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Interactive learning, informal networks and innovation: Evidence from electronics firm survey in the Pearl River Delta, China

Wenying Fu[a,b], Javier Revilla Diez[b,*], Daniel Schiller[b,c]

[a] School of Geography, South China Normal University, Zhongshan West Avenue No. 55, 510631 Guangzhou, China
[b] Institute of Economic and Cultural Geography, Leibniz University of Hannover, Schneiderberg 50, 30167 Hannover, Germany
[c] Lower Saxony Institute for Economic Research, Königstraße 53, 30175 Hannover, Germany

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ABSTRACT

Learning by interacting defines the endogenous path of economic development in modern innovation studies. In this paper, we aim to investigate the way that firms undertake interactive learning in the Chinese context by introducing the role of informal Guanxi network. In this way, this paper tries to bridge the gap between studies on firm innovation activities and those on the role of informal network for business performance. Based on an electronics firm survey in the Pearl River Delta, China, this article demonstrates that firms undertaking the highest intensity of interactive learning with the widest scope of business partners, such as foreign customers, domestic customers, parent companies, universities and sales agents, tend to achieve better innovation outcomes. It also verifies a more important role of interactive learning in incremental product innovation than in discontinuous innovation as electronics firms operate in highly modularized value chains. Furthermore, the intensive interactive learning firms have a much higher tendency to apply informal Guanxi networks with long-term business partners as a complement to deficient formal institutions in interactive learning than other firms. Overall, this paper contributes to the understanding of the form and effect of interactive learning in the Chinese context. Finally, the paper addresses the possible lock-in issue and points out further research questions on the changing pattern of interactive learning within a maturing institutional framework.

1. Introduction

Modern innovation studies adopt a system approach, in which the inter-firm linkages involve sustained quasi-cooperative relationships that shape the learning process and determine the innovation outcomes. The interactive learning process undertaken by groups of users and producers creates the diverse complexes of technological capabilities and determines the dynamics of the territorial innovation system as a whole (Lundvall, 1992; Smith, 2000). In addition, the research on regional innovation system extends the scope of interactive learning from within inter-firm linkages to the linkages between firms and other knowledge-producing institutes such as universities, research institutes and related service providers (Asheim and Coenen, 2005; Cooke et al., 1997; Howells, 1999; Revilla Diez, 2000).

Interactive learning is often discussed in relation to incremental innovation that relies on learning by doing and tacit knowledge in the economic geography literature (Capello, 1999; Cooke, 2001; Malmberg and Maskell, 2006). But some other authors found a positive impact of reliance on network strategies through interaction with external environment on discontinuous innovation (McKee, 1992; Lambe and Spekman, 1997). The mixed evidence on the role of interactive learning on different types of innovation calls for further empirical investigation. In particular, industrial trends such as modularization and mass customization that emerged in the 2000s remain a less considered mechanism that affects the ways firms innovate.

Therefore, this paper attempts to relate interactive learning with the two types of innovation, i.e. incremental innovation and discontinuous innovation, by reflecting on the latest trend in modern industries. The context of the investigation is one of the largest electronics industry clusters, the Pearl River Delta. This industrial cluster has taken the opportunity of relocation and of subcontracting processing functions from global lead firms in the 1990s. With the support of developed modularization technology in the 2000s, many local electronics firms in the Pearl River Delta started to upgrade from low-end suppliers and processors to final producers of mature products such as mobile phones, MP3 players, and home-use electronics products by integrating "off the shelf" modularized subcomponents into new product design. The modularity in the electronics industry reduces the uncertainty of entering a new mature product market, and on the other hand, necessitates the

* Corresponding author. Tel.: +49 511 7624492; fax: +49 511 7623051.
E-mail address: diez@wigeo.uni-hannover.de (J. Revilla Diez).

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interaction between specialized firms to explore the new market opportunities of new combinations within the current technological field. As such, the paper refreshes the theoretical discussion on the role of interactive learning on innovation through an empirical study in China.

In addition, a theory-informed investigation into the way interactive learning is organized in the context of China has been made. Informal Guanxi networks are a key element of *savoir-vivre* for doing business in China and it has been proved by previous studies that they have a positive impact on reducing transaction costs and sustaining reliable and responsive supplier–customer relationships (Luo, 2002; Meyer et al., 2009; Wu and Choi, 2004; Zhou et al., 2003). However, the role of informal Guanxi networks in fostering interactive learning processes still remains unclear. As such, this article tries to bridge the gap between studies on firm innovation activities and studies on the role of Guanxi network for business performance. Beyond that, it aims to find out how Guanxi networks with long-term business partners differentiate itself from those with relatives and friends, and whether one of them serves as a viable strategy to complement the deficient formal institutional environment in China. The selection of a partner with whom a firm establishes a Guanxi network determines the degree to which they share similar technical and market knowledge. The extent of 'cognitive proximity' (Boschma, 2005) is an elementary factor for effective interactive learning.

