



Building extra-regional networks for regional innovation systems: Taiwan's machine tool industry in China



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ABSTRACT

In the current knowledge-based global economy, regional innovation systems (RISs) require to establish external linkages to sustain their vitality. By using the investments of Taiwan's machine tool (MT) industry in China as the case, this paper studies how an RIS developed its extra-regional networks through building offshore industrial systems. We particularly examine the networking activities of Taiwanese MT firms in building their familiar networked-type industrial systems in China, and discuss how the emergence of such offshore industrial systems would influence the technological changes and inter-firm dynamics of Taiwan's MT firms and the MT RIS. In addition to providing empirical study discussing issues related to networking involved in the development of an RIS's extra-regional networks, this paper contributes to the RIS literature by presenting one evolutionary trajectory of RISs which has been of particular significance in the Taiwan–China context.

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1. Introduction

The regional innovation system (RIS) concept has been widely applied to account for the successful development of many high-performing or innovative regions in both developed and developing economies (Asheim and Coenen, 2005; Corrocher and Cusmano, 2014; Bjorn and Gertler, 2005; Doloreux, 2002; Chaminade and Vang, 2007; Lundvall et al., 2009; Cooke and Morgan, 1994). Recent researches on RIS, however, have criticized the localized or regional-fixed perspectives embodied in this concept and have emphasized the needs to analyze the role of extra-regional networks as mechanisms of knowledge generation and circulation in addition to processes and institutions within RISs (Lundvall et al., 2009; Doloreux and Parto, 2005; Benneworth and Dassen, 2011; Uyerra, 2010; Giuliani et al., 2005; Oinas and Malecki, 2002). It is further suggested that the RIS approach needs to be enriched by considering the cross-regional or international dimension of interactions between local and non-local actors through various individual, intra-firm and inter-firm networks (Asheim and Coenen, 2005; Pietrobelli and Rabelotti, 2009; Chaminade and Plechero, 2015; Coe et al., 2008; Yeung, 2013; Fransman, 2010). In response to this call, this paper addresses issues related to the development of extra-regional networks of an RIS by using the investments of Taiwan's machine tool (MT) industry in China as the study case.

One typical feature of most Taiwan's globally competitive industries, such as information technology (IT), footwear, MT, bicycle or musical instrument industries has been the existence of spatialized and network-typed industrial systems which serve as suitable geographical

and institutional arrangements for promoting production efficiency and technological learning (or innovation) of the individual firms and the industries (Lee and Saxenian, 2008; Chen and Lin, 2014; Mathews, 1997; Yan et al., 2011; Cheng, 2001; Chen, 2002). Although these Taiwanese firms and industries have continued to enjoy the agglomeration advantages brought by industrial clustering, they have been found to increasingly expand the spatial boundaries of their regional production and innovation networks outside the regions and even Taiwan (Chen and Lin, 2014; Ernst, 2010; Poon et al., 2006). Among their efforts in this course, the construction of offshore industrial systems by Taiwanese firms in China has been a subject receiving much scholarly attentions lately. Since the 1980s many Taiwanese manufacturers have joined the global trend by relocating a significant share of their production from their regional bases in Taiwan to China (Hsu and Chen, 2011). Their accelerated investments have resulted in the emergence of the so-called cross-border (or trans-border) regions, involving the transplantation of Taiwan's industrial systems to China (Lee, 2009; Yang and Hsia, 2007). The prominent examples include the formation of Taiwan's footwear cluster and electronics cluster in Pearl River Delta (PRD) region, and information technology cluster in Yangtze River Delta (YRD) region (Lee, 2009; Yang, 2009; Liu and Chen, 2012; Hsu, 2006).

In this paper, we conceptualize the transplantation of an RIS' regional networks to remote sites, i.e. the establishment of offshore industrial systems, as one specific means through which an RIS develops critical external linkages (see Fig. 1). Based on this idea, we examine how regional firms build up offshore industrial systems, and how such systems might affect the evolution of the home RIS. Given scholars have emphasized the significance of networking and the possession of network mobilization capability for firms to access external resources and capabilities

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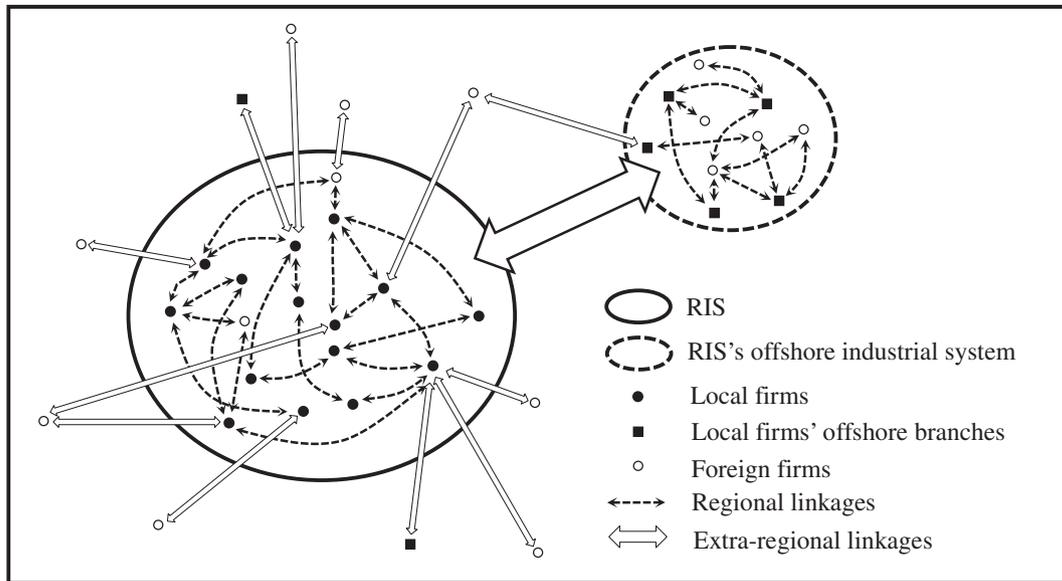


Fig. 1. RIS' extra-regional linkages and its' offshore industrial system.

(Partanen et al., 2008; Huggins and Thompson, 2015; Tomlinson and Fai, 2013; Ceci and Iubatti, 2012; Lechner and Dowling, 2003; Hoang and Antoncic, 2003; Jack, 2005), we particularly focus our investigations on the networking activities of firms and key factors influencing the processes and consequences of their actions.

