design of our foreign partner.” A manager from
Case C had similar comments: “Our foreign partner is very tight about its know-how of platform design and any information about their new products. But it doesn’t mind letting us acquire managerial skills. It needs us to do engineering work that it doesn’t want to do in house.”

**Pattern 2.** Hierarchical rigidity in a source network will reduce the flow of knowledge to the IJV, while the division of technical labor in the source network may result in knowledge content restrictions that limit the R&D capabilities that an IJV obtains or even cause a local partner’s existing R&D capabilities to atrophy.

*IJV to the recipient qiye jituan network*

Most previous literature on IJV knowledge transfer treats the IJV as an isolated recipient of the source’s knowledge but many IJVs in EEIs operate within local business networks, such as the *qiye jituan* in China. Thus, much of what the IJVs learn from their source networks does not stay within the IJV, but spreads to other members of the recipient network (Kister 1998). In other words, there is substantial knowledge diffusion within recipient networks. However, little research examines patterns of knowledge flow within recipient networks and the mechanisms that facilitate local knowledge diffusion.

Knowledge diffusion within the recipient network of an IJV will take place even in the face of legal restrictions. Typically, other actors in a recipient network are not entitled to receive technologies that the foreign partner provides to its local IJV. Each IJV we observed has a technology transfer agreement that strictly restricts the IJV from spreading the technology beyond its boundary. Nonetheless, in spite of these explicit restrictions, we found that managerial knowledge spreads widely within the recipient networks, while technical knowledge spreads to a lesser but nonetheless meaningful extent. This section discusses our findings about patterns of knowledge flow within recipient networks, recipient networks’ approaches for spreading knowledge among members, and factors that inhibit this knowledge flow.

The three *qiye jituan* that are involved in the four cases we studied have all been very active in developing unified knowledge sharing and creating systems within their networks. We found two mechanisms that facilitate the intra-group flow of managerial knowledge, including management rotation and management training centers.

First, the highest management of the *qiye jituan* often assign top managers of member firms, including IJVs, who then rotate among members of the *qiye jituan*. In our field interviews, interviewees from two out of the three *qiye jituan* indicate that their groups intentionally rotate managers of their IJV members in order to spread the advanced managerial styles and approaches
from the IJV to non-IJV member firms. In a similar vein, Kister (1998) discovered that director interlocks among qiye jituan member firms facilitate the spread of the IJV member’s information within the qiye jituan. In our study, the focus is on the flow of R&D-related knowledge, particularly tacit and group-embedded collective knowledge. Director interlocks, though capable of transferring information, are not sufficient to transfer collective knowledge. By contrast, top management job rotation allows the people to acquire tacit and group embodied managerial and technical knowledge through learning-by-doing in an IJV over relatively long periods, and then carry this knowledge to non-IJV firms as they rotate to new positions within the qiye jituan.

Managerial rotation is more effective than director interlocks for transferring collective knowledge, but not always sufficient because R&D capabilities are group embedded as well as tacit. Such capabilities are difficult to transfer through one or a few managers. A manager at the core firm of a qiye jituan expressed her concerns over this knowledge transfer mechanism: “No top manager in an IJV within our qiye jituan will stay on his job forever. Our point is clear – he is expected to bring the advanced managerial experiences to other brother firms…But things have not been working in our ways. Things are too difficult to change in SOEs even with a manager who has worked in IJVs for many years. Their history is too long and their culture is too hard to change.” As her statement pointed out, individual managers cannot fully change group-level knowledge by themselves, although individual managers are capable of transferring individual embodied tacit knowledge.

A second process for diffusing managerial knowledge involves management training centers, which partly overcome the limits in transferring group-embedded knowledge. All three qiye jituan that we studied possessed internal management training units. Besides routine technical training of personnel, these training units also organized regular training sessions for the top-level and mid-level managers from all member firms to learn managerial techniques, especially from those of the IJV member. A manager of an SOE that belonged to one of the qiye jituan we studied offered the following comments about this mechanism: “Yes, our qiye jituan works hard to spread that firm’s [the largest IJV member of that qiye jituan] managerial knowledge to us. How? By training us on a regular basis. Sometimes we were even brought to that firm’s training facility to get trained there.” A manager representing the foreign partner of Case B credited the this mechanism for its business success: “When we first established our IJV here, the qiye jituan brought managers from [Case A, another IJV associated with the same qiye jituan as the Case B]
to us and gave us seminars about how to conduct business in China for 3 days. We were also allowed to tour [Case A’s] manufacturing facilities. We’ve learned a lot of invaluable knowledge from [Case A].”

