Chapter 23
Regional Innovation Pattern: A Case of Beijing Biopharmaceutical Industrial Clusters

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ABSTRACT

Beijing biopharmaceutical industrial base are currently still in its infancy, innovation network and collaborative innovation system within pharmaceutical industrial clusters still have many problems, and cluster-based technology innovation mechanism and pattern needs further exploration. This study focuses on Beijing pharmaceutical industry clusters, and industry cluster theory, learning theory, and regional innovation system theory apply to the practice of Beijing pharmaceutical industrial bases. The study discusses on the related concepts of technology learning, and establishes a technology learning network among industry clusters, and presents a technological learning system under the cluster network on the basis of existing learning theory. According to characteristics of biopharmaceutical industry, the study develops a basic framework of regional innovation for biopharmaceutical industry clusters, and proposes synergistic development strategies of Beijing north and south pharmaceutical industry clusters.

INTRODUCTION

Several scholars have noted the importance of agglomeration, including economic geography, management and organization science (Krugman, 1991; Decarolis & Deeds, 1999; Gittelman, 2007; Erden & von Krogh, 2011). Marshall (1920) argued that agglomeration economies exist in many industries owing to industry specialization, labor pooling and the spillover of knowledge between firms and institutions. Firms in industries where major inputs include industry R&D, university research and skilled labor are more likely to cluster than firms in industries where knowledge spillovers from such sources are less important (Audretsch & Feldman, 1996). The biopharmaceutical industry consists of firms that develop and / or manufacture drugs for human therapeutics and/or diagnostic purposes, and that have at least one product that can only be produced by biotechnological methods; that is, techniques and technologies that use the principles of genetics, immunology and molecular, cellular and structural biology to discover

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and develop new products (Audretsch, 2001). The biopharmaceutical industry tends to be highly geographically concentrated, and similar to the high geographic concentration found in the biotechnology industry (Prevezer, 1997; Zucker, et al, 1998; Wu et al., 2008).

A reason of high geographical concentration in the biopharmaceutical industry is that clusters play an important part in drug development (Erden, & von Krogh, 2011). Drug development has shifted from being an activity of a single large pharmaceutical firm to a collective and collaborative activity involving different actors, such as dedicated biotechnology firms, large pharmaceutical firms, contract research organizations (CROs), public research laboratories, venture capital firms, research universities and regulatory institutions. Drug development consists of a less regulated phase of basic and preclinical research for new technology and compounds, as well as a highly regulated chain of clinical trials for developing a therapeutic compound for a specific medical indication or need. This 'basic' versus 'applied' research distinction allow firms to focus and specialize in different parts of the value chain. Yet, specialization also increases the interdependency between firms and other institutions; efficient and effective drug development requires interaction within and between phases (Cooke, 2005). Research has shown that clusters foster cooperation; knowledge flows between firms, and other institutions within clusters are less costly, more reliable and easier to coordinate (Maskell & Malmberg, 1999). However, it is not only vertical interactions between players in the industry (i.e. interactions between upstream suppliers and downstream buyers in a value chain) that impact drug development; the spillover of knowledge and information between competing firms also has a significant effect. In clusters, knowledge spills over more easily among firms and other organizations because of employee membership of professional associations, informal social relationships between scientists, sharing of scientific talent or laboratory equipment, university collaborations and market exchange of information (Zucker, et al, 1998). Baptista and Swann (1998) claim that one of the main reasons of the existence and success of clusters is the existence of knowledge externalities or spillovers. There is a widespread suggestion within the literature that the key cluster effect benefiting firms is tacit knowledge acquired through regular informal interaction between actors located in the cluster (Camagni, 1991; Dahl & Pedersen, 2004; Garnsey, 1998; O'Hagan & Green, 2002; Saxenian,1994; Richardson, et al. 2011), while the learning processes of the main actors are key elements to understanding the rise, growth and transformation of a cluster (Breschi & Malerba, 2001). Furthermore, the crucial role of learning in an industrial cluster has been clearly demonstrated by researchers (Rosenfeld, 1997; Porter, 1998; Morosini, 2004; Bathelt, Malmberg & Maskell, 2004; Li, 2014), they claim that geographic proximity and economical linkages among cluster firms are the basic characteristics of industrial clusters, firms in clusters have certain forms of commonality such as access to specialized factors, a supply of intermediate products, infrastructures and cultural embeddedness, and firms in clusters also have frequent interactions mainly reflected in the acquisition of knowledge, as well as in sharing, diffusing and creating it. A host of linkages among cluster members results in a whole greater than the sum of its parts (Porter, 1998). As a result, learning through networking and by interacting is seen as the crucial force pulling firms into clusters and the essential ingredient for the on-going success of an innovative cluster (Breschi & Malerba, 2001; Guo & Guo, 2011; Lei & Huang, 2014).

According to international standards the pharmaceutical industry is one of fifteen internationalization industries, and has an important position in the economic growth and industrial structure. The biotechnology and pharmaceutical industry, as one of Beijing five industries, is of significant for Beijing's economic development. Beijing biopharmaceutical industry started in 1980s, and "Beijing Bioengineering and Pharmaceutical Industry Development Promotion Program" issued in 2002 has effectively promoted the upgrading and development of Beijing biopharmaceutical industry, and biopharmaceutical industry