The Economic Geography of Innovation

This critical addition to the growing literature on innovation contains extensive analyses of the institutional and spatial aspects of innovation. Written by leading scholars in the fields of economic geography, innovation studies, planning, and technology policy, the fourteen chapters cover conceptual and measurement issues in innovation and relevant technology policies. The contributors examine how different institutional factors facilitate or hamper the flows of information and knowledge within and across firms, regions, and nations. In particular, they provide insights into the roles of important institutions, such as gender and culture, which are often neglected in the innovation literature, and demonstrate the key role that geography plays in the innovation process. They also discuss institutions and policy measures that support entrepreneurship and cluster development. The result is an excellent comparative picture of the institutional factors underlying innovation systems across the globe.

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The Economic Geography of Innovation

Edited by

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Working with such distinguished scholars from many parts of the world has been an exciting and challenging experience. The basic conception for a seminar that enabled me to have the contributors to this book prepare their papers arose from a graduate seminar I gave to a few students the two years previous to the official "Geography of Innovation" Special Program on Urban and Regional Studies (SPURS) seminar. At the initial graduate seminar, a small group of talented students helped me decide on what was missing from the innovation literature and who might be invited to give a talk to help fill the gap. The graduate students in the initial seminar included Genevieve Connors, who worked with me as an RA/TA, Criseida Navarro-Diaz, Smita Srinivas, and Christine Erickson. I thank each of them for the intellectual challenges they posed throughout the year. In the Fall of 2003, I gave the seminar as part of the SPURS seminar series. I thank Christine Erickson, the teaching assistant, Nimfa deLeon, SPURS administration, and especially John deMonchaux, SPURS director, and Lawrence S. Vale, department head, for their support during the summer as I prepared for the seminar as well as during the seminar itself.

When I moderated the Fall semester SPURS seminar, I had most of the speakers not only give a talk to the SPURS fellows, but also meet with a group of ten graduate students, most of whom were PhDs. Just when I thought I knew most of the current literature, one of these bright energetic students would find still another book or article that would shed new light on our discussions. The students were so motivated that I never had to assign anyone to do the reading for a specific day, because all of them did it and were prepared to discuss the issues covered in a critical, insightful way. I can truly say that this is the best seminar I ever taught at the MIT since coming in 1972. That exuberant feeling was evidently shared by the students who gave the seminar unusually high ratings in the end-of-term evaluation, and they requested that we continue to explore the topic of spatial concentration/dispersion in the following Spring term. Several of the students have used the papers they did for this seminar to jump-start them on dissertation research. I am

eternally grateful for the unique contribution each and every graduate participant made, including: Alberto Blanco, Liou Cao, Christine Erickson, Myoung-gu Kang, Criseida Navarro-Dias, Apiwat Ratanawarada, Elizabeth Reynolds, Michael Sable, Ryan Tam, and Christopher Zegras.

When the Cambridge-MIT Institute (CMI) agreed to fund the seminar series and the subsequent publication of this book of papers compiled from the lectures, I decided to hire a graduate student to help me review and edit the papers given by the speakers. I selected Apiwat Ratanawarada, and we soon became more like colleagues than professor – student. He is highly sought after to work with faculty in MIT, so that I was delighted that he agreed to work with me for a year on the reading and editing of the papers. He helped me provide the authors with an excellent critique of their papers and suggestions for revising them. The work we put into this stage of manuscript preparation paid off when Cambridge University Press agreed to publish the manuscript as a book. I deeply thank Apiwat for all his efforts in relation to the editing of the chapters, but also for the intellectually demanding questions he kept asking.

I deeply thank each of the authors who presented interesting lectures and have written exciting chapters. I had each do several rounds of revisions, but each person kept his/her sense of humor as I asked for one more change, often on the eve of a major holiday. You were a wonderful, supportive set of colleagues who have helped expand my own knowledge of innovation greatly. This book is indeed a fascinating contribution to the literature because of the knowledge you have shared with the world.

After Cambridge University Press agreed to publish the book, I needed to get the papers into a form that followed their guidelines, which is not an inconsequential task. Since October 2005, I have been assisted by three skilled people. Francis Diaz did all the reference checks and rearranging the references into the style required by the Press. This was a challenging job, partly because authors each initially used their own style, so that, in reality, we had fourteen different ways of doing the references. Jacob Wegmann assisted me in formatting the papers to the Press guidelines-and, in the process, he also did some excellent editing of each paper. Li Xin did an outstanding job of putting all the papers into a single document and doing final checks, with some assistance by Chen Zhiyu on the final day. I especially appreciate their willingness to take time during the busy winter holiday season to do this work.