We need to be clear at this point that MNEs typically prohibit the spread of proprietary technical knowledge of the IJV beyond the boundary of the IJV through such formal training mechanisms. Instead, the training sessions emphasize teaching procedural knowledge concerning managerial activities that underlie high-level R&D capabilities. Clearly, of course, some proprietary technical knowledge does spread informally. However, management training centers primarily emphasize the diffusion of managerial skills.

Despite the utility of the training center mechanism, one interviewee also pointed out its limit, even for diffusing managerial skills: “High- and mid-level managers of all member firms in our qiye jituan have received a lot of training. But they are at most 10 percent of total employees of their firms. The rest of the people who have not received the training were mostly indifferent to whatever changes the managers wanted to implement to their firms. They just don’t believe in the new ways of management.” Thus, even training centers may not be sufficient to address the group-embedded aspect of collective knowledge.

Pattern 3a. Managerial job rotation among members of recipient network and intra-network training programs facilitate the flow of managerial knowledge within a recipient network, but these mechanisms face limits in diffusing group-embedded knowledge across the recipient network.

We also investigated processes for diffusing technical knowledge. Two mechanisms arise here, including technical centers and supplier relationships.

All three qiye jituan we studied possessed technical centers (see Appendix 1). According a manager of one of the technical centers, the major goal for such centers is: “to ensure that we [local firms of the qiye jituan] do not totally rely on the foreign partner of the IJV to bring us R&D capabilities. If one day [the foreign partner of the IJV] decided to forsake us, we can still manage to design something that is reasonable.” Other managers of technical centers agreed with this philosophy, while adding that to compete with the giant foreign auto MNEs on new product development is not realistic. Their primary goal is to develop and maintain the R&D skills at the technical centers in order to non-IJV members of their qiye jituan and to ensure that the IJV member of their network does not dominate R&D activities within the recipient network.

We found limited evidence of knowledge flows from the IJVs to the technical centers of
the *qiye jituan*. One manager of the technological center of a *qiye jituan* mentioned: “[engineers in the IJVs’ technological staff] occasionally call us up and discuss technical issues with us. After all, we have more local experience than they do. We sometimes also learn from them. But this doesn’t mean that we can fully adopt their ways of management.”

Even more than technical centers, we found that supplier relationships play a major role in diffusing technical knowledge within *qiye jituan* networks. Sourcing choices varied substantially in our cases. Strong social and administrative ties and previous transactional relations cause the assembler members of a recipient network to select suppliers within their recipient network. Such buyer-supplier ties can serve as a conduit of knowledge flows. We found two types of vertical knowledge flow within recipient networks: first, from supplier IJVs to their local assembler customers and, second, from assembler IJVs to their local supplier firms.

Case D provides an example of supplier IJV to local assembler diffusion of technical knowledge. The IJV is a major diesel engine supplier for truck producers in China. Its major customer, Firm X, is a member of its local *qiye jituan* network. An engineer from this IJV has been working with Firm X for many years. He offered a detailed description of the content of the knowledge flow that his firm has brought to Firm X: “Engineers [from Firm X] have told me that their ability to design the power train-engine interface has been enhanced due to their connection with us. Why? Because our engine technology is world class. We have very strict technical standards and specifications regarding engine power-train matching. We send engineers to work with them to help them design this interface, test prototypes, make design changes based on our technical standards. We make a lot of design suggestions to ensure the overall vehicle performance.”

Case B provides an illustration of technical knowledge transfer from an assembler IJV to supplier firms in a *qiye jituan* network. The IJV in this case selected a clutch producer within its own *qiye jituan* to localize its clutch production. The clutch supplier received relevant drawings and documents regarding manufacturing process, and also received technical assistance from the IJV. Based on the QS 9000 quality standard, this clutch supplier needed to submit three versions of prototypes. One year after signing the sourcing contract, the supplier provided a beta prototype. The foreign expatriates at the IJV examined the prototype and concluded that the clutch supplier knew little about mass production of hydraulic clutches. Nonetheless, the IJV stayed with this
supplier and provided additional technical assistance. Less than six months later, the local supplier’s beta II prototype passed the quality tests and received approval from the IJV.

