

Cambridge University Press

978-0-521-86528-9 - The Economic Geography of Innovation

Edited by Karen R. Polenske

Excerpt

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Part I

Concepts and measurements in innovation

1 Introduction

Karen R. Polenske

1.1 Introduction

Every day people talk about innovation on the radio and television, as well as in newspapers, books, and popular and academic articles. In May 2004, for example, Alan Greenspan, then head of the US Federal Reserve Bank (FRB) spoke at an FRB conference of the Federal Reserve Board of Chicago on “Globalization and Innovation” (Greenspan 2004). *The Boston Globe* each Monday since February 7, 2000 has devoted an entire section of the newspaper to the topic of innovation, covering a wide spectrum of sectors, such as biology, information technology, and e-commerce. Even so, these leading conveyors of information, for the most part, neglect the fact that the innovation occurs *in space*. The product may be conceived in an office, a garage, or on an airplane, but to begin the process of developing the product to bring it to the market, a production facility must be built or located, or a part of another production area taken. The influential authors from the economics, industrial organization, planning, and political science fields I selected to write chapters for this book all help fill this “spatial gap” in the literature. They summarize and critique previous innovation theories and concepts, and provide insights into the spatial concentration and dispersion of innovation. They provide an interesting comparative picture of the institutional factors that underlie innovation systems in East Asia, Latin America, the United Kingdom, and the United States, indicating the vast geography over which innovation occurs.

1.2 Background to the book

The chapters in this book are mainly based on talks the authors gave at a seminar I organized for the attendees at the weekly Special Program on Urban and Regional Studies (SPURS) seminar at the MIT in the Fall of 2003, entitled Geography of Innovation. Speakers covered a number of topics related to innovation, its origins, concentration, and dispersal, and

how industries, communities, and regional economic-development planners have succeeded in developing knowledge-intensive industries. These different groups often form partnerships with universities and business, which is one of the aims of the Cambridge–MIT Institute (CMI), which helped to fund the seminar.

Recent success stories of cluster-based economic development emerging from cases such as Silicon Valley (California), Research Triangle Park (North Carolina), Bangalore (India), and the Ouli Region (Finland) suggest that the nature of innovation and economic development is changing. Regions all over the world are now attempting to follow these role models. Several years ago I began to question whether or not these economic-development strategies focused on innovation were effective and/or universally applicable. Too many of my colleagues have been concentrating their research and teaching on industrial clusters, whereas in my own work in China on cokemaking (Polenske 2006) and in the United States on the auto sector (Polenske 2004), I find many examples of industrial dispersion, sometimes along supply chains and sometimes not (Li and Polenske 2004).

Analysts and professional planners disagree on many aspects of innovation, including whether or not space or location matter in the new global economy, and whether or not some new forms of innovation could be the drivers of economic development for all regions. These are important issues for regional analysts to consider.

For this book, the authors draw on the perspectives in the literature of a wide variety of policymakers, bureaucrats, corporate innovators, and academics about innovation and its relationship to space and the process of economic development. One recurring theme is how technology, innovation, and alternative means of transferring knowledge are changing spatial relationships among firms – hence the title of the book, *The Economic Geography of Innovation*.

1.3 Issues concerning innovation

Those writing about innovation have stressed at least three main issues. First, the main theme of many of the studies is the attempt to define innovation. For those of us who are economists, we often refer to Schumpeter (1926) and his extensive discussion of technological change during the course of economic development. Actually, Schumpeter defined three phases of technological change: invention, innovation, and dispersion of innovation. Carter (2006, chapter 2 in this volume) clearly delineates how Schumpeter interprets these three phases and the importance this distinction has for research on innovation as the second stage of

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technological change. Some analysts in other theoretical disciplines who write about technological change, such as geographers, planners, and management analysts, may or may not refer to Schumpeter as the foundation of their understanding. Although they may use the terms “innovation,” “technological change,” and “entrepreneur,” many will use one or more of the three terms without providing a theoretical structure or definition underlying the term, nor explain how either of the first two terms can be measured. In fact, Schumpeter probably wrote more about the entrepreneur – i.e. *who* innovates – than about innovation – i.e. *what* is innovated.