This study relied mainly on qualitative data¹ based on more than 80 cases of in-depth interviews with decision-makers of Taiwanese MT firms, their suppliers, and related private and public agencies in Taiwan and China conducted in 2005–2006 and 2010–2013.² In the paper, we identify various networks critical to Taiwanese MT makers' China investments. Additionally, it is argued that establishments of offshore industrial systems by these firms are made effective through mobilizing their intra- and extra-regional linkages with various Taiwanese and Chinese actors. While the aggressive relation building efforts of Taiwanese MT entrepreneurs has been the key, we argue that their networking activities were particularly facilitated by both the pre-existing relational proximity between Taiwanese regional firms, and the cultural proximity between Taiwanese and Chinese partners. Furthermore, thanks to the establishments of its various production and business networks in China, the MT RIS in Taiwan has been allowed to secure new opportunities and complementary knowledge required for sustaining

¹ The strength of using qualitative techniques, particularly the corporate interviews, in studying the spatial phenomena of economic actions is well-recognized (Schoenberger, 1991) E. Schoenberger, The corporate interview as a research method in economic geography, *The Professional Geographer*, 43 (1991) 180–189, (Markusen, 1994) A. Markusen, Studying regions by studying firms, *Professional Geographer*, 46 (1994) 477–490. Since this study aims to understand and explore the implicit and subtle elements influencing firms' various networking activities that might not lend themselves to quantitative measurement, such methods seem most suitable (Wolfe and Gertler, 2004) D. Wolfe, M. Gertler, Clusters from the inside and out: local dynamics and global linkages, *Urban Studies*, 41 (2004) 1071–1093, (Oinas, 1999) P. Oinas, Activity-specificity in organizational learning: implications for analyzing the role of proximity, *GeoJournal*, 49 (1999) 363–372, (MacKinnon et al., 2002) D. MacKinnon, A. Cumbers, K. Chapman, Learning, innovation and regional development: a critical appraisal of recent debates, *Progress in Human Geography*, 26 (2002) 293–311.

² Typically, the in-depth interviews lasted one to three hours each. In addition to asking interviewees to first describe the history of their investments in China, the interviews addressed questions regarding how interviewees developed and used various networks in their ventures. A variety of secondary data were also used, including governmental statistics, corporate reports, industrial and financial analyses, and business and commercial journals and newspapers. Throughout the research process, we continuously validate our research findings by triangulating evidence from interviews and secondary data, and by comparing these findings with those from prior studies on the investment and networking activities of foreign firms (especially Taiwanese firms) in China. Later research stages included interviews with specialists to obtain critical evaluations of our findings.

its competitive and innovative dynamisms. Through such investigations and discussions, this study helps to address the critical insufficiencies in current RIS approach, specifically the neglect of external networks and institutions, and a failure to address regional evolution (Uyarra, 2010), as the paper provides not only detailed accounts of networking activities involved in the development of an RIS's extra-regional networks, but also describes the evolutionary trajectory of a particular RIS which has been of particular significance in the Taiwan–China context.

To present our findings, the remainder of this paper is organized as follows. Section two reviews the literature on RIS and studies related to the transplantation of Taiwan's industrial systems to China. Section three provides a brief description about Taiwan's MT industry and its China investments. In the fourth section we investigate the networking activities of Taiwanese MT firms in the processes of building offshore industrial system. The fifth section then turns to discuss how the emerging extra-regional networks affected the technological changes of Taiwanese MT firms and the RIS. The final section concludes.

2. Literature review

Since the 1990s, RIS has developed to become a widely used concept for analyzing the learning and innovation processes of firms or industries in many regions around the world (Corrocher and Cusmano, 2014; Bjorn and Gertler, 2005; Doloreux, 2002; Chaminade and Vang, 2007; Lundvall et al., 2009; Fu, 2015; Cooke et al., 1998). Building or strengthening RIS have even been one critical policy goal of governments in both developed and less-developed countries aiming to enable their firms or industries to obtain higher global competitiveness through various actions in local or regional levels (Chaminade and Vang, 2007; Lundvall et al., 2009; Uyarra, 2010; Rodríguez-Pose and Villarreal Peralta, 2015; Moodysson and Zukauskaitė, 2014). Like the concepts of innovation systems (Edquist, 2005) or industrial ecosystems (Fransman, 2010), the RIS approach stresses gaining a better understanding of innovation activities and outcomes through the systemic analysis of symbiotic interactions between firm and non-firm actors, and the institutions in which these actors are embedded. However, it has placed additional emphasis on the territorial dimension of innovation processes. According to Belussi et al. (2010), the notion of RIS originates from two sets of literature: the evolutionary economies literature that considers innovation as the result of complex and non-linear social processes, nurtured by various actors and factors within and outside the firms (Edquist, 2005); and the literature of industrial clusters

that emphasizes the geographical clustering of firms stimulates interactive learning and innovation, thus engendering sustained competitiveness of the firms and the cluster as a whole (Maskell, 2001; Cooke, 2001). While there seems to be no generally accepted definition of RIS, it is typically understood as a spatialized industrial system in which “firms and other organizations are systematically engaged in interactive learning through institutional milieu characterized by embeddedness” (Cooke et al., 1998). Specifically, the general idea of RIS concept is that the enhanced geographical and institutional proximities through industrial concentration of firms and other organizations provides the best condition for fostering not only knowledge exchanges, but also social relations building among regional actors that would stimulate their individual and collective innovation capabilities, consequently leading to vibrant regional development in the knowledge-based global economy.

The RIS concept has been applied to account for the successful development of many high-performing or innovative regions. However, the localized perspective adopted by traditional RIS approach that puts great emphasis on local sources of innovation recently has been challenged by scholars who questioned the seeming dominance of localized learning and innovation processes (MacKinnon et al., 2002). More specifically, it is argued that as a result of the development of information and communication technologies and modern transportation infrastructure, interactive learning and innovation can occur effectively through organizational and relational linkages between spatially distant actors (Bunnell and Coe, 2001; Amin and Roberts, 2008). Moreover, the creation of new ideas or capability should be viewed as a result of the integration of local and non-local interactions (Asheim and Isaksen, 2002; Bathelt et al., 2004). Alongside the increasing dissatisfaction among academics regarding the restrictive understanding of the nature of regional innovation processes, recent studies have begun to address the role of extra-regional networks as mechanisms for inducing knowledge generation and circulation within RISs (Lundvall et al., 2009; Doloreux and Parto, 2005; Giuliani et al., 2005; Chaminade and Plechero, 2015; MacKinnon et al., 2002; Asheim and Isaksen, 2002; Wang et al., 2014; Mastroeni et al., 2013). Scholars of global production networks (GPNs) and global value chains (GVCs), for instance, have shown that regional firms might be able to acquire locally-absent capabilities or resources through networking with other actors involved in such international collaborative arrangements. They further argue that the upgrading prospects of regional firms and the RISs, while dependent on the quantity and quality of regional assets, would also be contingent on the different patterns or governance forms of GPNs applied to these firms and regions (Pietrobelli and Rabellotti, 2009; Coe et al., 2008; Yeung, 2013; Yeung, 2009).