Case C is another example involving knowledge diffusion from an assembler IJV to a supplier. The assembler selected a seat producer from within its own qiye jituan network to supply seats for a new vehicle model that the IJV produces in China. The component sourcing engineers of this IJV formed a project team and worked closely with the project team of the seat supplier, with monthly meetings to coordinate technical issues. By following the IJV’s project management procedures and technical specifications, this seat supplier enhanced its R&D capabilities.

**Pattern 3b.** Technical centers and buyer-supplier relationships in the recipient network facilitate the flow of technical knowledge within a recipient network.

We note that division of labor has arisen at two points in the discussion, with contrasting impact on knowledge flow. Division of R&D labor in the source network, which is often an outcome of global strategy, restricts the flow of knowledge to the IJV. By contrast, division of sourcing labor in the recipient network, which is a consequence of vertical buyer-supplier relationships, enhances knowledge flows from the IJV.

The above patterns describe the positive effects of the local recipient network. Member firms in the qiye jitian network share knowledge with each other, particularly when they are involved in a specific relationship. However, we noticed that the role of the recipient networks might be declining, because some member firms are leaving the qiye jitian arrangement in pursuit of greater flexibility and independence.

The research revealed that the incentive for such exits partly arose because of restrictions in knowledge flows among member firms. We found that two factors inhibit knowledge flow among the member firms of this network, thus reducing its usefulness, including internal competition between assemblers and internal competition between individual managers.

Managers from several cases identified the existence of internal competition within recipient networks. In order to control major IJV member’s power, qiye jituan in the auto industry usually form more than one assembler IJVs with different MNEs. These IJVs, although they belong to the same recipient network, may compete intensely in the same market with only slight product differentiation. Such competitive relationships between the assembler IJVs within a recipient network can prevent knowledge flows – between the assembler IJVs and to other firms in their recipient network.
Respondents also identified competition among individual managers as a salient issue in retarding knowledge flows. Substantial salary differences between the IJV and other member firms within the LN have caused a brain drain from the non-IJV members. The compensation incentive restricts managerial movement to a one-way direction and thus reduces knowledge flows. While administrative directives can achieve rotation of personnel at the top levels of the management, movement at lower levels generally takes place more organically. Therefore, compensation can influence this process. Because most IJVs offer substantially higher salaries and benefits than non-IJV firms in China, the direction of flow of engineers often runs counter to the strategic goals of the top management of qiye jituan. A qiye jituan manager told us that they initially sent many top-notch engineers to work in the IJV in hope that they will acquire technical and managerial skills from the IJV and then return to their original non-IJV firms with the knowledge they acquired. But none of these engineers have returned so far.

Pattern 3c. Internal competition at both the inter-firm and the inter-personal levels restricts knowledge flows between an IJV and other members in the recipient network.

Asymmetric capabilities of networks

Even though the Chinese auto firms have made extensive technological progress in the last two decades, a large gap remains between the capabilities of recipient firms in the Chinese networks and the MNE source networks. This gap is even more severe in R&D capabilities than it is in process technologies. Intense competition in the Chinese product markets has driven the MNEs to transfer knowledge and upgrade the managerial and technical R&D capabilities of the IJVs, despite the potential leakage of these capabilities to the rest of the recipient network. Despite this motivation, it is difficult to transfer capabilities when the asymmetry in capabilities is so stark. Quite simply, the recipient firms commonly lack absorptive capacity needed to understand and incorporate many of the source firms’ skills.

The research suggested that limits in absorptive capacity arose most strongly from differences in organization, even more than from technological gaps between the source and recipient firms. A corporate culture of hierarchy and limited responsiveness that developed through many years in the planned economy often continues to dominate firms throughout the qiye jituan. Several respondents felt that the Chinese firms needed to unlearn their old mentality and become more market oriented in order to acquire advanced R&D capabilities. They noted that technical education helped them learn about new capabilities, but that organizations dominated by the old culture inhibit the ability to incorporate the new skills.
Nonetheless, some firms in our study have found ways to overcome some of the organizational inertia. Some respondents noted that it is easier to make technical and organizational changes within an IJV than it is to undertake immediate change of culture and practices in the traditional firms within the network. For example, a respondent in case B told us, “A lot of our engineers are from the technological center of our Chinese parent firm. When they were in the technological center, they could not achieve any new meaningful design [despite their knowledge of new skills]. Now, with new organization and advanced management [in the IJV], they developed a new car model based on an advanced chassis system from our foreign partner in only one year.”

