



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 Rabellotti, 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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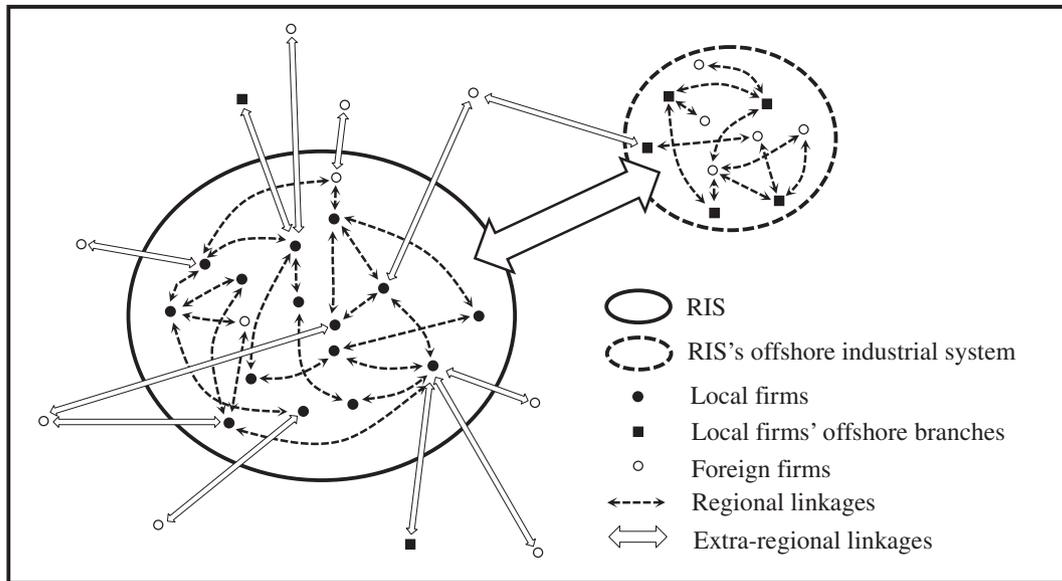


Fig. 1. RIS' extra-regional linkages and its' offshore industrial system.

(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

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