There is a consensus in the current RIS literature that long-term growth of an RIS would be determined by its ability to form appropriate intra- and extra-regional institutions that allow for the development of diverse and heterogeneous knowledge and organizational forms (Lundvall et al., 2009; Chaminade and Plechero, 2015; Bathelt et al., 2004; Belussi et al., 2010; Asheim and Gertler, 2005). When studying RISs in developing countries, besides analyzing the presence or absence of local institutions relevant for knowledge learning and creation, existing literature particularly stresses the importance of external linkages which channeled technologies or innovation engendered elsewhere to nurture the formation and development of RISs under late industrializing context (Chaminade and Vang, 2007; Lundvall et al., 2009; Giuliani et al., 2005; Yeung, 2013; Wang et al., 2014; Yeung, 2009). Various institutional arrangements or instruments, led by multinational corporations (MNCs) or the states, through such forms as direct investments, joint ventures, licensing, original equipment manufacture (OEM) or own-design manufacture (ODM) partnerships, and international cooperative R&D, for instance, have been addressed to be the extra-regional linkages which were instrumental for stimulating some dynamic industrial regions in East Asian countries, such as China, Taiwan, Korea, etc. (Lundvall et al., 2009; Giuliani et al., 2005; Chen,

2011a; Kim and Nelson, 2000). However, the construction of these linkages involved mostly cooperation between individual actors within and outside these regions. This gave rise to another critical form of extra-regional network mainly a result of regional actors' collective actions, but this type of network has been largely ignored in the RIS literature. In the case of Taiwan, for example, it is observed that many clustered firms have sought to better utilize extra-regional resources through transplanting their local industrial systems to foreign sites, e.g. China. As existing research has shown, some Taiwan's renowned industrial clusters, such as IT, footwear, MT, or bicycle, etc., currently have all established spatialized industrial systems in various regions in China (Ernst, 2010; Lee, 2009; Yang, 2009; Liu and Chen, 2012; Hsu, 2006; Brookfield and Liu, 2005; Hsing, 1998; Wang and Lee, 2007). As result of such transplantation projects, Taiwanese manufacturing firms have managed to build extensive production and distribution networks in China, allowing them to gain specific competitive edges vis-à-vis their counterparts from other countries especially in terms of exploring and exploiting China's production resources and markets (Ito, 2009).

The above-mentioned cross-border regionalization between Taiwan and China serves as a good example to illustrate the multi-scale nature of an RIS' cooperation and innovation networks in the current globalized economy. Recognizing the emergence and significance of such extra-regional networks in sustaining or even enhancing an RIS' competitiveness then raises questions about how those crucial networks were formed. While answering this empirical question is obviously important, we find such a question has been poorly addressed in existing RIS studies. More specifically, despite its increasing emphasis on global-local relations, the current RIS literature has been criticized by scholars for mostly focusing on providing a snapshot of a system's various networks, and not paying enough attention to the dynamic processes through which an RIS develops required extra-regional relations (Uyarra, 2010). Furthermore, issues related to how such relations would influence the regional competitiveness have also not been adequately examined (Benneworth and Dassen, 2011; Carlsson et al., 2002). In response to these omissions, this paper is to study the processes of and mechanisms relevant to the development of an RIS' extra-regional networks, and uses the investments of Taiwan's MT industry in China as the study case. Specifically, we conceptualize the transplantation of regional networks to remote sites, such as the emergence of cross-border regions between Taiwan and China, as one specific means through which RISs establish external linkages. Following this vein of thought, in addition to exploring various networks critical to Taiwanese MT firms' business activities in China, this paper discusses how these networks were accessed and developed, and how these networks exert influences over the capability-building of Taiwanese MT firms and the dynamisms of the MT RIS in Taiwan. As scholars have already emphasized the importance of networking and the possession of network mobilization capability for firms to access external resources (Partanen et al., 2008; Huggins and Thompson, 2015; Tomlinson and Fai, 2013; Ceci and Iubatti, 2012; Lechner and Dowling, 2003; Hoang and Antoncic, 2003; Jack, 2005), our study would particularly focus on the networking activities involved in the formation of offshore industrial systems and critical factors facilitating these processes.

Before presenting the findings, in next section we provide a short description of Taiwan's MT industry, and the investments of Taiwanese MT firms in China.

3. The investments of Taiwan's MT industry in China

As the world's fourth largest MT exporter and seventh largest MT producer in 2014 (Gardner Publications, 2015), Taiwan's MT industry, composed of numerous small and medium-sized MT manufacturers and specialized suppliers, has been renowned for attaining its global competitiveness by constructing a networked-type spatialized industrial system in central Taiwan, including Taichung, Nantou and



Fig. 2. The main locations of Taiwanese MT firms' investments in China.

Changhua (see Fig. 2) (Chen and Lin, 2014; Brookfield, 2008). In this industrial cluster, Taiwanese MT makers can outsource each step of the production process to capable local subcontractors, allowing them to maintain low overheads while achieving high flexibility in both internal and external operations. Also, through exploiting various learning channels and mechanisms available in the spatialized industrial networks, these firms were able to overcome their latecomer disadvantages in production and technological upgrading (Chen, 2009).

As an export-oriented industry that sells its products globally, Taiwan's MT industry began to explore the emerging Chinese market in the late 1980s (MIRL, 1995). Along with its continuing economic development, China has been the fastest growing MT market over the past two decades. Since the early 1990s, China has been one of the world's top four MT consumers and importers, and has maintained double-digit growth in MT demand. From 2002, it has even overtaken Germany and the USA to become the largest MT market in the world (ITIS, 2005). In 2014 China's consumption of MT products reached nearly US\$ 31.7 billion, accounting for about 42% of the world total (Gardner Publications, 2015). For Taiwanese MT makers, by 1992 China has surpassed the USA to be the largest customer of Taiwan-made MT products, and since 2002 roughly 40% of Taiwan's annual MT exports have shipped across the strait (TAMI, 2013).