Consequently, firms have found that it is useful to invest in individual technical training throughout the network, while also emphasizing movement of skilled personnel toward the IJVs. The IJVs actively support such approaches. A respondent in case A remarked, “We have been trying to attract high quality personnel from our other companies and top-notch universities to work for us.” Such movement helps the IJV avoid replicating traditional practices and routines, particularly when only a few individuals move at a time. Some respondents noted that when there is a wholesale movement of personnel, the practices and culture moves with them. A respondent in case C noted, “Transforming an old R&D unit is much more difficult than starting a new one from scratch.” But it is possible to reduce this problem by moving only a small number of people from the network’s established firms into the IJV. The existence of the qiye jituan provides the flexibility and leadership to accomplish this. A solitary firm that operated out outside such a network would have few options for moving and re-arranging people in order to break down old routines and transform an organization.

**Pattern 4.** Providing technical training to individuals in the recipient network and then permitting small-scale movement of skilled personnel to the IJV helps reduce the asymmetry in capabilities between the source and recipient networks.

**Asymmetric motives of networks**

Besides the significant asymmetry in technological and organizational capabilities of the source and recipient networks, the firms often have considerable differences in their goals and motives. On the surface, it may seem that transferring R&D capabilities is a common goal for both networks, yet there are many differences between these two networks concerning their expectations about this process. For example, MNEs typically prefer to transfer end stage R&D activities and capabilities to the IJV, whereas firms in the recipient network would prefer to
develop a full-range of R&D capabilities in the IJV. Second, the MNE does not want the knowledge transferred to the IJV to spill over to other network firms, while the recipient network clearly seeks such spillovers. In addition to these differences, we often noticed that the source and recipients networks disagreed about what product or technology should be brought into the IJV.

The MNE source managers and the qiye jituan recipient managers have identified several mechanisms to deal with such asymmetric motives. MNE often use contracts as the first line of defense for such concerns. The contractual goal was to write clear agreements that identified intellectual property rights issues and limited the control of the recipient firms on technology received from the MNE. Contracts sometimes assigned personnel or information technology to monitor the flow of information. In addition, contractual mechanisms included taking equity investment in the IJV in order to maintain control over technology and knowledge flows. Often, though, the contractual mechanisms were inadequate, sometimes due to the incompleteness of contracts and other times due to weak implementation mechanisms.

MNEs used several organizational mechanisms that limited undesired knowledge spillovers as complements to contracts. In practice, the salary differences between the IJV and the rest of the recipient network tended to reinforce the MNEs’ contractual aims, because the differences ensured the attractiveness of the IJV as a place to work and reduced the flow of personnel from the IJV to the rest of the recipient network. In addition, some MNEs tried to enhance their bargaining power by consolidating multiple JVs into a single venture or by implementing a centralized technology management policy in China.

Pattern 5a. MNE source networks use both contractual and organizational arrangements to reduce unintended outflow of their proprietary knowledge to members of the recipient network, with the organizational mechanisms having greatest effect.

The Chinese recipient network also finds itself in a position of having to deal with asymmetry in motives. In addition to dealing with limits that their MNE partners impose, the qiye jituan face provisions of the WTO agreements that specify property rights and restrict unintended knowledge transfers. The recipient networks have sometimes tried to enhance their bargaining positions by allying with multiple MNE partners. For example, Shanghai Auto Industry Corporation (SAIC) has allied with both VW and GM, while First Auto Work Group (FAW) has allied with both VW and Toyota. In addition, firms in the recipient networks are increasingly using non-IJV organizational mechanisms to acquire a broader range of R&D capabilities. These mechanisms include working with foreign and domestic R&D consulting firms, subsidizing their
own in-group technology centers to perform a wider-range of R&D work even when there is no immediate commercial pay-off for such investment, and establishing overseas technology centers as training centers and listening posts.