Overall, by investigating the willingness and capacity of electronics firms in the Pearl River Delta, China, to undertake interactive learning in product innovation activities, this article sheds light on the innovation mechanism in the Chinese industrial clusters. In the face of the global recession and domestic inflation, the capacity of Chinese firms to draw on innovation externalities is of great importance for regional structural adjustments and long-term development. The empirical substances, i.e. a uniquely designed firm survey directly collected from managers of electronics firms in the Pearl River Delta, China, enables the further understanding of social factors (Guanxi) that facilitate innovation in the Chinese context, in which the institutional framework is quite different from that in industrialized countries.

The remainder of this article is structured as follows: the second section elucidates the interactive process of innovation activities and discusses how different types of Guanxi networks assist firms in interactive learning activities in the Chinese institutional setup. Two hypotheses are derived based on the theoretical discussion. The third section presents the dataset, related parameters and the methodology applied. The fourth section discusses the empirical results. The fifth section concludes and discusses policy implications.

2. Innovation, interactive learning and informal networks

2.1. Innovation as an interactive process

Unlike exogenous inputs such as capital and labor, innovation and learning contribute to the improvement of productivity and are determinant to long-term economic growth (Arrow, 1962; Nelson and Siegel, 1987; Romer, 1986).

In Lundvall's (1992) seminal work on national systems of innovation, he proposed that the approach towards systemic innovation and interactive learning considers the stock and rate of R&D investment as the new determining variable in economic growth. In other words, interactive learning creates increasing returns for the stock of knowledge and thus underpins long-term economic growth.

In this part, we borrow the classification of knowledge by Salter and Reddaway (1969), i.e. firm-specific knowledge, sector product-field-specific knowledge, and generally applicable knowledge, for the discussion on why and how firms undertake interactive learning in innovation activities.

2.2. Why firms undertake interactive learning

The firm-specific knowledge is well elaborated on by Nelson and Winter's (1982) proposition of organizational routine. Routine consists of particular resources, skills, experience and know-how that the firm accumulates over time (Levitt and March, 1988), and is therefore difficult to imitate for others.

Organizational routines develop in a path-dependent manner, in which the firm tends to search for information and undertake activities related to its own knowledge sphere (Kline and Rosenberg, 1986). Therefore, the firm displays bounded rationality and competence in the innovation-related activities, which has two important implications for the role of interactive learning in innovation.

Firstly, bounded rationality implies that the decision-making process is determined by limited information, limited knowledge and limited resources of the individuals or entities, thus leading them to base decision-making on existing knowledge and capacity, which results in a satisfactory solution rather than an optimal one based on total rationality (Simon, 1957, 1991). As a result, firms with bounded rationality are not able to calculate the result of decision-making on innovation investment when faced with uncertainty in the environment. In order to reduce risk-related uncertainty, firms have to collect more technical information and market information from external organizations.

Secondly, the firms only master and excel in a limited range of products and processes due to the bounded competence. As a result, firms are constantly confronted with technological problems in the innovation process which lie outside their range of knowledge and competence (Smith, 2000). This kind of knowledge is not only limited to codified knowledge, such as the support of specialized equipment and operating software, but also refers to the more important tacit knowledge, such as technical know-how and experience, which is a key to problem-solving in the process of prototype development and the technically specific design. Due to the tacitness of most knowledge, the firms need to engage in face-to-face interaction with other organizations in order to solve these problems and optimize the innovation outcomes.

Therefore, due to bounded rationality and competence, firms need to complement internal efforts in innovation with interaction with other organizations in order to facilitate innovation-related decisions by searching for relevant information, and must also support innovation implementation with external codified and tacit knowledge.

2.3. How firms undertake interactive learning

Tacit knowledge is not only confined to individuals or groups of cooperating individuals, but also embeds within specific industries, which is often referred to in the literature as the "technological paradigm" (Dosi, 1988). Technological paradigm refers to the common technological features, such as technical parameters, performance characteristics and use of materials shared by firms in an industry (Smith, 2000). Moreover, the sector product-field-specific knowledge also covers knowledge on markets, such as customer needs and the supply of industry-specific skills. Therefore, firms within the same production field are close in cognitive proximity, which facilities the interactive learning process (Boschma, 2004). Cognitive proximity within the same industrial space and supplier link would affect the search and imitation costs when exploiting knowledge.

Kline and Rosenberg's (1986) early work on the "chain-linked model of innovation" suggests that increased demand of the user firms would generate a rapid rate of technical change for the

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