To exploit China's market and low-cost manufacturing resources, Taiwanese MT makers started to establish subsidiary plants in China since the early 1990s. Previous studies of investments by Taiwan's manufacturing industries in China have suggested that, in order to construct production networks in China, Taiwanese firms often employed the so-called "Hens lead chicks" strategy, in which Taiwanese firms would motivate and support their local suppliers in home regions to join their China ventures. And the ability to work with familiar partners has been further suggested as being the key to the smooth transplantation of industrial systems from Taiwan to China (Hsu and Chen, 2011; Yang and Hsia, 2007; Yang, 2009; Hsing, 1998; Wang and Lee, 2007). Yet, in the case of Taiwan's MT industry, the firms seems to have encountered significant challenges in replicating their Taiwanese production systems in China. On the one hand, because of their smaller

size, Taiwanese MT firms have limited capacity to encourage and little leverage to pressure their local suppliers to invest in China. On the other hand, many of their suppliers are small metalworking shops with insufficient resources to establish geographically separated operations. As a result, Taiwanese MT firms have to build their production capabilities in China either through sourcing most of their supplies directly from Taiwan, enabling themselves to perform CKD (complete knock-down) or SKD (semi knock-down) assembly in their China plants,³ or establishing local production systems from scratch.

Although Taiwanese MT makers acknowledged the difficulties of undertaking production in China, market forces have driven them to do so. In addition to accommodating the requests of their major customers who often prefer purchasing MT products from makers with Chinese manufacturing facilities, the investments in China by Taiwanese MT firms also reflected strategic responses of Taiwanese firms to the changing policies of the Chinese government. To boost the development of its manufacturing sector, China has offered exemption on import duties for MT products. Nevertheless, the Chinese government has gradually raised the quality thresholds of the MT products to which these duty exemptions apply in an effort to protect and promote its domestic MT industry. Furthermore, recognizing the improving capabilities of Chinese MT manufacturers, in 2007 China canceled duty exemptions on many lower-end and certain middle-end MT imports. Given their products shipped to China were mostly in this quality level, the price advantage enjoyed by Taiwanese MT makers was thus seriously compromised. Since China is too large a market to be ignored, Taiwanese MT firms had little choice but to move their production facilities there. Consequently, there are now over one hundred Taiwanese MT firms conducting manufacturing operations in China, about 70% of whom (including nine Taiwan's top 10 MT firms) are concentrated in the YRD region (TAMI, 2015). (see Fig. 2, and Table 1).

³ In the CKD arrangement, a machine tool firm dismantles its machine tool products into kit form in Taiwan and ship the kits to its China plant for reassembly, while in the SKD arrangement, some parts are sourced locally in China.

Table 1

Subsidiary plants of Taiwan's top 10 MT firms in China.

Source: TAMI (2015), Company websites and author's survey.

Rank	MT Firm	Subsidiary Plant(s) in China	Year Established	Location
1	Fair Friend	Hangzhou Good Friend	1993	Hangzhou
2	Tongtai	Tongyu	2004	Suzhou
3	Goodway	Goodway (Suzhou)	2003	Suzhou
4	Chin Fong	Chin Fong (China)	1994	Ningbo
5	Yeong Chin	Yeong Chin (Shanghai)	2001	Shanghai
6	Litz	Litz (Jiaxing)	2004	Shanghai
7	Victor	Zhongtai	1995	Tianjin
8	She Hong*	N/A	N/A	N/A
9	Shieh Yih	Xie Yi	2003	Kunshan
10	AWEA	Best Way	2001	Shanghai
		Dawea	2002	Suzhou

Note: *No plant in China.

4. The networking of Taiwanese MT firms in China

One common feature in the operation of small and medium-sized enterprises (SMEs) has been reliance on networking to access required external resources complementary to their limited internal resources (Lechner and Dowling, 2003; Hoang and Antoncic, 2003). In the case of Taiwan's MT industry, the numerous MT SMEs are found to heavily embed their capabilities in their local extra-firm networks, nurtured by industrial clustering (Chen, 2011b). With regard to their ventures in China, it thus can be assumed that networking would play significant role in determining these MT makers' investment processes. This section therefore focuses on investigating the networks utilized by and networking activities of Taiwanese MT firms in their China ventures. According to our studies, two sets of networks cultivated by Taiwanese MT firms, one Taiwanese and the other Chinese, are identified to be crucial.

4.1. The mobilization of Taiwanese networks

4.1.1. Supports received from Taiwanese customers

The local MT customers in Taiwan have been emphasized as essential agents helping Taiwanese MT firms upgrade their technological capabilities (Chen and Lin, 2014; Chen, 2009). Since many of their domestic clients have built production bases in China, Taiwanese MT manufacturers were motivated to follow suit. The existing connections with Taiwanese customers further facilitated these MT firms' cross-strait investments. Specifically, many respondents indicated in the interviews that their early operations in China primarily involved transactions with Taiwanese industrial firms, including such as performing post-sales services or supplying local-assembled MT products. By doing business with their familiar domestic customers in China, these ill-experienced Taiwanese MT makers with little or no prior experience of offshore operations were allowed to gradually accumulate relevant knowledge and capacity. And mainly for such a reason, most Taiwanese MT firms have chosen to establish their China branches near their Taiwanese customers to maintain closer interactions. Consequently, the YRD region, which hosts the majority of Taiwanese industrial firms, is also where most Taiwanese MT makers are concentrated.

Taiwanese customers have also been instrumental marketing agents for their domestic MT suppliers in China. In the interviews, some MT firm managers especially stated that the referrals of their domestic customers have been the key channels through which they were able to explore China's market. For example, as many Taiwanese MT products were installed in Taiwanese manufacturers' Chinese plants, these Taiwan-made machines gained greater exposure to local potential buyers. Here is a typical instance provided by the respondents: In their business dealings with Taiwanese manufacturers, Chinese industrial firms would need to pay on-site visits to their Taiwanese production partners to discuss issues related to their transactions and collaboration. During such visits, these Chinese firms would have the

chance to learn the operational conditions and functions of Taiwan-made machines installed in those plants. Moreover, with the information provided by their Taiwanese partners, the Chinese firms might gain further interest in sourcing Taiwanese equipment and get in touch with potential Taiwanese suppliers. As a result, the business opportunities of Taiwanese MT makers in China might therefore emerge.

4.1.2. Cooperation among Taiwanese MT firms

The dense interactions among agglomerated firms that stimulate localized co-opetition mechanisms have been suggested as a typical characteristic of industrial clusters or RISs. But in Taiwan's MT industry, the collocated MT firms were found to mostly demonstrate the dynamics of competition with little cooperation (Chen, 2011b). Acknowledging the apparent rivalry among these MT makers, however, should not lead to the conclusion that they would not work together. One notable instance is the usual phenomenon of Taiwanese MT firms that sell different products would enter complementary supply arrangements (TAMI, 2005). Such collaborative arrangements actually were also adopted by a few Taiwanese MT entrepreneurs in their early marketing attempts in China. In the cases of Victor and Fair Friend, the two earliest Taiwanese MT investors in China, considering the fact that big Chinese buyers often like to purchase various types of MT products, Victor (specialized in lathes) and Fair Friend (specialized in machining centers) offered each other complementary products to secure orders, and thus gradually penetrated into the Chinese market.