**Pattern 5b.** Recipient networks in emerging economies use several organizational mechanisms to overcome limits on knowledge flow that source networks impose.

5. Discussion and Conclusions

This paper has focused on the transfer of capabilities between source and recipient networks via a joint member of the two networks. We emphasize individually carried and group-embedded tacit knowledge needed to improve firms’ R&D capabilities, where we refer to knowledge that is both tacit and group-embedded as collective knowledge. We believe that this research will interest academics who are studying the transfer of capabilities and knowledge, as well as practitioners in both the MNE and EE contexts. We observed significant knowledge flows from different MNE network members to IJVs and, in spite of restrictions, subsequent capability transfer into different members of recipients’ *qiye jituan* networks. We also observed some counter-flow of knowledge from IJV to MNE source networks and from *qiye jituan* to IJVs. At the same time, we identified several barriers that reduce these flows.

We found a strong flow of both individually carried knowledge and group-level technical and managerial knowledge between the MNEs’ source networks and their IJVs. The existence of a training plan tailored to EE countries, personnel rotation, existence of other subsidiaries similar in tasks and culture, and network-wide conventions facilitate such knowledge flows (Pattern 1). At the same time, we also found that MNE hierarchical rigidity and knowledge content restrictions inhibit this flow (Pattern 2).

We found that the knowledge flow between an IJV and its recipient *qiye jituan* network also occurs, although typically to a weaker degree than knowledge flow from the source network to the IJV. Knowledge that diffuses into the recipient network tends to be individually carried managerial knowledge with a more limited diffusion of individual or group-embedded technical knowledge. The Chinese recipient networks use managerial job rotation and internal training to facilitate diffusion of managerial knowledge (Pattern 3a). They also use technical centers and internal sourcing to facilitate technical diffusion (Pattern 3b), with internal sourcing having the greatest effect.

At the same time, we found substantial barriers, particularly to the flow of group-level knowledge. We also found that competition between firms within a recipient network and salary
differences between IJV and non-IJV personnel inhibit knowledge flow from an IJV to its recipient network (Pattern 3c).

Finally, we found two kinds of asymmetries between the source and recipient networks: in terms of capabilities and in terms of motives. The study suggests that recipient network investments in individual technical training while rearranging personnel within the recipient network in order to break down old cultures helps overcome capability asymmetries (Pattern 4). We also found that MNE networks use several contractual and organizational mechanisms to guard against undesired spillovers (Pattern 5a), with the organizational mechanisms having the greatest impact, while several organizational mechanisms help qiye jituan networks overcome such limits on knowledge diffusion (Pattern 5b). Thus, the firms are carrying out an ongoing juggling of strategic inter-dependence and separation.

**Implications for theory**

The field research has implications for theories related to flow of knowledge and, more generally, for the capability perspective on business strategy. First, the research emphasizes the need for network-to-network analysis rather than examining only individuals and firms, as most prior research has done. When source and recipient firms are embedded in broader networks, it is useful to recognize the relationships in the networks. In our case, the networks are firms linked through common ownership patterns, but one could consider other kinds of socially defined networks. The research shows that important conclusions arise from such an approach. We found patterns of knowledge flow between these two networks via their common member, as well as various network level variables that influence this flow.

We identified several factors that enhance or retard the flow of knowledge. The results emphasize the correspondence between the nature of knowledge and the processes that will transfer them effectively. Hands-on experience plays an important role in the transfer of tacit skills, but the distinction between individually carried and group embedded capabilities is also critical because group-embedded capabilities typically require group-to-group contact to transfer. The observations are consistent with evolutionary theories of organization. Movement of personnel accomplishes the flow of individually carried capabilities, but not that of the group embedded ones, but ongoing organizational relationships can help transfer group-embedded tacit knowledge.

The tension between enhancing and retarding knowledge flows has important implications for whether the prior network knowledge stock acts positively as absorptive capacity (Cohen and
Levinthal 1990) or as a core rigidity (Leonard Barton 1992). Given that a recipient network affects the initial endowment of R&D routines in an IJV through R&D personnel transfer, the recipient network’s previous R&D knowledge stock influences the learning capability of the recipient organization. A common notion concerning the effect of preexisting organizational knowledge on firms’ capability to learn is based on the idea of absorptive capacity, which enables the organization to learn new knowledge more effectively if the new knowledge builds cumulatively on the previous knowledge stock (Cohen and Levinthal 1990). However, the preexisting knowledge stock may act as core rigidity that limits a firm’s ability to change. It is interesting to compare these effects and consider situations where one of them will dominate.