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funding was provided to me from the three academic divisions that they represent. Finally, I am required to say the following, but I do appreciate the support from the UK government for the CMI project. In this case, I believe they have received real value for the funds, thanks perhaps to all the people mentioned above, plus all the talented authors. I especially thank the staff at Cambridge University Press for their careful work on this manuscript. Chris Harrison, Publishing Director (Social Sciences), kindly gave me strong encouragement and important information on the publication protocols during the initial stages of the review and editing; Dr. Lynn Dunlop, then Assistant Editor, Economics and Business, Joanna Breeze, Production Editor, and her colleague Jodie Barnes responded quickly to my e-mails and kept their sense of humor as I had to delay longer than anticipated in sending the final product, Barbara Docherty, copy-editor, did an excellent job of editing. Overall, these and other CUP employees helped make this a superb publication.

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Abstracts

Part I Concepts and measurements in innovation

1 *Introduction*

Karen R. Polenske

Innovation occurs in a particular place at a particular time. One recurring theme throughout this book 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*. I discuss in this chapter some of the reasons this book is unique among the many publications on innovation. My main reason for collecting this set of contributions is to highlight the fact that innovation is done in space, whereas most innovation 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. I end the chapter with a review of the remaining thirteen chapters.

2 *Measurement of the clustering and dispersion of innovation*

Anne P. Carter

In modern economics, we try to explain levels of output and of input, prices, and incomes in quantitative terms. Measurement is thus prerequisite to scientific progress in this field. Innovation generally involves qualitative change, and therefore complicates the problem of measuring economic variables. In this chapter, I explain the obstacles that innovation poses to measurement, and therefore to quantification, in economics. I review the "double-inversion" strategy proposed by Leontief to represent the most rapidly changing sectoral outputs in terms of their more standard inputs. Because change affects virtually all inputs and outputs, this strategy proved impractical, and Leontief recognized that input-output

analysis, and indeed most analysis implemented with the national accounts, could be valid only in the short or medium term.

Contemporary economists have used proxies and other creative strategies to study innovation, circumventing the essential difficulties of measuring qualitative change. In this chapter, I provide an overview of these strategies and their contribution to our understanding of how a rapidly evolving economy works. However, the problem of measuring the standard economic variables in the face of rapid innovation remains unsolved. Is it possible that today's quantitative economic variables are themselves becoming obsolete?

3 Measuring the geography of innovation: a literature review

Apiwat Ratanawaraha and Karen R. Polenske

We focus in this chapter on the measurement issues arising from analysts using diverse definitions and approaches to study the distributive patterns of innovation, none of which is ideal. Through a review of innovation literature, we identify the data and indicators commonly used to assess innovation and its distribution, as well as the strengths and weaknesses of such measures. We conclude that the available measures are inadequate not only because of limited data availability, but also because analysts have not sufficiently defined and conceptualized theoretical methods to conduct the measurements, nor have they considered the trade-offs between relatively simple indicators and more comprehensive means of conducting measurements of innovation.

4 Employment growth and clusters dynamics of creative industries in Great Britain

Bernard Fingleton, Danilo C. Igliori, Barry Moore, and Raakhi Odedra

In this chapter, we test some of the main hypotheses about the importance of horizontal clusters for employment growth in small firms. We adopt a simple concept of clustering to examine its impact on SME's employment growth in creative industries, using evidence for Great Britain, 1991–2000. In the main section of the chapter, we estimate spatial econometric models, controlling for supply- and demand-side conditions in order to isolate the effect of initial cluster intensity. One important aspect of the chapter is the existence of a declustering mechanism due to congestion effects. The estimated spatial econometric model provides evidence supporting the presence of positive and negative externalities associated with

different levels of cluster intensity, with respect to employment growth in the creative industries. It is also apparent that external effects spill over across area boundaries. These effects point to the importance of local spin-offs and knowledge flows creating technological externalities that transgress area boundaries. These findings reinforce the claim by other analysts that agglomerations play an important role in economic performance. However, they also indicate that the positive effects of cluster intensity have upper thresholds, and we can have the opposite situation where negative externalities predominate and employment is destroyed.