Regardless of their business conflicts, Taiwanese MT firms would also help each other in providing information about local sources of supplies. For instance, in our interviews, when asked where and how they found local suppliers, most respondents reported that they have benefited from the suggestions and references from some of their Taiwanese counterparts with more experiences in practicing localized subcontracting production in China. Nevertheless, one should note that, owing to the ability to source local capable suppliers are often being considered a critical competitive asset of MT makers, such intelligence might not flow freely among Taiwanese circles. In the context, many respondents stated that they managed to acquire it through their inter-personal networks.

4.1.3. Inter-dependence between Taiwanese MT firms and suppliers

Since they learned the factors underlying domestic suppliers' reluctance to join their China ventures, Taiwanese MT makers have been attempting to help their important production partners to eliminate the obstacles. While their assistance in this course mainly involve committing to placing favorable and stable orders to the suppliers, MT firms might even make more aggressive efforts in the forms of allowing the suppliers to found their workshops inside the MT firms' China plants through providing space, raw materials, and even employee recruitment help, etc.. Such a practice is actually the application of the so-called "inside subcontracting arrangement" that has been popular in many Taiwan's subcontracting-based industries (Shieh, 1992), just in a large-scale and different contexts. Adopting such an arrangement in China offers critical advantages to both Taiwanese MT makers and suppliers. For the MT firms, they could therefore source prompt and reliable local supplies from trusted Taiwanese subcontractors, while preserving production and organizational flexibility. For the suppliers, the MT firms' assistance enabled them to minimize the costs and risks associated with initiating their China investments. Moreover, along with their stable growth, later some of these suppliers had managed to move out the MT firms' plants and been able to establish their own manufacturing bases in China.

As global MT makers from countries, like Taiwan, Korea, Japan, and Germany, began to rush into China, and China's domestic MT industry rapidly grew, more Taiwanese suppliers became willing to enter this market. Although their China investments might not receive direct assistance from Taiwanese MT firms as the examples mentioned above, almost all suppliers admitted in the interviews that orders

from and connections to their fellow MT firms from Taiwan indeed allowed them to survive through the early difficult days. Consequently, thanks also to the presence of a growing pool of Taiwanese local suppliers, Taiwanese MT makers have been able to enhance their capabilities in organizing regional subcontracting networks in China.

4.2. *The cultivation of Chinese networks*

The significance of developing guanxi networks for successful business dealings in China has been repeatedly stressed (Hsing, 1998; Carlisle and Flynn, 2005). By taking advantage of their linguistic and cultural affinity with China, compared to investors of other countries, Taiwanese investors have been able to more easily develop guanxi with their local agents in China (Hsing, 1996). Yet, the shared commonality between Taiwanese and Chinese does not guarantee the smooth interaction and cooperation in their networking. Taiwanese firms still need to develop relation-specific skills and capabilities for better network governance (Chen, 2011b; Lorenzoni and Lipparini, 1999). Besides studying three types of Chinese networks critical to the transplantation of Taiwanese industrial system in China, here we address the networking activities and strategies Taiwanese adopted in developing their Chinese connections.

4.2.1. *Cultivating Chinese suppliers*

Since they began their operations in China, Taiwanese MT makers have been striving to explore local Chinese suppliers. Because MT manufacture in China used to be highly integrated by state-owned enterprises (SOEs), local capacity for MT supplies outside these SOEs was therefore poorly developed. In this situation, Taiwanese MT firms sought to cultivate local supply sources through working with the emerging Chinese metalworking shops, but they have had to tackle following critical issues encountered during the cooperation processes.

Due to the technological backwardness and inexperience of Chinese metalworking shops in manufacturing or processing MT parts, Taiwanese MT makers have to expend considerable effort to teach and communicate with them to ensure supply quality, which increases production costs and reduces production efficiency. Moreover, even if these MT makers can outsource work to suitable Chinese suppliers, they must still constantly monitor these suppliers to safeguard their orders, as many Taiwanese MT makers commented that their Chinese suppliers have serious problems in activity scheduling.⁴

To tackle these issues, rather than waiting passively for local supply capacity to gradually develop, Taiwanese MT makers have aggressively cultivated capable Chinese suppliers and nurtured their relationships by utilizing various governance skills. Through the referrals of their Taiwanese connections or screening the local yellow books, Taiwanese MT makers first could find some Chinese metalworking shops with the potential to be their suppliers. After on-site visits to evaluate the metalworking shop technological capabilities and owner willingness to cooperate, they then placed subcontracting orders to suitable shops. Following a few rounds of transactions, the more capable and responsible local subcontractors were retained in the supplier network, while others were dropped. Moreover, to ensure the quality of supplies, these Taiwanese firms also dispatched technological staff to assist their Chinese suppliers to solve production issues. When the inferior manufacturing capabilities of their Chinese suppliers were identified as the result of poor equipment, Taiwanese MT makers might even provide loans to help suppliers upgrade their machinery.

While the technical issues of suppliers thus might be partially solved, Taiwanese MT firms also have to deal with a critical but common

problem in their cooperation with Chinese suppliers, namely that suppliers who fail to deliver quality supplies might be reluctant to take responsibility, leading to a serious conflict between the two parties. In Taiwan, the regional institutional environment and the long-term relationships between MT makers and suppliers have allowed many of the transactions among actors in this industry to be based on oral agreements. Due to the absence of such favorable regional institutions in China, Taiwanese MT firms have learned the need to sign written contracts with Chinese subcontractors, while still seeking to nurture their mutual trust and relations through repeat transactions.

Although Taiwanese MT makers are still working on developing closer collaborative relationships with Chinese suppliers, their efforts seemed to start paying off. In the interviews conducted during 2005 and 2006, most respondents complained extensively about their bad impressions of and relationships with Chinese suppliers, and stressed that they would place orders mainly with Taiwanese suppliers. Nevertheless, in our more recent interviews during 2010–2013, many Taiwanese MT makers expressed that their ratio of procurement from Chinese subcontractors had increased significantly, and they had cultivated a few reliable Chinese suppliers, making their ideal projects of building effective networked production systems in China more and more feasible.

4.2.2. *Developing political networks*

The necessity of interpersonal relationships with government officials to achieve business success in China has become common wisdom (Hsing, 1996; Pearce and Robinson, 2000; Yau et al., 2000). Yet, it is also noted that the levels of difficulty in cultivating relationships with Chinese officials would differ according to investment type and scale (Yeung and Tung, 1996). For instance, the high-tech or high-profile larger leading global firms which have been prioritized by Chinese authorities would have easier accesses to government officials. In contrast, smaller or non-high-tech investors, like Taiwanese MT makers, cannot expect significant preferable policy measures or special attention from China's central or local governments. In this context, networking with Chinese officials demands more deliberate efforts on the part of these smaller firms.