Previous literature suggests that core rigidities are important when the environment changes disruptively and renders the knowledge stock obsolete (Levitt and March 1988; Leonard-Barton 1992; Baum and Ingram 1998). In general, group-embedded knowledge of the organization, although it can be modified cumulatively, is very difficult to change in a disruptive manner. Preexisting tacit and embedded routines (i.e., collective knowledge) can become core rigidities when they conflict with routines that the firm wishes to acquire. As Leonard-Barton puts it “Values, skills, managerial systems, and technical systems that served the company well in the past and may still be wholly appropriate for some projects or parts of projects, are experienced by others as core rigidities – inappropriate sets of knowledge” (Leonard-Barton 1992: 118).

We found that the effect of previous individual experience might differ from that of group experience. Previous individual experiences form individual absorptive capacity, which can help a recipient organization learn more effectively even when the environment changes disruptively and group-embedded capabilities have created core rigidities. This difference occurs because individual-carried knowledge tends to be less inertial than group-embedded knowledge in a time of disruptive change (Mukherjee, Mitchell, and Talbot 2004). We find that, when facing a disruptive change, existing group-embedded capabilities inhibit the transfer of new capabilities, whereas preexisting knowledge set carried by individuals can help an organization acquire new capabilities.

Is it possible for recipient firms to take advantage of absorptive capacity yet avoid the pitfalls of core rigidities? R&D capabilities represent typically involve extensive elements of collective knowledge and can decline when the knowledge group faces drastic reductions. Sproull, Weiner, and Wolf (1978) showed that old routines weaken when many new members join a group.
Consistent with this, we found that the recipient organization could take advantage of the individual absorptive capacity of the experienced personnel when it transfers R&D personnel from its network. At the same time, the recipient organization may avoid inheriting undesirable routines, which act as core rigidities, by avoiding large-scale organizational transplantation. Thus, when new knowledge presents a drastic change from the preexisting knowledge, if the recipient organization can import the individual absorptive capacity of experienced R&D personnel without inheriting the core rigidity, then the recipient network’s previous R&D stock improves the effectiveness of R&D capability transfer of the IJV.

**Implications for emerging economies**

The research also has specific implications for managers in emerging economies, whether from MNEs or local firms. First, the study emphasizes the network nature of recipient organizations in emerging economies. Previous studies have generally examined the recipient as a single organization in isolation, but our study shows that the flows within recipient networks can be significant enough that the source-recipient relationship should be managed at the network level. The intra-network capability flows have played a significant role in the upgrading of local firms in China and elsewhere. We believe that appreciation of the role of these networks is important for both local firms and the MNEs.

Recipient networks such as the *qiye jituan* networks in China not only provide internal commercial and capital markets, but also act as knowledge disseminators. Although the internal market role of these networks is fading as EEs become more market-oriented and external markets become more efficient, recipient networks’ role as knowledge disseminators remains salient.

From the perspective of the MNEs, our research has highlighted some of the restrictions on knowledge transfers. Hierarchical rigidity and content restrictions that arose from global R&D strategies were most salient in reducing knowledge flow. The MNE managers must decide if these policies are optimal, keeping in mind their benefits as well as costs.

MNEs doing business in emerging economies face an interesting challenge. As competition increases among MNEs, they need to upgrade technology in local markets to stay competitive. It is no longer possible to do business in major emerging economies with obsolete technology, as was the norm a few decades ago. Yet, the transfer of capabilities is challenging. Transferring capabilities – as against one-time technology transplants – to local subsidiaries or IJVs encounters large differences between local organizations and MNEs in terms of technical
capabilities, organizational capabilities, and organizational cultures. Further, firms must balance
the knowledge transfer process against procedures for reducing unintended knowledge flows. Our
research helps shed some light on mechanisms to deal with these asymmetries and challenges.