Part II Institutional and spatial aspects of information and knowledge flows

5 *Tacit knowledge in production systems: how important is geography?*

Meric S. Gertler

Within economic geography and industrial economics, interest in the concept of tacit knowledge has grown steadily in recent years. Nelson and Winter stimulated this interest in the work of Michael Polanyi by using the concept of tacit knowledge to inform their analysis of the routines and evolutionary dynamics of technological change. Recently, the concept has received even closer scrutiny. Analysts argue whether or not geographical proximity is a precondition for the effective transmission of tacit knowledge between economic actors. In this chapter, I seek to bring clarity to this debate by exploring an important, but hitherto neglected, aspect of tacit knowledge in the workplace – namely, its institutional underpinnings. While much of the innovation literature focuses on a single question: can tacit knowledge be effectively shared over long distances?, I argue that this issue cannot be properly analyzed without considering a prior question: how is tacit knowledge produced, and what role do institutional frameworks play in this process? I explore these arguments through the use of a case study examining attempts to transfer tacit production knowledge between geographically distant partners.

I revisit Michael Polanyi's original conception of tacit knowledge, showing it to be limited by its experiential and cognitive emphasis, with insufficient attention devoted to the role and institutional foundations of social context. Alternatively, I argue that analysts cannot sort out the geography of tacit knowledge (i.e. whether, or under what conditions, it can be transmitted over long distances) without inquiring into the foundations of context and culture and the institutional underpinnings of economic

activity, taking the work of another Polanyi (Karl Polanyi) as the logical starting point.

6 *The self-aware firm: information needs, acquisition strategies, and utilization prospects*

Amy Glasmeier

Debates about the extent to which regions are differentially conditioned to foster innovation move in two divergent directions. The first set of analysts takes a normative approach in suggesting what is required of regions and firms to be competitive, innovative, and resilient. Their perspective draws largely on case studies of "successful" regions or of firms where learning either occurs or is in some way suboptimal. The second set of analysts takes a perspective with a positive approach to firm learning and investigates the practice of information acquisition, knowledge creation, and behavioral change in firms. While the first analysts suggest that firms can and do act deliberately and with forethought, the second, survey-based, analysts suggest that firms are fallible, narrowly focused, and myopic. How do we reconcile these two apparently divergent perspectives?

In this chapter, I affirm the ways in which firms acquire information and the degree to which they act on it. These results demonstrate that firms by and large minimize their search processes for information. Further, having acquired it, they fail to act on this information in a deliberate fashion. These findings appear invariant across locations, suggesting that decisionmakers who design policies to enhance firm-level innovation and regional competitiveness should be mindful of the actual behavior of firms as they design public-sector programs. I provide a broad representative assessment of the capabilities of SMEs to acquire and utilize strategic business and technical information and speculate about the stages of being firms can and do reflect that coincide with a heightened ability to acquire, translate, and internalize strategic information.

7 *Theorizing the gendered institutional bases of innovative regional economies*

Mia Gray and Al James

Although social institutions are widely regarded as key determinants of success in high-growth regional economies, the regional learning and innovation literature remains largely premised on a series of assumptions regarding work patterns and social interactions among entrepreneurs and

science oriented employees that are gender-blind. Focusing on the industrial agglomeration of ICT firms in Cambridge, England, we examine the role that gender plays in constructing distinctive patterns of work and sociocultural interaction among male and female workers within this so-called "blueprint" regional economy, and how female workers' abilities to contribute to key processes widely theorized to positively underpin learning and innovation at the levels of the firm and the region are constrained relative to their male colleagues. We also discuss the wider implications of these findings for socially inclusive regional economic development strategies.

8 *Multinationals and transnational social space for learning: knowledge creation and transfer through global R&D networks*

Alice Lam

In this chapter, I contrast the experiences of four MNCs, headquartered in two countries, Japan and the United States, in order to evaluate the influence of national patterns of organization and innovation on global R&D networks. I consider the comparative effectiveness of the different models of R&D organization in co-ordinating globally dispersed knowledge creation. I find a substantial amount of variation in the degree to which the firms succeed in attaining a high degree of "embeddedness" in the innovation networks of the host country, in this case the United Kingdom, where their overseas research facilities are located. Among other factors, I find that the degree to which a corporation's R&D network is distributed rather than hierarchical bears significantly upon the degree to which it successfully achieves the goal of fostering transnational learning.