Second, as researchers discuss their concerns about how to define innovation. I am struck by the many different interpretations of innovation, the lack of consensus on a framework both to define the theory of innovation and the ways to measure it, and by the vast number of empirical studies that are done, but using relatively simplistic measures. Most of the studies are aspatial, with the analyst focusing on the *type* of innovation done, not where it is done and on how knowledge is transferred depending upon whether it is codified or tacit knowledge. The researchers often measure the amount of innovation being done in a region/country by examining patents, funds allocated for innovation research, and other unidimensional measures, often not even determining the location where the person applying for a patent is located or in which region, city, or country the innovation research expenditures are made. Basically, for many innovation analysts, it seems that location is not an important variable.

Third, one of the key themes in this book is innovation diffusion across space, and the related topic of knowledge dispersal, which are also major themes in much of the innovation literature. To study the question of innovation diffusion, analysts must not consider something after it has been innovated, but where, i.e. – the geographical place – the innovation occurs, and under what conditions. If all innovators and people using the innovation were clustered in the same location, those who write about tacit versus codified knowledge would have far less to say. The transmission of tacit knowledge would blend with the transmission of codified knowledge. It is precisely because the geographical places where innovation occurs are often widely dispersed that many analysts have written about the creation, acquisition, and sharing of tacit versus codified knowledge.

As Lundvall (2006, chapter 10 in this volume) maintains in chapter 10, to understand how knowledge is transferred, analysts need to distinguish that knowledge that is local from that which is global, and to understand that the process of learning is an interactive, socially embedded, localized one.

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Schumpeter discussed ways in which the entrepreneur was a key to pushing technological change, with progress being the result of creative destruction. In a different, but related vein, Dahmén (1970) and Hirschman (1958) both looked at the backward and forward vertical linkages in the production system, emphasizing that the backward linkages were especially important to ensure that development occurred.

One of Leontief's major contributions to economics was his elegant, but simple, input-output model to show quantitatively the interactions among sectors in an economy (Leontief 1936). The fact that sometimes indirect effects of any given investment, say, in air transportation, may outweigh the direct effects is still not well known among economists. Lundvall and his colleagues (2006) are some of a growing group of analysts who examine the underlying institutions (e.g. laws, codes of behavior, norms) within which such quantitative interactions occur. As analysts examine innovation across countries, the differences in such institutions become critical for understanding the nature of the development process. In this volume, Gertler (2006, chapter 5) and Lam (2006, chapter 8) illustrate how conditions may appear identical in a firm operating in two countries, but these underlying institutions, especially the way workers obtain the knowledge they bring to the workplace, may play a critical role in determining whether the knowledge can be or is transferred successfully from one worker to another.

1.4 General focus of the book

The contributors in this volume explore the spatial elements of innovation and their economic, organizational, and social impacts. How do these impacts affect regional development and public policy? How can a region begin to build a labor force that can sustain innovation? The authors discuss flows of knowledge, regional asset-based economic development, and sustainability, and they therefore differentiate the perspective of a national from that of a regional planner. Some authors discuss the concept of a "learning region," a concept used by a growing number of communities in Europe. The chapters enrich our discussions of the academic and professional-practice literature as they provide answers to the following types of questions:

- First, what innovation concepts have important spatial implications, and how have analysts measured these concepts? How applicable are the concepts and the measurements to developing as well as developed countries?

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- Second, what are the institutional and social factors – such as education, gender, income, and laws – that affect the flows of knowledge and information within and across firms, regions, and countries?
- Third, which national patterns of organization and innovation affect the global research and development (R&D) networks and transnational learning in multinational enterprises (MNEs) in different countries?
- Fourth, are networks of skilled engineers becoming increasingly important mechanisms for transferring skill and know-how across long distances?
- Fifth, how do local and national institutional arrangements affect the development of entrepreneurship and technological capability in different regions and countries?
- Sixth, do companies in different countries have similar or different criteria for locating and growing where they do? What are the key factors affecting their initial location decision, as well as any later decisions to move or expand?
- Seventh, what types of co-ordination allow some groups of agents to carry out successful economic development, and what distinguishes these groups from cases of failure?