Taiwanese MT firms have been mostly established and run by mechanical entrepreneurs who have had few political-business networks during their development processes in Taiwan (TAMI, 2005). They are aware that in China they might need to change their practices and engage more actively in networking with Chinese officials since it is vital to their ventures. Yet, actually doing so is not an easy task, especially for these mechanical entrepreneurs with little experience and knowledge of dealing with officials. While most Taiwanese MT managers have struggled to build their Chinese political networks, we found that the two current largest Taiwanese MT firms in China, Victor and Fair Friend, both have made progress in networking with Chinese officials in their investment processes. Furthermore, their operations in China seem to all have benefited greatly from their government connections. In the case of Victor, according to the general manager of its China branch, this firm received numerous support in the process of establishing its plant in Qingpu, Shanghai, such as loans and land provision guarantees, from Chinese local government officials, particularly the city mayor, with whom he is now a friend of many years (Author interview, August 30, 2011).

In the case of Fair Friend, this firm has even constructed extensive linkages with China's government officials of various levels. Fair Friend's CEO, Jimmy C.Y. Chu, was the former chairman of Taiwan's Council for Industrial and Commercial Development, one of Taiwan's major business organizations, and thus is well-connected in Taiwanese political circles. Along with his aggressive investments in YRD region, mainly in Zhejiang, Chu gradually developed inter-personal relationships with provincial and local government officials. When interviewed, Chu emphasized that Zhejiang officials would rely on his personal ties to access many Taiwan's important political figures. He even has been friends with China's current president, Xi Jinping, since Xi served as the party chief of Zhejiang (Author interview, September 3, 2010). With its increased investments in Zhejiang, Fair Friend become more famous

⁴ For example, once a Chinese supplier is receiving multiple orders simultaneously, it is quite often that this supplier later might fail to deliver supplies to its customers on time (Brookfield and Liu, 2005) J. Brookfield, R.-J. Liu, The internationalization of a production network and the replication dilemma: Building supplier networks in Mainland China, *Asia Pac. J. Manag.*, 22 (2005) 355–380.

as its plant was frequently visited by important Chinese government officials. This firm's close connections to the Chinese government are also manifested in the example that Zhejiang provincial government occasionally would use the conference room of Fair Friend's plant for meetings (Author interview, June 21, 2011).

Fair Friend's strong political networks are believed to provide many business advantages. These networks have facilitated and accelerated this firm's investment in China. In the government's recent established industrial parks in Hangzhou, for example, Fair Friend was even prioritized by the government over other incoming investors in allocating lands for Fair Friend's upcoming investment project (Author interview, June 21, 2011). Moreover, Fair Friend's abundant implicit and explicit connections with Chinese officials also have played vital role in helping it quickly build reputation and gain market acceptance in China (Yau et al., 2000). While the magnitude of the influence of Fair Friend's political networks on its business success of Taiwanese MT firms in China cannot be properly determined, most Taiwanese MT managers interviewed, and even Fair Friend's executives, all agreed that this firm's phenomenal achievements in China, in terms of becoming one of the largest foreign MT investors in China, would not have been possible without cultivating these important government connections.

4.2.3. Building relationships with MT customers

Besides establishing production sites, the investments of Taiwanese MT firms in China also include building extensive marketing networks. In the Chinese market, MT makers with a renowned brand name or of larger scale have clear marketing advantages. Given the information about imported foreign MT equipment was not well circulated, Chinese MT users have been more reliant on sourcing equipment from leading global makers with well-established reputations. In addition, most Chinese MT buyers are large manufacturers whose orders are not easily accommodated by small-scaled MT makers. In this situation, Taiwanese MT SMEs have employed both active and passive strategies to overcome the sales and marketing disadvantages.

Since the sale/purchase of MT products is characterized by a lengthy procedure, from design/development, installation/start-up, to normal operation, producers and buyers require frequent and detailed interaction in their transaction process. Inexperienced Chinese MT users might encounter greater difficulties in communicating with foreign equipment suppliers with distinct cultural and institutional backgrounds (Gertler, 2004). Such barriers of interaction, however, would be lower if they source their machines from Taiwan. Linguistic commonality first facilitates better interaction between Taiwanese suppliers and Chinese users in tackling both business and technical issues related to their transactions. As the general manager of a leading firm pointed out one specific strength of Taiwanese MT makers vis-a-vis their foreign rivalries in China,

Since we are all from Chinese-based societies, and share a similar language, culture, ethnic emotions, etc., we especially have advantages in negotiating deals with Chinese customers in terms of product price, education and training, and technological interactions. This is a very important factor allowing us to enter China's market. (Author interview, August 17, 2011).

Additionally, Taiwanese MT makers have been renowned for the high cost/performance ratio of their products, and their flexibility in supplying machines that cater to customers' requirements, including delivery time or technological specifications, etc., serving well the demands of Chinese MT users. For instance, the major Chinese MT buyers, such as those SOEs, often imported advanced equipment from Europe.⁵

⁵ According to observation and experiences of some Taiwanese machine tool makers interviewed, many Chinese industrial firms seemed unwilling to buy machine tools produced by Japan and the USA, due to political or historical conflicts between China and these two countries.

Since the prices of Taiwan-made MT products were sometimes just one third of the prices of comparable European products, purchasing equipment from Taiwan represented an economical option. Also, Taiwanese MT makers have been aware that in China's political system those SOEs often have critical concerns regarding if their annual budgets could be spent before the end of a fiscal year. By guaranteeing transactions would be completed according to their Chinese customers' specific procurement procedures, Taiwanese MT firms managed to successfully secure orders from such clients.

To penetrate the Chinese market, Taiwanese MT entrepreneurs also employed various strategies to build relationships with their Chinese customers. In fact, Taiwanese MT firms seem naturally familiar with the social skills required in the Chinese context, and many practices they adopted in dealing with Chinese customers were actually similar to those they used with Taiwanese customers. For instance, providing special favors, in monetary or non-monetary form, to the procurement staff of their buyers, have been utilized by some Taiwanese MT makers as one strategy in competing with their foreign rivals for orders in China. In addition to seeking to socialize with Chinese customers on business occasions or after-work banquets, a few Taiwanese MT managers admitted that they sometimes paid commissions to the key persons responsible for equipment procurement at potential or existing Chinese buyers. As most respondents said, since both Taiwanese and Chinese speak the same language and share the same culture, they could understand the implicit meanings behind the words of their Chinese customers in their business dealings, and accordingly provided proper favors to secure their relationships.⁶

5. Capability-enhancing mechanisms resulting from the transplantation project

This section concerns questions regarding how the transplantation project mentioned in previous sections affected the capability improvements of Taiwanese MT firms and the MT RIS. Obviously, the enhanced capacity to exploit China market has enabled Taiwanese MT firms to achieve higher revenues, and therefore be endowed more financial resources to undertake technological investments. In the interviews, for example, many Taiwanese MT firms stated that they now can afford to hire R&D staff or even set up specialized R&D offices in their Taiwan headquarters. Besides the intra-firm financial stimulus, according to the author's previous study (Chen, 2013), it is also found that other critical capability-enhancing mechanisms might emerge out of the construction of offshore industrial system, as demonstrated in the following cases.