9 *Brain circulation and regional innovation: The Silicon Valley–Hsinchu–Shanghai triangle*

AnnaLee Saxenian

A highly mobile community of Chinese engineers and entrepreneurs with work experience and connections in Silicon Valley is transferring know-how and skill between distant regional economies faster and more flexibly than most MNCs and transforming the geography of IT production. The focus of the chapter is on the relocation of semiconductor design and manufacturing from its original concentration in the United States and Japan, first to Taiwan and subsequently to Shanghai, in the last two

decades. A similar process of "brain circulation" has reshaped the spatial distribution of other IT sectors.

Part III Institutions and innovation systems

10 *National systems of production, innovation, and competence building*

Bengt-Åke Lundvall, Björn Johnson, Esben S. Andersen, and Bent Dalum

The authors have worked on innovation systems for almost two decades, and this chapter is an attempt to take stock. Section 10.1 reflects on the innovation system concept in the light of economic geography and it has been authored specifically for this volume, while the following sections form a shortened and slightly revised version of a paper published in *Research Policy* (Lundvall *et al.* 2002). In section 10.2, we reflect upon the emergence and fairly rapid diffusion of the concept of "national system of innovation," as well as related concepts. In section 10.3, we describe how the Aalborg version of the concept evolved by a combination of ideas that moved from production structure towards including all elements and relationships contributing to innovation and competence building. In section 10.4, we discuss the challenges involved in both a theoretical deepening of the concept and in moving toward a broader approach.

11 *Perspectives on entrepreneurship and cluster formation: biotechnology in the US Capitol region*

Maryann P. Feldman

The US Capitol region ranks as one of the important biotechnology (biotech) clusters in the United States. This chapter documents the highlights of the historical development of the cluster. The Capitol region biotech cluster, in essence, is the result of three reinforcing sets of factors: pre-existing resources, entrepreneurship, and the incentives and infrastructure provided by government. Because of significant investments in science and technology (S&T), the region was prepared to capitalize on technological opportunities in biotechnology as well as institutional policy changes that facilitated technology-based entrepreneurship, which partially contributed to its rise in the United States from twelfth place in 1975 to fourth place in 1999 in the number of biotech patent applications.

12 *Facilitating enterprising places: the role of intermediaries in the United States and United Kingdom*

Christie Baxter and Peter Tyler

Regions around the world want the economic benefits associated with high-technology companies. But creating and nurturing such centers, what we call "enterprising places," is a complex process. Even when a place has the essential resources – an excellent university or research center, facilities for companies, and an educated workforce – it is not clear how to sustain a center from them. The efforts of policymakers to do just that comprise a rich source of experimental evidence. We examine that evidence here, focusing on the kinds of organizations regional leaders have used to facilitate the development of enterprising places in Eastern Massachusetts and Scotland's Central Belt.

We find that intermediaries, organizations whose structure and mission was to connect different sectors, were central in the design and implementation of development policies and programs in the two regions. In addition to their programmatic missions, intermediaries enabled entrepreneurship, leadership, innovation, and a continuity of purpose during periods of political and economic change. These intermediaries also changed over time, reflecting evolving theories of economic development and the geographic, cultural, and political environment of the regions in which they were embedded. We find that the differences between intermediaries in Massachusetts and Scotland, which reflect national differences in institutional structure, have affected the kinds of partnerships and outcomes these intermediaries have achieved. Such differences could contribute to the greater vitality of centers in the United States relative to those in the United Kingdom.

13 *Innovation, integration, and technology upgrading in contemporary Chinese industry*

Edward S. Steinfeld

China's extraordinary economic transformation over the past two decades has been linked inextricably with the interaction between the depth of the domestic institutional reform and the degree of Chinese producers' engagement in the global economy. Even so, the competitiveness and sustainability of China's firms in the global market are still under debate. I argue that Chinese firms are structured in a fashion that allows them to compete extremely effectively on the basis of low cost in relatively low-value manufacturing activities, although this structure does not easily allow them to move upward in the production chain into more innovative,

higher-return activities. In this chapter, I examine the limits and sustainability of the "virtuous interaction" between Chinese firms' engagement in the global competition and governmental reform style, state capacity, as well as industrial policy. I examine both whether Chinese firms can develop organizationally the sort of innovative capacities that lead to long-term competitiveness, and what the obstacles to date have been.