Obviously, no one contributor attempts to answer all these questions but, in combination, they provide interesting insights into these and related questions. They explore the innovative ways in which new developments in different industry sectors affect the clustering of firms, the development of global supply chains, and the ability to develop and sustain learning regions. They examine some of the new-economy developments in terms of the ability of a region to be or to become sustainable.

We are not the first to look at the issue of innovation and its spatial dispersion, but our discussions are differentiated in a number of ways from most others who write about the general topic of innovation. First, like some others before us, we are interested in the historical development of the concepts of national systems of innovation, learning economies, tacit and codified knowledge. In each case, however, we try to show how these and related concepts affect analysts' understanding about innovation concentration/dispersal over space and time; thus, many of the contributors take an economic-geography perspective as they write. Second, in this volume, the contributors present evidence from a wide number of countries, such as Brazil, Canada, Japan, Mexico, PRC, Taiwan, the United Kingdom, and, of course, the United States. In most of the currently available books, the focus is primarily on Europe (e.g. Fisher and Fröhlich 2001; Acs, Groot, and Nijkamp 2002; Asheim 2003; Brouck, Dohse, and Soltwedel 2003; and Fornahl and Brenner 2003). Third,

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some contributors in this book use quantitative measures, others use qualitative measures, and some use both types of measures to emphasize the points they make about the economic geographies of innovation. The reason is obvious. An analyst should approach a complex issue such as innovation and its concentration/dispersal with the means to examine the issue from many different sides, which must, of necessity, include the use of quantitative as well as qualitative methods.

1.5 Specifics of the book

For each chapter, the author has provided a detailed abstract (pp. xix–xxvi), so that here I only summarize briefly the different contributions, starting with those on measurement of innovation, in order to understand the full diversity of this volume. The three major parts of the book are (I) Concepts and measurements in innovation, (II) Institutional and spatial aspects of information and knowledge flows, and (III) Institutions and innovation systems.

Part I of the book contains three chapters concerning concepts and measurements of innovation. In chapter 2, Anne P. Carter makes a thorough and fascinating exploration of whether or not innovation limits the effective measurement of standard economic variables – and, if it does, in what way – and examines current strategies for studying innovation itself. Based upon her unique personal knowledge of Joseph Schumpeter and extensive work for many years with Wassily Leontief, she discusses the historical and institutional roots of the concept of innovation. Apiwat Ratanawaraha and Karen R. Polenske, in chapter 3, build upon the more general treatment of innovation by Carter to review the existing innovation literature from a spatial perspective and identify many types of innovation concentration/dispersion measurements and their strengths and weaknesses – a first-ever summary of such measurements. Bernard Fingleton, Danilo C. Iglori, Barry Moore, and Raakhi Odreda in chapter 4 emphasize realism by focusing on how the clustering of SMEs in Great Britain affects employment growth in so-called “creative industries” from 1991 to 2000.

Part II of the book concerns institutional and spatial aspects of information and knowledge flows. Meric S. Gertler, in chapter 5, eloquently introduces the reader to the nuances and the institutional foundations of workers’ tacit knowledge, how it is produced, and how it is distinguished from codified knowledge. If they are distinct types of knowledge, is geographical proximity a precondition for the effective transmission of tacit knowledge between economic actors? Gertler explores how it affects the geographical structure of production and innovation systems, especially

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in terms of the effective transmission of tacit technical knowledge, showing that culture plays an important role.

In Chapter 6, Amy Glasmeier builds upon the learning-economy concept by discussing organizational learning. She asks two critical, interrelated questions. First, how do firms acquire strategic information, what are their sources and uses, and what actions do they take based on the information acquired? Second, what characterizes firms that actually act in a self-aware manner; at an existential level are there multiple stages of being? Her answers are partially based upon an extensive firm survey she conducted with colleagues. Mia Gray and Al James, in chapter 7, successfully make the reader consider some real situations within organizations, namely the role that gender plays in information and communication technology (ICT) firms in Cambridge, England, in constructing distinctive patterns of sociocultural interactions, and, specifically, what of those gendered patterns of social interaction the material impacts are on firms' abilities to innovate.