5.1. Enhancement of sales capacity

Considering their limited resources and capacity to build and maintain their own global distribution networks, the majority of Taiwanese MT firms have relied on foreign dealers (agents or distributors) to market their products and perform post-sale services (MIRL, 1995; MIRL, 1999). However, China's emerging business opportunities and the geographical as well as cultural proximities between Taiwan and China have encouraged Taiwanese MT makers to take on the task in terms of building up their own overseas sales capacity. With shared cultural background, Taiwanese MT makers are able to interact efficiently with Chinese MT buyers, allowing the Taiwanese significant advantages in marketing their products and nurture fruitful relationships. Along with the growing sales of Taiwan-made MT products in China, more Taiwanese MT firms were motivated to undertake cross-strait investments of sales. According to the latest data, more than 150 Taiwanese

⁶ Another example is that, recognizing that many of their Chinese buyers were from inner China and rarely had the opportunity to visit China's big coast cities, Taiwanese machine tool makers would include some tourism activities in the business trip itineraries of their Chinese customers.

MT makers have established sales or post-sale service branches in China (TAMI, 2015).

Besides securing greater financial profits from product sales and post-sale services, improving on their direct sales capabilities resulted from such investments implies greater technological learning opportunities for Taiwanese MT firms. Literature of innovation systems has suggested user-producer interaction to be one of the most critical mechanisms stimulating technological changes or innovation in a national, regional or sectoral systems (Fagerberg et al., 2005). But in the development process of Taiwan's MT industry, Taiwanese MT firms have not benefited much from extra-regional user-producer interactions since they have to go through dealers to reach their foreign advanced users. Not knowing how their machines are utilized by users has greatly constrained the capabilities of Taiwanese MT makers to actively improve and refine their technologies and products. Nevertheless, thanks to the establishments of their own sales facilities in China, Taiwanese MT firms are able to resolve such issues, as almost all respondents pointed out in the interviews that they now have more opportunities to reach their end-users through their China sales branches.

5.2. Enhancement of advanced technologies and products

In the global MT market, Taiwan-made MT products have often been recognized as medium level. Due to the lack of reputation in manufacturing sophisticated products, Taiwanese MT makers have experienced huge difficulties in promoting their higher-end machines. However, given China's huge appetites for advanced MT equipment cannot be accommodated fully by existing leading global makers, Taiwanese MT makers found their ways to penetrate into the segment of this market in China (as discussed in 4.2.3). The recent development of Taiwan-made higher-end MT products for automotive industry serves as the best example. According to the CEO of one Taiwan's leading MT maker:

Most automotive makers would source their equipment from those global leading MT firms, and would not consider purchasing Taiwan-made advanced MT products. You know, we actually have accumulated related knowledge and technologies in developing equipment for automotive industry for many years. We just have not had the opportunities to show our capabilities to those users. Yet, China's automotive industry gave us the opportunity. To Chinese automotive makers, European and Japanese equipment were often too expensive. Not to mention that some Chinese would be reluctant to buy Japanese products with their rooted hostile emotion toward Japanese. As a result, they then turned to buy equipment from Taiwanese MT firms. Moreover, given that both of us speak the same language, our knowledge exchanges would be easier... (Author interview, August 17, 2011).

Through selling their products to Chinese automotive makers, Taiwanese MT firms gained critical knowledge regarding the procedures of processing sophisticated parts for automotive manufacturing, and, furthermore, improved their capabilities in developing other more advanced equipment for this industry. In the specific case of automotive machines, for example, after gradually accumulating its experiences and capabilities in designing and manufacturing the automotive production lines, one Taiwanese MT maker now even evolves to become one of the world's few turnkey equipment suppliers for automobile industry, and has managed to compete head to head with other leading global firms from Japan, Germany and Korea in China.

5.3. Enhancement of transnational linkages

Global manufacturers have been driven to invest in China to exploit its production resources and huge market. To reduce the operation costs and risks, many of these global firms would prefer using the cheaper

Taiwan-made MT products in their China plants instead of sourcing equipment from their familiar suppliers in advanced countries, allowing Taiwanese MT makers to establish connections with foreign technologically-sophisticated clients. In addition to enjoying knowledge spillovers through user-supplier interaction, the newly-established relationship with foreign clients also provided the business opportunities for Taiwanese MT firms in the home region. For instance, a Taiwanese manager explained in the interview that one of his American clients often used only Japanese MT equipment. However, after learning that its subcontractors in China have been using the Taiwanese firm's MT products, the American manufacturer then purchased some products from this Taiwanese MT maker in the former's China plant, and was convinced the functionality and quality of the machines seemed comparable to that of Japanese. As a result, in addition to sourcing more equipment from this Taiwanese firm in China, the American manufacturer further placed orders to the Taiwanese firm's headquarter to supply equipment for its other overseas factories.

The strong presence of Taiwanese MT makers in China also attracted a few foreign MT makers who intended to explore China market to build partnerships with their Taiwanese counterparts (Ito, 2009). The most notable example is the establishment of a joint venture between one Taiwanese leading MT firm and one Japanese specialized lathe maker in China in 2004. With the technological inputs from Japanese and the well-developed industrial networks of Taiwanese in China, this joint venture achieved a great success. Specifically, in just one year this Taiwanese-Japanese co-founded MT firms was able to balance its operation in 2005, and has maintain strong growth ever since. Such results further inspired more Japanese MT makers to collaborate with Taiwanese firms to exploit China's market, resulting in the recent prosperous development of Taiwanese-Japanese joint-ventures in Taiwan's MT industry. While it seems still too early to determine the outcomes, it is believed that the emergence of such direct trans-national cooperation at least would help Taiwanese MT firms involved to source sophisticated technologies from their Japanese partners. Moreover, given the presence of various local knowledge sharing mechanisms in Taiwan's MT industry, one can also expect that the enhanced capability of these Taiwanese firms would eventually be diffused to and learned by their regional partners and neighbors, leading to a synchronized improvement of all actors within the MT RIS in Taiwan.