14 Society, community, and development: a tale of two regions

Michael Storper, Lena Lavinas, and Alejandro Mercado-Célis

Contemporary social science remains quite divided about the type of co-ordination that allows some groups of agents to carry out successful economic development and which distinguishes them from cases of failure. In some cases, it is said to be traditional or nonmarket forms of co-ordination, such as family, networks, or shared traditions: these are "communitarian" sources of organization. In most mainstream economics, however, the opposite is said to be necessary: anonymous and transparent rules of the market, property rights, and contracts. These are "societal" forces. For example, for some analysts, Silicon Valley is a case of community, while for others it is due to appropriate societal forces. The same cleavage can be found in rival interpretations of the success of the "Asian Tigers," the industrial clusters of the "Third Italy," or any of a host of other cases. A more robust explanation shows how both communitarian and societal forces act as checks and balances on one another, all the while each creating specific, but different, sources of efficiency in the economy. We illustrate this view via a study in contrasts, between a failed case of low-technology economic development in the Brazilian Northeast, and a success story in the state of Jalisco, Mexico.

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Abbreviations and acronyms

2S LS	Two-Stage Least Squares
ABPI	Association of the British Pharmaceutical Industry
ADV	Advertising
AGCI	Adjusted Geographic Concentration Index
AGS	Alliance for Global Sustainability
AMRICD	Army Medical Research Institute of Chemical Defense
AMRIID	Army Medical Research Institute of Infections Disease
ARC	Architectural/engineering Activities
ART	Artistic and Literary Creation
ASE	Advanced Semiconductor Engineering
B2B	Business-to-business
BANCOMEXT	Banco Nacional de Comercio Exterior
BNDES	Banco Nacional de Desenvolvimento Economico e Social
BRIMS	Basic Research Institute in Mathematical Science
BSI	BioSpace International
CAD	Computer-aided design
CAPES	Coordenaçáo de Aperfeiçoamento de Pessoal de Nível Superior
CASPA	Chinese American Semiconductor Association
CEO	Client executive officer
CESPRI	Centre for Research on Innovation and Internationalization
cGMP	Current Good Manufacturing Procedures
CIE	Chinese Institute of Engineers
CINA	Chinese Internet and Networking Association
CIS	Community Innovation Survey
CMI	Cambridge–MIT Institute
CORDIS	Community R&D Information Service

CORDIS–RTD	Community R&D Information Service – Research and Technology
CQI	Continuous Quality Improvement
CR4	Concentration 4 ratio
CRADAs	Cooperative Research and Development Agreements
CSISS	Center for Spatially Integrated Social Science
DBED	Department of Business and Economic Development
DCCS	Dynamically Controlled Crystallization System
DCMS	Department for Culture, Media and Sport
DRUID	Danish Research Unity for Industrial Dynamics
DTI	Department of Trade and Industry
DUI	Doing, Using, and Interacting
DUSP	Department of Urban Studies and Planning
EGGCI	Ellison–Glaeser Geographic Concentration Index
EPAT	European Patents Database
EPO	European Patent Office
ERI	Edinburgh Research and Innovation Ltd.
ERSO	Elections Research and Service Organization
EU	European Union
FDA	Food and Drug Administration
FDI	Foreign direct investment
FMS	Flexible manufacturing systems
FRB	Federal Reserve Bank
FT	*Financial Times*
FY	Fiscal Year
GCI	Geographic Coincidence (Concentration) Index
GDP	Gross domestic product
GERD	Gross expenditures on R&D
GR	Gene-Related
GREMI	Groupe de Recherche Européen sur les Millieux Innovateurs
GSMC	Grace Semiconductor Manufacturing Corp
GTDN	Group for the Development of the Northeast
HC	Horizontal Clustering
HCLQ	Horizontal Clustering Location Quotient
HGS	Human Genome Sciences
HHI	Herfindahl – Hirschman index
HP	Hewlett-Packard
HPAEs	Highly-performing Asian economies
IA	Interfirm Alliance
IBGE	Instituto Brasileiro de Geografia e Estatística
ICs	Integrated circuits