Limitations and future research

As an exploratory study, our purpose was to apply a dual network perspective as a new
lens and to determine if we could identify implications that a firm-to-firm approach would not
disclose. We believe that we have identified important conclusions concerning capability transfer
within source and recipient networks. Nonetheless, the paper has several limitations. First, our
conclusions are exploratory and need to larger sample studies to verify and extend. It is possible
that the choice of our context, industry, or cases influenced our findings. A broader study would
help mitigate such concerns. Second, such studies could use more fine-grained network measures,
to investigate differences in knowledge flow that arise from differences in network structure.
Third, we have de-emphasized the motivational factors for R&D capability transfer in order to
undertake a focused study on the coordination factors for R&D capability transfer. It will be useful
to examine the interplay between these sets of factors. We believe that this study provides a base
on which to build in order to overcome these limitations.
References

51. The State Administration of Machinery Industry, P.R. China, 1995, Policies about China automotive industry (SAMI, Beijing)
## Appendix 1. The Three Largest Chinese Automotive Business Groups

<table>
<thead>
<tr>
<th></th>
<th>First Auto Work Group (FAW)</th>
<th>Dongfeng Group</th>
<th>Shanghai Auto Industry Corp (SAIC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of car producers</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Number of truck producers</td>
<td>13</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Number of engine producers</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Number of component producers</td>
<td>3</td>
<td>23</td>
<td>44</td>
</tr>
<tr>
<td>2002 revenue (at 1990 level)</td>
<td>107 billion US$</td>
<td>84 billion US$</td>
<td>128 billion US$</td>
</tr>
<tr>
<td>2002 asset (at 1990 level)</td>
<td>89 billion US$</td>
<td>70 billion US$</td>
<td>94 billion US$</td>
</tr>
<tr>
<td>2002 profit (at 1990 level)</td>
<td>24 billion US$</td>
<td>22 billion US$</td>
<td>34 billion US$</td>
</tr>
<tr>
<td>2002 ROA</td>
<td>27 %</td>
<td>32 %</td>
<td>36 %</td>
</tr>
<tr>
<td>Total R&amp;D personnel</td>
<td>2,594</td>
<td>4,946</td>
<td>2,390</td>
</tr>
<tr>
<td>R&amp;D/Sales intensity</td>
<td>1.5 %</td>
<td>1.5 %</td>
<td>1.3 %</td>
</tr>
<tr>
<td>Number of technological centers</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of training center</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Year developed first car</td>
<td>1958</td>
<td>none</td>
<td>1958</td>
</tr>
<tr>
<td>Year developed first truck</td>
<td>1956</td>
<td>1975</td>
<td>none</td>
</tr>
<tr>
<td>Number of IJVs</td>
<td>2</td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>Type of IJV</td>
<td>Car</td>
<td>Car, truck, and engine</td>
<td>Car, truck, and components</td>
</tr>
<tr>
<td>Foreign partners</td>
<td>VW, Toyota</td>
<td>PSA, Nissan, Cummins</td>
<td>GM, VW, Delphi, Visteon</td>
</tr>
<tr>
<td>IJV’s volume/group volume *</td>
<td>85 %</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>IJV’s revenue/group revenue *</td>
<td>34 %</td>
<td>n/a</td>
<td>66 %</td>
</tr>
<tr>
<td>IJV’s profit/group profit *</td>
<td>41 %</td>
<td>n/a</td>
<td>60 %</td>
</tr>
<tr>
<td>IJV’s R&amp;D personnel/group R&amp;D personnel *</td>
<td>12 %</td>
<td>n/a</td>
<td>22 %</td>
</tr>
<tr>
<td>IJV’s R&amp;D intensity *</td>
<td>1.6 %</td>
<td>n/a</td>
<td>1.2 %</td>
</tr>
<tr>
<td>Year IJV started car production *</td>
<td>1989</td>
<td>1992</td>
<td>1983</td>
</tr>
</tbody>
</table>

**Notes**
- Data source: China Automotive Industry Yearbook 2003 (Edited by Chinese Automotive Technology Research Center)
- For items with *, we only include car-producing IJVs.
- For FAW and Dongfeng, we only include tightly-linked members of business groups.
Figure 1. Two Perspectives on Knowledge Source and Recipient in IJV Capability Transfer

a. The traditional aggregated perspective (The arrow depicts the knowledge flow)

b. The network perspective (The arrow depicts the knowledge flow)