6. Concluding remarks

6.1. The development and significance of RISs' extra-regional networks

In the current globalized economy, to sustain its vitality an RIS needs to build external linkages (Lundvall et al., 2009; Doloreux and Parto, 2005; Giuliani et al., 2005; Oinas and Malecki, 2002). In this paper, by using the transplantation of Taiwan's MT industry in China as the example, we discuss how an RIS builds up its extra-regional networks with a focus on the networking activities involved in the process. As small firms with limited resources and experiences in constructing offshore industrial system, Taiwanese MT firms succeeded through utilizing and cultivating various intra- and extra-regional Taiwanese and Chinese networks as summarized in Table 2. On the one hand, through mobilizing their pre-existing Taiwanese relational and business networks with other regional partners, Taiwanese MT firms have obtained critical support, ranging from orders, referrals of business, information of suppliers, to joint-marketing or investments, and so on, allowing them to survive their initial set-up phase, and to gradually accumulate the knowledge and capabilities needed to conduct more extensive and elaborated networks in China. On the other hand, to undertake such a project, they also aggressively cultivated local Chinese networks. As demonstrated in our examples, the networking activities of Taiwanese MT makers with their vital Chinese partners, including suppliers, government officials and customers, have been particularly facilitated by the cultural and linguistic affinity between the two parties.

Table 2
Networking of Taiwanese firms in building MT RIS' extra-regional networks in China.

Networking activities	Mobilizing Taiwanese networks	Cultivating Chinese networks
Results	<ul style="list-style-type: none"> • Receiving supports from Taiwanese MT customers • Initiating cooperation with other Taiwanese MT firms • Encouraging offshore investments of Taiwanese MT suppliers • Accumulating relevant knowledge and capacity for constructing offshore industrial systems in China 	<ul style="list-style-type: none"> • Cultivating Chinese MT suppliers • Developing Chinese political networks • Establishing relationships with MT customers in China • Developing localized networks in China • Stimulating technological changes of Taiwanese firms and Taiwan's MT RIS
Key underlying facilitating factors	<ul style="list-style-type: none"> • Pre-existing relational proximity among actors in Taiwan's MT RIS 	<ul style="list-style-type: none"> • Cultural proximity between Taiwanese and Chinese partners

In addition to analyzing factors and mechanisms underlying the process, this paper has short discussions about the influences of the extra-regional networks on the development of an RIS, especially in terms of triggering technological changes of the individual firms and the region as whole. Our research shows that, through their networking efforts, Taiwanese MT firms were able to not only exploit China's large market, but also to collaborate with customers and partners at various levels of technological sophistication. More importantly, in China, Taiwanese MT makers enjoy greater opportunities to engage in user-producer interactive learning with advanced MT users (e.g. in the automotive and automation industries). These opportunities have allowed Taiwanese MT makers to enhance some critical capabilities for which development support was inadequate in their home region.⁷

6.2. The increased tension among RIS' local actors resulted from the development of extra-regional relations

The research findings indeed echo existing studies that maintain that the knowledge required for RISs to improve their competitiveness not only results from local interaction but also is often obtained through extra-regional relationships (Lundvall et al., 2009; Doloreux and Parto 2005; Giuliani et al., 2005; MacKinnon et al., 2002; Asheim and Isaksen, 2002). However, one should note that, although the development of intra- and extra-regional relationships might be complementary (Bathelt et al., 2004), recent studies have started to suggest that, as firms' external interactions grow increasingly distant, the intra-regional networks that once were crucial for local firms' production and innovation capabilities might be replaced by distanced ones (Menzel and Fornahl, 2010; Ter Wal and Boschma, 2011). In this paper, we not only do not find evidence on such trend, but also further maintain the positive effects of the emerging extra-regional networks on advancing the capabilities of individual firms and the RIS as a whole.

But, in our empirical study, we do find some emerging unfavorable influences brought by the development of extra-regional relationships particularly on the inter-firm dynamics within the Taiwanese circle. More specifically, the formation of industrial networks in China by Taiwanese MT firms has implications for their networking with Taiwanese partners. Their ventures of in China indeed benefited greatly from Taiwanese networks. However, the significance of such networks to these MT firms' current operations seems to have been decreasing. In my fieldworks, it is not uncommon to hear Taiwanese managers stating that they now preferred doing business with Chinese rather

⁷ Although they were derived mainly from the study of the MT industry, such findings might be applicable to other Taiwanese capital goods or low-tech manufacturing industries in China. Some of these industries are observed to share similar characteristics with MT industry. For instance, they are all mostly SME-based, and, more importantly, rely heavily on knowledge inputs from technologically sophisticated users in the process of acquiring upgraded technologies. It is believed that, by investing in China, firms in these sectors might also access capability-enhancing mechanisms similar to those in the case of MT industry, as doing so will provide them with increased opportunities to interact and collaborate with capable actors appeared in China.

than Taiwanese.⁸ Besides, the relationships between Taiwanese MT makers and their Taiwanese suppliers appear to be changing as well. Even though many interviewees still emphasized that their current local production networks in China mainly comprised local Taiwanese suppliers, they also pointed out that their partnerships in the remote sites actually has not been that smooth.⁹ Moreover, as more Taiwanese suppliers were exposed to China's huge demand for MT parts and processing, these suppliers might turn to prioritize orders from larger Chinese customers, seriously testing their existing long-term relationships with Taiwanese MT makers. The above observation from the case of Taiwan's MT industry seems to indicate the emergence of cross-border regions might subsequently exert negative effects on the relations among networked actors in the home regions. However, more evidence is required to substantiate this assertion. Further, this paper suggests that it is worth to conduct more follow-up and related research that investigates the changing nature and forms of networking among actors within incumbent RIS as these regional actors have sought to develop more non-local relationships. We believe that such studies would shed light on our understanding about the evolution of industrial networks and organizations within RISs in response to the intensified trans-regional interaction and cooperation.

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⁸ For example, some interviewees complained that Taiwanese buyers would frequently ask for favorable prices or payment conditions, seriously comprising their profit margins. In contrast, Chinese customers not only might place larger orders, but rarely bargained for discounts, making them more welcome to Taiwanese machine tool makers.

⁹ One typical complaint was that the quality of the parts and processing services provided by their Taiwanese partners has been below expectations. As a result, machine tool firms have to invoke more stringent requirements on their Taiwanese suppliers, such as more frequent quality testing. This situation then increases tensions between these long-term partners, because such strict requirements are rarely implemented in Taiwan's machine tool industry, and could be taken as an insult by the affected Taiwanese suppliers.

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