ICSI	Integrated Circuit Solution, Inc.
ICT	Information and communication technology
IDRP	International Development and Regional Planning
IKE	Innovation, Knowledge, and Economic
ILO	International Labor Organization
IMF	International Monetary Fund
INEGI	Instituto Nacional de Estadística Geografia e Informática
INPI	Institut National de la Propriété Industrielle
INSEE	Institut National de la Statistique et des Etudes Economiques
IPEA	Instituto de Pequisa Econômica Aplicadae
IPRs	Intellectual property rights
ISI	Institute for Scientific Information
ISLI	Institute for System Level Integration
ISSI	Integrated Silicon Solutions, Inc.
ISRN	Innovation Systems Research Networks
ISTAT	Instituto Nazionale di Statistica
IT	Information technology
ITIs	Intermediary Technology Institutes
IUL	Institut für Umweltschutz und Landwirtschaft
IV	Instrumental Variables
JCL	J-ICT Cambridge Laboratory
J-ICT	Japanese Information and Communication Technology
JLL	Japan London Laboratory
J-Pharma	Japanese Pharmaceutical
JPO	Japanese Patent Office
JV	Joint venture
KM	Knowledge management
LECs	Local enterprise companies
LGC	Locational Gini Coefficient
LQ	Location Quotient
LSE	London School of Economics and Political Science
M&As	Mergers and acquisitions
MAED	Mass Alliance for Economic Development
MBI	Massachusetts Biomedical Initiatives
MERIT	Maastricht Economic Research Institute on Innovation and Technology
MERIT-CATI	Maastricht Economic Research Institute on Innovation and Technology – Co-operative Agreements and Technology Indicators

MIT	Massachusetts Institute of Technology
MNCs	Multinational corporations
MNE	Multinational enterprise
MOT	Motion Pictures and Video Production
MRC	Microelectronics Research Centre
MTC	Massachusetts Technology Collaborative
NAFTA	North American Free Trade Agreement
NAICS	North American Industrial Classification System
NASA	National Aeronautics and Space Administration
NBER	National Bureau of Economic Research
NCEQW	National Center on the Education Quality of the Workforce
NIH	National Institutes of Health
NIS	National and regional innovation systems
NIST	National Institute of Standards and Technology
NOMIS	Nomis Official Labor Market Statistics
NSB	National Science Board
NSI	National System of Innovation
NSF	National Science Foundation
OECD	Organization for Economic Co-operation and Development
OEM	Original equipment manufacturer
ONS	Office for National Statistics
PACEC	Public and Corporate Economic Consultants
PC	Personal computer
PCTPAT	Patent Convention Treaty Patents Applications Database
PHT	Photographic Activities
PRC	People's Republic of China
R&D	Research and development
RBS	Royal Bank of Scotland
RDAs	Regional Development Agencies
RIP	Registro de la Propriedad Industrial
RISESI	Regional Impact of the Information Society on Employment and Integration
RTD	Research and Technology Development
RTV	Radio and Television
S&E	Science and engineering
S&T	Science and technology
SBA	Small Business Administration
SBIR	Small Business Innovation Research

SCI	Science Citation Index
SCNM	Sistema de Cuentas Nacionales de México
SE	Scottish Enterprise
SEIJAL	Sistema Estatal de Información Jalisco
SEIT	Socio-Economic Implications of Telecommunications
SEZ	Special Economic Zone
SFT	Software Consultancy and Supply
SIC	Standard Industrial Classification
SIE	Scottish Institute for Enterprise
SIMS	School of Information Management and System
SKU	Stock keeping unit
SMEs	Small and medium-sized enterprises
SMIC	Semiconductor Manufacturing International Corp
SOEs	State-owned enterprises
SPRU	Science Policy Research Unit
SPURS	Special Program on Urban and Regional Studies
SRAMs	Static Random Access Memory
STI	Science, technology, and innovation
STTR	Small Business Technology Transfer
SUDENE	Superintendency for the Development of the Northeast
T&T	Tlaquepaque and Tonalá
TEDCO	Technology Development Corporation
TEEH	Technology–Energy–Environment–Health
TLO	Technology Licensing Office
TPO	Technology Patent Office
TSER	Targeted Socio-Economic Research
TSMC	Taiwan Semiconductor Manufacturing Corp
TVE	Township and Village Enterprises
UALAD	Unitary and Local Authority Districts
UCL	University College London
UFRJ	Universidade Federal do Rio de Janeiro
UK	United Kingdom
UNCTAD	United Nations Commission for Trade and Development
UNIVIMP	University Impact Variable
USA	United States
USPTO	US Patent and Trademark Office
VAT	Value-added tax
VINNOVA	Systems of Innovation Authority