In chapter 8, Alice Lam continues the examination of clustering, but she uses empirical evidence from case studies she conducted in the R&D laboratories of US and Japanese MNEs in the United Kingdom. She examines how these MNEs establish collaborative linkages with higher-education institutions in order to obtain access to the foreign academic knowledge base and scientific labor. She finds that US firms co-ordinate dispersed learning more globally and embed themselves in more local innovation networks than the Japanese MNEs. In chapter 9, AnnaLee Saxenian brings new and exciting insights into the role Taiwan is playing in supplying networks of skilled engineers and entrepreneurs to Shanghai who first returned to Taiwan from Silicon Valley and elsewhere and now are setting up firms in Shanghai. These networks allow entrepreneurship and innovation to continue to occur away from the established technology regions.

Part III of the book concerns institutions and innovation systems. The last part of chapter 10, by Bengt-Åke Lundvall, Björn Johnson, Esben S. Andersen, and Bent Dalum, has been previously published. The chapter is particularly relevant for this volume, partly because Lundvall and Johnson's concept (1994) of a learning economy was one of the exciting concepts discussed by many participants throughout the 2003 innovation seminar at MIT, and it initially drew me into an in-depth examination of spatial aspects of innovation. Lundvall writes an extensive preface to their already-published paper (Lundvall *et al.* 2002) in which they extended the theoretical concept of a learning economy, partially in order to make it applicable to the analysis of poor countries. In chapter 11, Maryann P. Feldman examines the Capitol region in the United States, arguing

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that it is one of the most important US biotechnology centers because of three interrelated factors: pre-existing resources, entrepreneurship, and the incentives and infrastructure provided by government. Christie Baxter and Peter Tyler, in chapter 12, compare how high-technology centers in the United States and the United Kingdom originated and developed and the roles that government and public policy played. Whereas the quality of the workers and the availability of a critical network infrastructure were the dominant factors facilitating their origin, public policy played the most important role as development and expansion occurred. This “policy context” permitted different organizations from different sectors to share a collective role in facilitating business development. The organizations functioned within and across academic, government, high-tech industry, and nonprofit sectors.

No book on innovation would be complete without a discussion of the PRC. Edward S. Steinfeld, in chapter 13, forcefully argues that Chinese firms, on the one hand, can compete well in producing relatively low-value manufacturing goods because of their low production cost, especially low wages. On the other hand, he argues that they have limited innovative capacity and ability to work within global supply chains of high-technology goods, primarily because of their historical Chinese traditions, bottlenecks in the institutional reform process, and inconsistencies in governmental industrial policy. In the final chapter 14, Michael Storper, Lena Lavinas, and Alejandro Mercado-Célis compare a success story from Jalisco, Mexico, with a failure story of low-technology economic development in Northeast Brazil. They show that the type of coordination of family and social networks, as well as property rights and other rules and regulations, are some of the key factors explaining the difference.

So much is being written about innovation by so many different authors that one can question whether another book is needed. I believe it is, because the spatial distribution of innovation is not well researched, and the contributors to this book are important analysts in the field of innovation and have made a tremendous contribution to thinking about spatial distribution issues. Innovation itself is important, for a number of reasons. According to Debresson (1996, p. 10), “innovation can contribute to the creation of wealth and induce growth, structural change, and development.” Some people, and some regions, are poor and others are rich. If innovation does contribute to the creation of wealth, then its spatial distribution may help some of the poor people and regions to rise out of the poverty in which they live, or it may be one of the factors leading to a widening of the gap between the rich and

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the poor. Although this aspect of innovation is not an explicit part of what the authors of these chapters cover, I am certain that those interested in these and related topics can gain from reading their fascinating contributions.

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